Date: September 11, 2020

Code/Standard Title: ***NFPA 70® – National Electrical Code®***

CODE/STANDARD EVALUATION

TITLE: Technical Evaluation of the Changes in *NFPA 70* between 2017 and 2020 Editions

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1. DESCRIPTION

10 CFR 851 - "DOE Worker Health and Safety Program", as amended by Technical Amendment dated 12/18/2017, requires that the 2017 edition of *NFPA 70* - *"National Electrical Code" (NEC)* be utilized.

The purpose of this evaluation is to document the acceptability of the changes introduced in 2020 edition of *NFPA 70* as compared to the 2017 edition and to identify and evaluate the impact of the changes to the safety and health of workers. The following revisions are not included in the Comparison Table (Attachment #3):

- sections of the *NEC* that deal strictly with residential, health care installations, or systems not in use in industrial applications,
- majority of editorial or usability changes, clarifications, relocations, additions of definitions, rearrangement of sections and related cross-reference revisions, or changes related to bringing the code in alignment with the *NEC* Style Manual,
- changes adding a requirement for a particular type of equipment or material to be listed,
- changes to voltage level applicability from 600 V to 1000 V (consistent with the changes introduced in previous editions of the *NEC*),
- changes to cross-references to other Sections,
- references to national consensus standards or updating edition dates.

Articles with no changes or with changes falling into one of the above categories are not listed. Informational Notes and Informative Annexes were not evaluated as they are not part of the enforceable Code requirements.

2. TECHNICAL JUSTIFICATION

The attached comparison was prepared by Andrew Drutel and reviewed by Jackie McAlhaney.

Attachment #3 to this CSE provides comparisons of changes that were made to 2017 edition of *NEC* in 2020 edition of the code. Each line item listed in the "Comparison Table" has been reviewed and rated for the impact on worker safety. A rating of "1" (editorial), "2" (technical improvement), or "3" (potential safety consequence) has been assigned for each item. Any item with a ranking of "3" requires additional justification. Examples of the three ratings are provided below.

1. Editorial Change – No impact to worker health or safety
   Example: Adding a metrication reference.

2. Technical Improvement – Addition, enhancement, or change in methodology or acceptance criteria that does not degrade worker safety when compared to the previous edition.
   Example: Adding requirements for equipment grounding for lighting switches supplied by a general-purpose branch circuit.

3. Potential Safety Consequence – Changes or revisions that potentially make the electrical installation less robust and could affect personnel safety. A ranking of "3" requires additional justification or further action.
   Example: Change in an overcurrent protection of a conductor or equipment which could result in reduced margin of safety.

As demonstrated in Attachment #3, there has been only one change to the *NFPA 70, National Electrical Code* in the 2020 Edition that could present adverse impact to worker health or safety (change to Subsection 700.12(I)(2)(3), rated "3", as described above). All other provisions of the 2020 edition are at least as protective as provided in the edition specified in 10 CFR 851, *NFPA 70*-2017.

Subsection 700.12(I)(2)(3) addresses requirements for individual emergency lighting units, which are required to illuminate means of egress in case of loss of general area illumination due to a normal power loss. The following is the revised text, per *NFPA 70, National Electrical Code*, 2020 Edition (only the relevant portion is quoted):

> 700.12 General Requirements
> (I) Unit Equipment
> (2) Installation of Unit Equipment
> (3) The branch circuit feeding the unit equipment shall be one of the following:
>
> a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches
>
> b. Where the normal lighting circuit is served by one or more branch circuits, a separate branch circuit, provided with a lock-on feature, that originates from the same panelboard as the normal lighting circuits. The branch circuit disconnecting means for this branch circuit shall be provided with a lock-on feature

The change in this subsection will result in an unsafe condition. Opening of a branch circuit breaker in an area where general lighting is served by a single branch circuit will result in a loss of general lighting, with emergency lighting unit equipment not activated if not fed from the same branch circuit. This is not consistent with *NFPA 101, Life Safety Code*, 2017, Section 7.9.2.3(2) which states:

> 7.9.2.3 The emergency lighting system shall be arranged to provide the required illumination automatically in the event of any interruption of normal lighting due to any of the following:
> (1) Failure of a public utility or other outside electrical power supply
> (2) Opening of a circuit breaker or fuse
> (3) Manual act(s), including accidental opening of a switch controlling normal lighting facilities

The text in subsection 700.12(I)(2)(3) of NFPA 70-2020 shall be replaced with the followingwording based on NFPA 70-2017, Subsection 700.12(F)(2)(3):

(3) The branch circuit feeding the unit equipment shall be one of the following:

a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches

b. Where the normal lighting circuit is served by one or more branch circuits, a separate branch circuit, provided with a lock-on feature, that originates from the same panelboard as the normal lighting circuits. The branch circuit disconnecting means for this branch circuit shall be provided with a lock-on feature

3. GENERAL NOTES

1. The Comparison Table (Attachment #3) does not represent all changes potentially having impact on future installations. Refer to the *NEC* - 2020 for the full extent of the changes introduced in this new edition of the code.
2. In some cases, text of a particular revised section was truncated, capturing only portion of the text relevant to a particular change. New Articles or Articles rearranged in their entirety are not copied in the Comparison Table.
3. The following Tentative Interim Amendments were considered in this evaluation: TIA 20-1 through TIA 20-9.
4. The following Errata were considered in this evaluation: Errata 70-20-1, Errata 70-20-2, Errata 70-20-3, and Errata 70 NEC Handbook 2020 Article 210.12(A).

4. REFERENCES

1. 10 CFR 851, Worker Safety and Health Program (including Technical Amendment dated 12/18/2017)
2. IEEE 844.1, IEEE/CSA Standard for Skin Effect Trace Heating of Pipelines, Vessels, Equipment, and Structures - General, Testing, Marking, and Documentation Requirements
3. *NFPA 70, National Electrical Code* (2017 and 2020 editions)
4. *NFPA 101*, Life Safety Code (2018 edition)

5. ATTACHMENTS

1. Letter, Mello (*NFPA*) to Drutel, dated May 7, 2020
2. Email, Davis (*NFPA)* to Drutel, dated September 11, 2020
3. Comparison Table

NATIONAL FIRE PROTECTION ASSOCIATION
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SENT VIA EMAIL
andrew.drutel@srs.gov

May 7, 2020

Andrew M. Drutel, P.E.
Savannah River Nuclear Solutions
Savannah River Site
Building 730-2B, Rm. 217
Aiken, SC 29808

Re: Requests for NFPA® Material – Updated Permission Letter

Dear Mr. Drutel:

We are writing in response to your request on behalf of Savannah River Nuclear Solutions ("**SRNS**") to use certain material which is the intellectual property of the National Fire Protection Association® ("**NFPA®**"). Specifically, SNRS has requested NFPA's permission to use excerpts from the NFPA 70® 2017 and 2020 editions of the National Electrical Code® ("**NEC®**")(collectively, the "**NFPA Material**") to compare the two editions of the NEC and evaluate technical changes, additions of new Articles and changes not related to industrial applications, with the goals of: 1) demonstrating to SNRS' customer, Department of Energy ("**DOE**"), that the 2020 edition of the NEC is as protective to the worker safety as the 2017 edition of the NEC; and 2) adopting the 2020 edition of the NEC at Savannah River Site ("**SRS**") in April 2020.

It is our understanding that SRNS' proposed comparison and evaluation document would consist of technical changes only from the 2017 and 2020 editions of the NEC and a commentary regarding acceptability of the individual changes for use at SRS. For changes selected for evaluation, the exact text from the 2017 and 2020 editions will be reflected to help readers understand the nature and the impact of the specific change. We also understand SNRS will quote changes which are applicable to industrial uses or settings, and will exclude other changes, such as editorial changes, rearrangement of articles, changes to articles which are not applicable to the work at SRS (e.g., residential installations, carnivals, fairs, motion picture locations, pipe organs, swimming pools, etc.), and changes to certain parts of the Code, such as informational notes. Furthermore, new articles will not be quoted but will be listed by title only. For changes selected for evaluation, the exact text from the 2017 and 2020 editions will be reflected to help readers understand the nature and the impact of the specific change.

NFPA is willing to grant SNRS' request for permission to use the NFPA Material with the following terms and conditions:

1. NFPA sent (via a secure, password-protected email) to SNRS with a Word document containing the technical changes between the 2017 and 2020 editions of the NEC ("**Technical Changes**"). SNRS will review the Technical Changes and will provide NFPA an Excel spreadsheet containing a list of NEC Articles which SNRS would like to receive from NFPA. NFPA will then provide SNRS with the NEC Articles requested (via a secure, password-protected email) ("**NEC Articles**"); however, NFPA will provide titles only for any new NEC Articles.

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2. SNRS may set forth the NFPA Material referenced in its evaluation and comparison document only this one time for the goals stated above and at no other time and for no other purpose. SNRS may copy and paste such NFPA Material. Except as set forth herein, SNRS may not reproduce, distribute, share or sell the NFPA Material and may not use the NFPA Material in any other manner, form or format.

3. SRS agrees to include the following credit statement where the NFPA Material appears:

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4. Upon creation and prior to publication, SNRS shall send to NFPA a copy of SNRS' comparison and evaluation document, including the attribution statement described herein.

5. SNRS acknowledges and agrees that, as between SNRS and NFPA, NFPA owns and has all right, title and interest to the NFPA Material, including all intellectual property rights therein, and SNRS shall not take any steps that would violate such rights.

6. All rights in the NFPA Material not expressly granted pursuant to the terms of this letter agreement are expressly reserved in their entirety to NFPA.

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10. On or before September 30, 2020, SNRS shall destroy all Technical Changes and NEC Articles provided by NFPA to SNRS. Immediately after destruction, SNRS shall provide NFPA with written confirmation of such destruction.

Sincerely,

William Mello
Director of Sales

Andrew Drutel

From: Davis, Chris <CDavis@nfpa.org>
Sent: Friday, September 11, 2020 4:18 PM
To: Andrew Drutel
Cc: Jackie Mcalhaney; Herlihy, Irene; Mello, William
Subject: RE: Use of NFPA PDF Files for Code Evaluation at SRS

Dear Mr. Drutel:

I confirm that SNRS may release the evaluation document to the DOE and members of the EFCOG.

Best regards,

Chris

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NEC Section	2017 NEC®	First Revision/ Second Revision	2020 NEC®	2020 NEC® Summary of Changes	Rank
Chapter 1	**General**				
Article 100	**Definitions**				
Reconditioned	N/A	SR-8072	**Reconditioned.** Electromechanical systems, equipment, apparatus, or components that are restored to operating conditions. This process differs from normal servicing of equipment that remains within a facility, or replacement of listed equipment on a one-to-one basis. (CMP-10) Informational Note: The term *reconditioned* is frequently referred to as *rebuilt*, *refurbished*, or *remanufactured*.	New definition for equipment restored to operating conditions outside the purview of normal servicing or part replacement. Impacts: No negative impact.	1
Article 110	**Requirements for Electrical Installations**				
110.12(C)	**110.12 Mechanical Execution of Work.** Electrical equipment shall be installed in a neat and workmanlike manner.	FR-8484	**110.12 Mechanical Execution of Work.** Electrical equipment shall be installed in a neat and workmanlike manner. **(C) Cable and Conductors**. Cables and conductors installed exposed on the surfaces of ceilings and sidewalls shall be supported by the building structure in such a manner that the cables and conductors will not be damaged by normal building use. Such cables and conductors shall be secured by hardware including straps, staples, cables ties, hangers, or similar fittings designed and installed so as to not to damage the cable. The installation shall also conform with 300.4 and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental	New requirements addressing general installation requirements and support methods for cables and conductors. Impact: No negative impact.	2

NEC Section	2017 NEC®	First Revision/ Second Revision	2020 NEC®	2020 NEC® Summary of Changes	Rank
			air (plenum) shall be listed as having low smoke and heat release properties.		
110.14(D)	**Installation.** Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, a calibrated torque tool shall be used to achieve the indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.	FR-8510, SR-8069	**Terminal Connection Torque.** Tightening torque values for terminal connections shall be as indicated on equipment or in installation instructions provided by the manufacturer. An approved means shall be used to achieve the indicated torque value.	Revision to remove *calibrated torque tool* and to require an approved means to achieve correct torque values. Impact: No negative impact	1
110.21(A)(2)	Reconditioned Equipment. Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning. Reconditioned equipment shall be identified as "reconditioned" and approval of the reconditioned equipment shall not be based solely on the equipment's original listing. *Exception: In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.21(A)(2) shall not be required.*	FR-8580, SCR-71	**Reconditioned Equipment.** Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning. Reconditioned equipment shall be identified as "reconditioned" and the original listing mark removed. Approval of the reconditioned equipment shall not be based solely on the equipment's original listing. *Exception: In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.21(A)(2) shall not be required for equipment that is reconditioned by the owner or operator as part of a regular equipment maintenance program.*	Revision to require original listing mark be removed for reconditioned equipment. Revision to Exception to clarify that it applies where equipment is reconditioned as part of a regular equipment maintenance program. Impact: No negative impact.	1
110.22(A)	**Identification of Disconnecting Means.** **(A) General.** Each disconnecting means shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident. The marking shall be of sufficient durability to withstand the environment involved.	FR-8600	**Identification of Disconnecting Means.** **(A) General.** Each disconnecting means shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident. In other than one- or two-family dwellings, the marking shall include the identification of the circuit source that supplies the disconnecting means. The marking shall be of sufficient durability to withstand the environment	Revision to correlate with 408.4 by requiring the circuit source to be identified. Impact: No negative impact – improves safety.	2

NEC Section	2017 NEC®	First Revision/ Second Revision	2020 NEC®	2020 NEC® Summary of Changes	Rank
			involved.		
110.26(C)(2)	**110.26 Spaces About Electrical Equipment** **(2) Large Equipment.** For equipment rated 1200 amperes or more and over 1.8 m (6 ft) wide that contains overcurrent devices, switching devices, or control devices, there shall be one entrance to and egress from the required working space not less than 610 mm (24 in.) wide and 2.0 m (6½ ft) high at each end of the working space. A single entrance to and egress from the required working space shall be permitted where either of the conditions in 110.26(C)(2)(a) or (C)(2)(b) is met. (a) *Unobstructed Egress.* Where the location permits a continuous and unobstructed way of egress travel, a single entrance to the working space shall be permitted . (b) *Extra Working Space.* Where the depth of the working space is twice that required by 110.26(A)(1), a single entrance shall be permitted. It shall be located such that the distance from the equipment to the nearest edge of the entrance is not less than the minimum clear distance specified in Table 110.26(A)(1) for equipment operating at that voltage and in that condition.	FR-8653, SR-8104	**110.26 Spaces About Electrical Equipment** **(2) Large Equipment.** For large equipment that contains overcurrent devices, switching devices, or control devices, there shall be one entrance to and egress from the required working space not less than 610 mm (24 in.) wide and 2.0 m (6 ½ ft) high at each end of the working space. This requirement shall apply to either of the following conditions: (1) For equipment rated 1200 amperes or more and over 1.8 m (6 ft) wide (2) For service disconnecting means installed in accordance with 230.71 where the combined ampere rating is 1200 amperes or more and over 1.8 m (6 ft) wide Open equipment doors shall not impede the entry to or egress from the working space. A single entrance to and egress from the required working space shall be permitted where either of the conditions in 110.26(C)(2)(a) or (C)(2)(b) is met. (a) *Unobstructed Egress.* Where the location permits a continuous and unobstructed way of egress travel, a single entrance to the working space shall be permitted. (b) *Extra Working Space.* Where the depth of the working space is twice that required by 110.26(A)(1), a single entrance shall be permitted. It shall be located such that the distance from the equipment to the nearest edge of the entrance is not less than the minimum clear distance specified in Table 110.26(A)(1) for equipment operating at that voltage and in that condition.	Revision to include two or more service disconnects installed in accordance with 230.71 that have combined ratings of 1200 amperes or more. New requirement to specify open equipment doors shall not impede the entry to or egress from the workspace. Impact: No negative impact – improves safety.	2

NEC Section	2017 NEC®	First Revision/ Second Revision	2020 NEC®	2020 NEC® Summary of Changes	Rank
110.26(C)(3)	**(C) Entrance to and Egress from Working Space.** **(3) Personnel Doors.** Where equipment rated 800 A or more that contains overcurrent devices, switching devices, or control devices is installed and there is a personnel door(s) intended for entrance to and egress from the working space less than 7.6 m (25 ft) from the nearest edge of the working space, the door(s) shall open in the direction of egress and be equipped with listed panic hardware.	FR-8658	**(C) Entrance to and Egress from Working Space.** **(3) Personnel Doors.** Where equipment rated 800 amperes or more that contains overcurrent devices, switching devices, or control devices is installed and there is a personnel door(s) intended for entrance to and egress from the working space less than 7.6 m (25 ft) from the nearest edge of the working space, the door(s) shall open in the direction of egress and be equipped with listed panic hardware or listed fire exit hardware	Revision to include listed fire exit hardware to correlate with fire and building codes. Impact: No negative impact.	2
110.26(D)	**(D) Illumination.** Illumination shall be provided for all working spaces about service equipment, switchboards, switchgear, panelboards, or motor control centers installed indoors. Control by automatic means only shall not be permitted. Additional lighting outlets shall not be required where the work space is illuminated by an adjacent light source or as permitted by 210.70(A)(1), Exception No. 1, for switched receptacles.	SR-8105	**(D) Illumination.** Illumination shall be provided for all working spaces about service equipment, switchboards, switchgear, panelboards, or motor control centers installed indoors. Control by automatic means shall not be permitted to control all illumination within the working space. Additional lighting outlets shall not be required where the work space is illuminated by an adjacent light source or as permitted by 210.70(A)(1), Exception No. 1, for switched receptacles.	Revision to prevent complete loss of illumination when controlled by automatic means. Impact: No negative impact.	2
110.32	**110.32 Work Space About Equipment.** Sufficient space shall be provided and maintained about electrical equipment to permit ready and safe operation and maintenance of such equipment. Where energized parts are exposed, the minimum clear work space shall be not less than 2.0 m (61⁄2 ft) high (measured vertically from the floor or platform) or not less than 914 mm (3 ft) wide (measured parallel to the equipment). The depth shall be as required in 110.34(A). In all cases, the work space shall permit at least a 90 degree opening of doors or hinged panels.	FR-8686	**110.32 Work Space About Equipment.** Sufficient space shall be provided and maintained about electrical equipment to permit ready and safe operation and maintenance of such equipment. Where energized parts are exposed, the minimum clear work space shall be not less than 2.0 m (6 1⁄2 ft) high (measured vertically from the floor or platform) and the width of the equipment or 914 mm (3 ft) wide (measured parallel to the equipment), whichever is greater. The depth shall be as required in 110.34(A). In all cases, the work space shall permit at least a 90-degree opening of doors or hinged panels. Within the height requirements of this section, other equipment that is associated with the electrical	Revision to require both minimum width and height as conditions where energized parts are exposed. New provisions added for other equipment permitted in the workspace, prohibited storage, and guarding of exposed live parts. Impact: No negative impact – improves safety	2

NEC Section	2017 NEC®	First Revision/ Second Revision	2020 NEC®	2020 NEC® Summary of Changes	Rank
			installation and is located above or below the electrical equipment shall be permitted to extend not more than 150 mm (6 in.) beyond the front of the electrical equipment. Working space required by this section shall not be used for storage. When normally enclosed live parts are exposed for inspection or servicing, the working space, if in a passageway or general open space, shall be suitably guarded.		
Chapter 2	**Wiring and Protection**				
Article 200	**Use and Identification of Grounded Conductors**				
200.3	**200.3 Connection to Grounded System.** Premises wiring shall not be electrically connected to a supply system unless the latter contains, for any grounded conductor of the interior system, a corresponding conductor that is rounded. For the purpose of this section, *electrically connected* shall mean connected so as to be capable of carrying current, as distinguished from connection through electromagnetic induction. *Exception: Listed utility-interactive inverters identified for use in distributed resource generation systems such as photovoltaic and fuel cell power systems shall be permitted to be connected to premises wiring without a grounded conductor where the connected premises wiring or utility system includes a grounded conductor.*	FR-7614	**200.3 Connection to Grounded System.** Grounded conductors of premises wiring systems shall be electrically connected to the supply system grounded conductor to ensure a common, continuous grounded system. For the purpose of this section, *electrically connected* shall mean making a direct electrical connection capable of carrying current, as distinguished from induced currents. *Exception: Listed interactive inverters identified for use in distributed resource generation systems such as photovoltaic and fuel cell power systems shall be permitted to be connected to premises wiring without a grounded conductor if the connected premises wiring or utility system includes a grounded conductor.*	Revision to clarify applicability of requirement and to recognize that inverters can be interactive with other electrical power sources. Impact: No negative impact – improves safety.	2
Article 210	**Branch Circuits**				
210.5(C)(1)	**210.5 Identification for Branch Circuits.** **(C) Identification of Ungrounded Conductors.** Ungrounded conductors	SR-7525	**210.5 Identification for Branch Circuits.** **(C) Identification of Ungrounded Conductors.** Ungrounded conductors shall be	Revision to permit multiple systems having the same system voltage class to	2

NEC Section	2017 NEC®	First Revision/ Second Revision	2020 NEC®	2020 NEC® Summary of Changes	Rank
	shall be identified in accordance with 210.5(C)(1) or (2), as applicable. **(1) Branch Circuits Supplied from More Than One Nominal Voltage System.** Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 210.5(C)(1)(a) and (b). (a) *Means of Identification.* The means of identification shall be permitted to be by separate color coding, marking tape, tagging, or other approved means. (b) *Posting of Identification Means.* The method utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment. The label shall be of sufficient durability to withstand the environment involved and shall not be handwritten. *Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection,*		identified in accordance with 210.5(C)(1) or (2), as applicable. **(1) Branch Circuits Supplied from More Than One Nominal Voltage System.** Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and by system voltage class at all termination, connection, and splice points in compliance with 210.5(C)(1)(a) and (b). Different systems within the same premises that have the same system voltage class 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 utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment. The label shall be of sufficient durability to withstand the environment involved and shall not be handwritten. *Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it shall be permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection, and splice point in*	employ the same identification system. Impact: No negative impact.	

NEC Section	2017 NEC®	First Revision/ Second Revision	2020 NEC®	2020 NEC® Summary of Changes	Rank
	and splice point in compliance with 210.5(C)(1)(a) and (b). Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words "other unidentified systems exist on the premises."		*compliance with 210.5(C)(1)(a) and (b). Labeling shall be required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words "other unidentified systems exist on the premises."*		
210.6(C)	**210.6 Branch-Circuit Voltage Limitations.** The nominal voltage of branch circuits shall not exceed the values permitted by 210.6(A) through (E). **(C) 277 Volts to Ground.** Circuits exceeding 120 volts, nominal, between conductors and not exceeding 277 volts, nominal, to ground shall be permitted to supply the following: (1) Listed electric-discharge or listed light-emitting diode type luminaires (2) Listed incandescent luminaires, where supplied at 120 volts or less from the output of a stepdown autotransformer that is an integral component of the luminaire and the outer shell terminal is electrically connected to a grounded conductor of the branch circuit (3) Luminaires equipped with mogul-base screw shell lampholders (4) Lampholders, other than the screw shell type, applied within their voltage ratings (5) Auxiliary equipment of electric-discharge lamps Informational Note: See 410.137 for auxiliary equipment limitations.	FR-7587	**210.6 Branch-Circuit Voltage Limitations.** The nominal voltage of branch circuits shall not exceed the values permitted by 210.6(A) through (E). **(C) 277 Volts to Ground.** Circuits exceeding 120 volts, nominal, between conductors but not exceeding 277 volts, nominal, to ground shall be permitted to supply cord-and-plug-connected or permanently connected utilization equipment, or the following types of listed luminaires: (1) Electric-discharge luminaires with integral ballasts (2) LED luminaires with LED drivers between the branch circuit and the lampholders (3) Incandescent or LED luminaires, equipped with medium-base or smaller screw shell lampholders, where the lampholders are supplied at 120 volts or less from the output of a stepdown autotransformer, LED driver, or other type of power supply that is an integral component of the luminaire (4) Luminaires equipped with mogul-base screw shell lampholders (5) Luminaires equipped with lampholders, other than the screw	Revision to clarify and to expand applicability to types of luminaires not previously covered. Impact: No negative impact.	2

NEC Section	2017 NEC®	First Revision/ Second Revision	2020 NEC®	2020 NEC® Summary of Changes	Rank
	(6) Cord-and-plug-connected or permanently connected utilization equipment		shell type, when used within their voltage ratings of their lampholders (6) Luminaires without lampholders (7) Auxiliary equipment of electric-discharge or LED-type lamp (8) Luminaires converted with listed retrofit kits incorporating integral LED light sources or accepting LED lamps that also conforms with 210.6(C)(1), (C)(2), (C)(3), (C)(4), or (C)(5)		
210.8	**210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.** Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through (E). The ground-fault circuit interrupter shall be installed in a readily accessible location. For the purposes of this section, when determining distance from receptacles the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window.	FR-7863, SR-7685	**210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.** Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through (F). The ground-fault circuit interrupter shall be installed in a readily accessible location. For the purposes of this section, when determining the distance from receptacles the distance shall be measured as the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or the shortest path without passing through a window.	Revision to clarify how proximate measurement for GFCI protection is made. Impact: No negative impact. Improves safety.	2
210.8(B)	**(B) Other Than Dwelling Units.** All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less and three-phase receptacles rated 150 volts to ground or less, 100 amperes or less installed in the following locations shall have ground-fault circuit-interrupter protection for personnel.	FR-7791, SR-7724	**(B) Other Than Dwelling Units.** All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the locations specified in 210.8(B)(1) through (B)(12) shall have ground-fault circuit-interrupter protection for personnel.	Revision to base requirement on branch circuit voltage rating and to specify voltage ratings of receptacles covered. Impact: No negative impact. Improves safety	2

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210.8(B)(8)	(8) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms	FR-7791, Detail FR-8124	(8) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms	Revision to expand applicability to similar buildings. Impact: No negative impact. Improves safety	2
210.8(B)(10)	(10) Unfinished portions or areas of the basement not intended as habitable rooms	FR-7791, Detail FR-8125	(10) Unfinished areas of basements	Revision to expand applicability to entire unfinished area. Impact: No negative impact. Improves safety	2
210.8(B)(1–3), (5–8), and (10)	N/A	FR-8128 Detail, FR-7791, SR-7724	*Exception to (1) through (5), (8), and (10): Listed locking support and mounting receptacles utilized in combination with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not be required to be ground-fault circuit-interrupter protected. If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.*	New exception to cover locking support and mounting receptacles. Impact: No negative impact. Improves safety	2
210.8(B)(11)	N/A	FR-7791, Detail FR-8126	(11) Laundry areas	Revision to add new location where GFCI protection of receptacles is required. Impact: No negative impact. Improves safety	2
210.8(B)(12)	N/A	FR-7791, Detail FR-8127	(12) Bathtubs and shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall	Revision to add new location where GFCI protection of receptacles is required. Impact: No negative impact. Improves safety	2

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210.8(D)	N/A	FR-7689, SR-7737	**(D) Specific Appliances.** Unless GFCI protection is provided in accordance with 422.5(B)(3) through (B)(5), the outlets supplying the appliances specified in 422.5(A) shall have GFCI protection in accordance with 422.5(B)(1) or (B)(2). Where the appliance is a vending machine as specified in 422.5(A)(5) and GFCI protection is not provided in accordance with 422.5(B)(3) or (B)(4), branch circuits supplying vending machines shall have GFCI protection in accordance with 422.5(B)(1) or (B)(2).	New requirement to provide direction to Article 422 for appliance GFCI requirements and where it is necessary to provide GFCI protection in branch circuits supplying vending machines. Impact: No negative impact. Improves safety	2
210.8(E)	N/A	SR-7587	**(E) Equipment Requiring Servicing.** GFCI protection shall be provided for the receptacles required by 210.63.	New requirement on GFCI protection of maintenance receptacles required by 210.63. Impact: No negative impact. Improves safety	2
210.8(F)	N/A	SR-7676	**(F) Outdoor Outlets.** All outdoor outlets for dwellings, other than those covered in 210.8(A)(3), Exception to (3), that are supplied by single-phase branch circuits rated 150 volts to ground or less, 50 amperes or less, shall have ground-fault circuit-interrupter protection for personnel. *Exception: Ground-fault circuit-interrupter protection shall not be required on lighting outlets other than those covered in 210.8(C).*	New requirement and exception on GFCI protection of outdoor outlets supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less. Impact: No negative impact. Improves safety	2
210.15	N/A	SR-7657	**210.15 Reconditioned Equipment.** The following shall not be reconditioned: (1) Equipment that provides ground-fault circuit-interrupter protection for personnel (2) Equipment that provides arc-fault circuit-interrupter protection	New requirement to identify types of equipment used in branch circuits that cannot be reconditioned. Impact: No negative impact.	2

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			(3) Equipment that provides ground-fault protection of equipment		
210.19(A)(1), Exception No. 2	**210.19 Conductors — Minimum Ampacity and Size.** **(A) Branch Circuits Not More Than 600 Volts.** Informational Note No. 1: See 310.15 for ampacity ratings of conductors. **(1) General.** Branch-circuit conductors shall have an ampacity not less than the maximum load to be served. Conductors shall be sized to carry not less than the larger of 210.19(A)(1)(a) or (b). (a) Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum branch-circuit conductor size shall have an allowable ampacity not less than the noncontinuous load plus 125 percent of the continuous load. (b) The minimum branch-circuit conductor size shall have an allowable ampacity not less than the maximum load to be served after the application of any adjustment or correction factors. *Exception: If the assembly, including the overcurrent devices protecting the branch circuit(s), is listed for operation at 100 percent of its rating, the allowable ampacity of the branch-circuit conductors shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load.*	FR-7981, SCR-13	**210.19 Conductors — Minimum Ampacity and Size.** **(A) Branch Circuits Not More Than 600 Volts.** **(1) General.** Branch-circuit conductors shall have an ampacity not less than the larger of 210.19(A)(1)(a) or (A)(1)(b) and comply with 110.14(C) for equipment terminations. (a) Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum branch-circuit conductor size shall have an ampacity not less than the noncontinuous load plus 125 percent of the continuous load in accordance with 310.14. (b) The minimum branch-circuit conductor size shall have an ampacity not less than the maximum load to be served after the application of any adjustment or correction factors in accordance with 310.15. *Exception No. 2 to (1)(a) and (1)(b): Where a portion of a branch circuit is connected at both its supply and load ends to separately installed pressure connections as covered in 110.14(C)(2), it shall be permitted to have an allowable ampacity, in accordance with 310.15, not less than the sum of the continuous load plus the noncontinuous load. No portion of a branch circuit installed under this exception shall extend into an enclosure*	New permissive exception on sizing branch circuit conductors that supply continuous loads. Impact: No negative impact.	2

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			containing either the branch-circuit supply or the branch-circuit load terminations.		
210.63(A) and (B)	**210.63 Heating, Air-Conditioning, and Refrigeration Equipment Outlet.** A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location for the servicing of heating, air-conditioning, and refrigeration equipment. The receptacle shall be located on the same level and within 7.5 m (25 ft) of the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment disconnecting means. *Exception: A receptacle outlet shall not be required at one- and two-family dwellings for the service of evaporative coolers.*	FR-7588, SR-7566	**210.63 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). **(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 branch-circuit disconnecting means.	Revision to combine requirements for receptacle outlets in the vicinity of certain mechanical equipment types with the requirements for receptacle outlet in the vicinity of indoor service equipment. Revision to expand requirement to also apply to indoor areas containing electrical equipment that is not service equipment and to specify the power-supply connection for the required receptacle outlet. Impact: No negative impact. Improves safety.	2

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Article 215	**Feeders**				
215.10	**215.10 Ground-Fault Protection of Equipment.** Each feeder disconnect rated 1000 amperes or more and installed on solidly grounded wye electrical systems of more than 150 volts to ground, but not exceeding 600 volts phase-to-phase, shall be provided with ground-fault protection of equipment in accordance with the provisions of 230.95.	FR-8361	**215.10 Ground Fault Protection of Equipment.** Each feeder disconnect rated 1000 amperes or more and installed on solidly grounded wye electrical systems of more than 150 volts to ground, but not exceeding 600 volts phase-to-phase, shall be provided with ground-fault protection of equipment in accordance with 230.95. *Exception No. 3: If temporary feeder conductors are used to connect a generator to a facility for repair, maintenance, or emergencies, ground-fault protection of equipment shall not be required. Temporary feeders without ground-fault protection shall be permitted for the period necessary but shall not exceed 90 days.*	Editorial revision and addition of new exception to cover temporary installations of feeders supplied by a portable generator(s). Impact: No negative impact	2
Article 220	**Branch-Circuit, Feeder, and Service Load Calculations**				
220.11	N/A	FR-8104	**220.11 Floor Area.** The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use	New section containing relocated requirement on determining the floor area of a building or other area. Impact: No negative impact.	2
220.12(A)	**220.12 Lighting Load for Specified Occupancies.** A unit load of not less than that specified in Table 220.12 for occupancies specified shall constitute the minimum lighting load. The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use.	FR-8075	**220.12 Lighting Load for Non-Dwelling Occupancies.** **(A) General.** A unit load of not less than that specified in Table 220.12 for non-dwelling occupancies and the floor area determined in 220.11 shall be used to calculate the minimum lighting load. Motors rated less than $1/8$ HP and connected to a lighting circuit shall be considered general lighting load.	Revision to limit applicability to non-dwelling occupancy types and to include some small motors as general lighting load. Impact: No negative impact.	2

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Article 225	**Outside Branch Circuits and Feeders**				
225.30(B)	**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 (E). For the purpose of this section, a multiwire branch circuit shall be considered a single circuit. Where a branch circuit or feeder originates in these additional buildings or other structures, only one feeder or branch circuit shall be permitted to supply power back to the original building or structure, unless permitted in 225.30(A) through (E). **(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 charging systems listed, labeled, and identified for more than a single branch circuit or feeder **(B) 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	FR-8380, SR-7866	**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 (E). For the purpose of this section, a multiwire branch circuit shall be considered a single circuit. Where a branch circuit or feeder originates in these additional buildings or other structures, only one feeder or branch circuit shall be permitted to supply power back to the original building or structure, unless permitted in 225.30(A) through (E). **(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 charging 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, no 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	New requirement to permit multiple feeders where they originate in the same supply equipment and terminate in separate disconnecting means. Impact: No negative impact	2

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			not apply. Each disconnect shall be marked to indicate the load served.		
Article 230	**Services**				
230.46	**230.46 Spliced Conductors.** Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 300.5(E), 300.13, and 300.15.	SR-7871	**230.46 Spliced and Tapped Conductors.** Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 300.5(E), 300.13, and 300.15. Power distribution blocks, pressure connectors, and devices for splices and taps shall be listed. Power distribution blocks installed on service conductors shall be marked “suitable for use on the line side of the service equipment” or equivalent. Effective January 1, 2023, pressure connectors and devices for splices and taps installed on service conductors shall be marked “suitable for use on the line side of the service equipment” or equivalent.	Revision to require certification of methods used to splice or tap service-entrance conductors. Impact: No negative impact. Improves safety.	2
230.62(C)	**230.62 Service Equipment — Enclosed or Guarded.** Energized parts of service equipment shall be enclosed as specified in 230.62(A) or guarded as specified in 230.62(B).	FR-8459, SR-7896	**230.62 Service Equipment — Enclosed or Guarded.** Energized parts of service equipment shall be enclosed as specified in 230.62(A) or guarded as specified in 230.62(B). **(C) Barriers.** 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 terminals.	New requirement to cover the construction of service equipment to reduce risk of inadvertent contact with energized parts. Impact: No negative impact. Improves safety.	2

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230.66	**230.66 Marking.** Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed or field labeled. Individual meter socket enclosures shall not be considered service equipment but shall be listed and rated for the voltage and ampacity of the service. *Exception: Meter sockets supplied by and under the exclusive control of an electric utility shall not be required to be listed.*	FR-8460, SR-7897	**230.66 Marking.** **(A) General.** Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed or field evaluated. **(B) Meter Sockets.** Meter sockets shall not be considered service equipment but shall be listed and rated for the voltage and current rating of the service. *Exception: Meter sockets supplied by and under the exclusive control of an electric utility shall not be required to be listed.*	Revision to clarify approval benchmark for service equipment and to organize multiple requirements into separate subdivisions. Impact: No negative impact	2
230.71	**230.71 Maximum Number of Disconnects.** **(A) General.** The service disconnecting means for each service permitted by 230.2, or for each set of service-entrance conductors permitted by 230.40, Exception No. 1, 3, 4, or 5, shall consist of not more than six switches or sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard or in switchgear. There shall be not more than six sets of disconnects per service grouped in any one location. 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-protective device(s) (3) Control circuit of the ground-fault protection system	FR-8463, SR-7901	**230.71 Maximum Number of Disconnects.** Each service shall have only one disconnecting means unless the requirements of 230.71(B) are met. **(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-protective device(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 230.2 or for each set of service-entrance conductors permitted by 230.40, Exception No. 1, 3, 4, or 5. The two to six service disconnecting means shall be permitted to	Revision to require a single service disconnecting means except under specified conditions. Impact: No negative impact. Improves safety.	2

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	(4) Power-operable service 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 conductors of the service with no more than six operations of the hand.		consist of a combination of any of the following: (1) Separate enclosures with a main service disconnecting means in each enclosure (2) Panelboards with a main service disconnecting means in each panelboard enclosure (3) Switchboard(s) where there is only one service disconnect in each separate vertical section where there are barriers separating each vertical section (4) Service disconnects in switchgear or metering centers where each disconnect is located in a separate compartment		
230.82(10)	N/A	Detail FR-8623, SR-7912	**230.82 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: (10) Emergency disconnects in accordance with 230.85, if all metal housings and service enclosures are grounded in accordance with Part VII and bonded in accordance with Part V of Article 250.	New condition to cover specific equipment type permitted to be connected on the supply-side of the service disconnecting means. Impact: No negative impact	2
230.82(11)	N/A	Detail FR-8628, SR-7912	(11) Meter-mounted transfer switches nominally rated not in excess of 1000 volts that have a short-circuit current rating equal to or greater than the available fault current. A meter-mounted transfer switch shall be listed and be capable of transferring	New condition to cover specific equipment type permitted to be connected on the supply-side of the service disconnecting means. Impact: No negative impact	2

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			the load served. A meter-mounted transfer switch shall be marked on its exterior with both of the following: a. Meter-mounted transfer switch b. Not service equipment		
Article 240	**Overcurrent Protection**				
240.62	N/A	SR-7974	**240.62 Reconditioned Equipment.** Low-voltage fuseholders and low-voltage nonrenewable fuses shall not be permitted to be reconditioned.	New section to prohibit low-voltage fuseholders and low-voltage nonrenewable fuses from being reconditioned. Impact: No negative impact. Improves safety.	2
240.67(A)	**240.67 Arc Energy Reduction.** Where fuses rated 1200 A or higher are installed, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020. **(A) Documentation.** Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the fuses.	SR-7991	**240.67 Arc Energy Reduction.** Where fuses rated 1200 A or higher are installed, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020. **(A) Documentation.** Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the fuses. Documentation shall also be provided to demonstrate that the method chosen to reduce clearing time is set to operate at a value below the available arcing current.	Revision to require documentation specifying the arc flash mitigation method chosen. Impact: No negative impact.	2
240.67(B)	**(B) Method to Reduce Clearing Time.** A fuse shall have a clearing time of 0.07 seconds or less at the available arcing current, or one of the following shall be provided:	FR-8641, SR-7991	**(B) Method to Reduce Clearing Time.** A fuse shall have a clearing time of 0.07 seconds or less at the available arcing current, or one of the following means shall be provided and shall be set to operate at less than the available arcing current:	Revision to set parameters for operation of a fuse with respect to the available arcing current, add one additional arc flash mitigation method.	2

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	(1) Differential relaying (2) Energy-reducing maintenance switching with local status indicator (3) Energy-reducing active arc flash mitigation system (4) An approved equivalent means		(1) Differential relaying (2) Energy-reducing maintenance switching with local status indicator (3) Energy-reducing active arc-flash mitigation system (4) Current-limiting, electronically actuated fuses (5) An approved equivalent means	Impact: No negative impact.	
240.67(C)	N/A	Detail SR-8020	**(C) Performance Testing.** The arc energy reduction protection system shall be performance tested by primary current injection testing or another approved method when first installed on site. This testing shall be conducted by a qualified person(s) in accordance with the manufacturer's instructions. A written record of this testing shall be made and shall be available to the authority having jurisdiction.	New subdivision to provide requirements for performance testing. Impact: No negative impact. Requires performance testing of newly installed arc energy reduction protection systems. Impacting new projects employing arc energy reduction mechanism.	2
240.87(A)	**240.87 Arc Energy Reduction.** Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1200 A or higher, 240.87(A) and (B) shall apply. **(A) Documentation.** Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s).	SR-7999	**240.87 Arc Energy Reduction.** Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1200 A or higher, 240.87(A) and (B) shall apply. **(A) Documentation.** Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s). Documentation shall also be provided to demonstrate that the method chosen to reduce clearing time is set to operate at a value below the available arcing current.	Revision to require documentation specifying the arc flash mitigation method chosen. Impact: No negative impact.	2
240.87(B)	**(B) Method to Reduce Clearing Time.** One of the following	SR-7999 FR-8671	**(B) Method to Reduce Clearing Time.** One of the following means shall be provided and	Revision to set parameters for the operation of a circuit	2

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	means shall be provided: (1) Zone-selective interlocking (2) Differential relaying (3) Energy-reducing maintenance switching with local status indicator (4) Energy-reducing active arc flash mitigation system (5) An instantaneous trip setting that is less than the available arcing current (6) An instantaneous override that is less than the available arcing current (7) An approved equivalent means		shall be set to operate at less than the available arcing current: (1) Zone-selective interlocking (2) Differential relaying (3) Energy-reducing maintenance switching with local status indicator (4) Energy-reducing active arc flash mitigation system (5) An instantaneous trip setting. Temporary adjustment of the instantaneous trip setting to achieve arc energy reduction shall not be permitted. (6) An instantaneous override (7) An approved equivalent means	breaker with respect to the available arcing current. Revision to prohibit temporary adjustment as a means to achieve energy arc reduction. Impact: No negative impact	
240.87(C)	N/A	Detail SR-8030	**(C) Performance Testing.** The arc energy reduction protection system shall be performance tested by primary current injection testing or another approved method when first installed on site. This testing shall be conducted by a qualified person(s) in accordance with the manufacturer's instructions. A written record of this testing shall be made and shall be available to the authority having jurisdiction.	New subdivision to provide requirements for performance testing. Impact: No negative impact. Testing documentation will be required.	2
240.88	N/A	Detail SR-8011	**240.88 Reconditioned Equipment.** Reconditioned equipment shall be listed as "reconditioned" and the original listing mark removed. **(A) Circuit Breakers.** The use of reconditioned circuit breakers shall comply with (1) through (3):	New section to address requirements for reconditioned equipment. Provides limits where reconditioned overcurrent protection devices can be used. Impact: No safety impact. Improves safety.	2

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			(1) Molded-case circuit breakers shall not be permitted to be reconditioned. (2) Low- and medium-voltage power circuit breakers shall be permitted to be reconditioned. (3) High-voltage circuit breakers shall be permitted to be reconditioned. **(B) Components.** The use of reconditioned trip units, protective relays, and current transformers shall comply with (1) and (2): (1) Low-voltage power circuit breaker electronic trip units shall not be permitted to be reconditioned. (2) Electromechanical protective relays and current transformers shall be permitted to be reconditioned.		
240.102	N/A	SR-8048	**240.102 Reconditioned Equipment.** Medium-voltage fuseholders and medium-voltage nonrenewable fuses shall not be permitted to be reconditioned.	New section to prohibit low-voltage fuseholders and low-voltage nonrenewable fuses from being reconditioned. Impact: No negative impact.	2
Article 242	**Overvoltage Protection**				
Article 242 242.1	*Global change, relocating and combining requirements found in Articles 280 and 285. (Actual Articles not copied)*	Global FR-8221, Global SR-8083	**242.1 Scope.** This article provides the general requirements, installation requirements, and connection requirements for overvoltage protection and overvoltage protective devices. Part II covers surge-protective devices (SPDs) permanently installed on premises wiring systems of not more than 1000 volts, nominal, while Part III	New article to relocate requirements from Articles 280 and 285. This article provides the requirements for overvoltage protection and overvoltage protective devices.	1

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			covers surge arresters permanently installed on premises wiring systems over 1000 volts, nominal.	Impact: No safety impact.	
280.14 (*see Informational Note, above)*	**280.14 Routing of Surge Arrester Grounding Conductors.** The conductor used to connect the surge arrester to line, bus, or equipment and to a grounding conductor connection point as provided in 280.21 shall not be any longer than necessary and shall avoid unnecessary bends.		**242.48 Routing of Surge Arrester Grounding Conductors.** The conductor used to connect the surge arrester to line, bus, or equipment and to an equipment grounding conductor or grounding electrode connection point as provided in 242.50 shall not be any longer than necessary and shall avoid unnecessary bends.	Expanded to add a grounding electrode as a connection point for a grounding conductor. Impact: No safety impact.	2
Article 250	**Grounding and Bonding**				
250.25	N/A	Global FR-8198, SR-7778	**250.25 Grounding System Permitted to Be connected on the Supply Side of the Disconnect.** The grounding of systems connected on the supply side of the service disconnect, as permitted in 230.82, that are in enclosures separate from the service equipment enclosure shall comply with 250.25A) or (B). **(A) Grounded System.** If the utility supply system is grounded, the grounding of systems permitted to be connected on the supply side of the service disconnect and are installed in one or more separate enclosures from the service equipment enclosure shall comply with the requirements of 250.24(A) through (D). **(B) Ungrounded Systems.** If the utility supply system is ungrounded, the grounding of systems permitted to be connected on the supply side of the service disconnect and are installed in one or more separate enclosures from the service equipment enclosure shall comply with the	New section to cover requirements for grounding and bonding of supply-side disconnects. Impact: No negative impact.	2

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			requirements of 250.24(E).		
250.28(A)	**250.28 Main Bonding Jumper and System Bonding Jumper.** For a grounded system, main bonding jumpers and system bonding jumpers shall be installed as follows: **(A) Material.** Main bonding jumpers and system bonding jumpers shall be of copper or other corrosion-resistant material. A main bonding jumper and a system bonding jumper shall be a wire, bus, screw, or similar suitable conductor.	FR-7685	**250.28 Main Bonding Jumper and System Bonding Jumper.** For a grounded system, main bonding jumpers and system bonding jumpers shall be installed as follows: **(A) Material.** Main bonding jumpers and system bonding jumpers shall be of copper, aluminum, copper-clad aluminum, or other corrosion-resistant material. A main bonding jumper and a system bonding jumper shall be a wire, bus, screw, or similar suitable conductor.	Revision to correlate with Table 250.102(C)(1) for bonding jumper material. Impact: No safety impact.	1
250.30	**250.30 Grounding Separately Derived Alternating-Current Systems.** In addition to complying with 250.30(A) for grounded systems, or as provided in 250.30(B) for ungrounded systems, separately derived systems shall comply with 250.20, 250.21, 250.22, or 250.26, as applicable. Multiple separately derived systems that are connected in parallel shall be installed in accordance with 250.30.	FR-8097	**250.30 Grounding Separately Derived Alternating-Current Systems.** In addition to complying with 250.30(A) for grounded systems, or as provided in 250.30(B) for ungrounded systems, separately derived systems shall comply with 250.20, 250.21, 250.22, or 250.26, as applicable. Multiple power sources of the same type that are connected in parallel to form one system that supplies premises wiring shall be considered as a single separately derived system and shall be installed in accordance with 250.30.	Revision to clarify multiple separately derived systems of the same type connected in parallel are considered to be a single separately derived system. Impact: No negative impact.	2
250.30(A)(1)(b), Exception	**(A) Grounded Systems.** A separately derived ac system that is grounded shall comply with 250.30(A)(1) through (A)(8). Except as otherwise permitted in this article, a grounded conductor shall not be connected to normally non–current carrying metal parts of equipment, be connected to equipment grounding conductors, or be reconnected to ground on the load side of the system bonding jumper. Informational Note: See 250.32 for connections at separate buildings or structures and 250.142	FR-8097	**(A) Grounded Systems.** A separately derived ac system that is grounded shall comply with 250.30(A)(1) through (A)(8). Except as otherwise permitted in this article, a grounded conductor shall not be connected to normally non–current-carrying metal parts of equipment, be connected to equipment grounding conductors, or be reconnected to ground on the load side of the system bonding jumper. Informational Note: See 250.32 for connections at separate buildings or structures	New exception to permit system bonding jumper to be installed at other than the disconnecting means located at each separate source for parallel installations. Impact: No negative impact.	2

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	for use of the grounded circuit conductor for grounding equipment. *Exception: Impedance grounded neutral system grounding connections shall be made as specified in 250.36 or 250.187, as applicable.* **(1) System Bonding Jumper.** An unspliced system bonding jumper shall comply with 250.28(A) through (D). This connection shall be made at any single point on the separately derived system from the source to the first system disconnecting means or overcurrent device, or it shall be made at the source of a separately derived system that has no disconnecting means or overcurrent devices, in accordance with 250.30(A)(1)(a) or (b). The system bonding jumper shall remain within the enclosure where it originates. If the source is located outside the building or structure supplied, a system bonding jumper shall be installed at the grounding electrode connection in compliance with 250.30(C). *Exception No. 1: For systems installed in accordance with 450.6, a single system bonding jumper connection to the tie point of the grounded circuit conductors from each power source shall be permitted.* *Exception No. 2: If a building or structure is supplied by a feeder from an outdoor separately derived system, a system bonding jumper at both the source and the first disconnecting means shall be permitted if doing so does not establish a parallel path for the grounded conductor. If a grounded conductor is used in this manner, it shall not be smaller than*		and 250.142 for use of the grounded circuit conductor for grounding equipment. *Exception: Impedance grounded neutral system grounding connections shall be made as specified in 250.36 or 250.187, as applicable.* **(1) System Bonding Jumper.** An unspliced system bonding jumper shall comply with 250.28(A) through (D). This connection shall be made at any single point on the separately derived system from the source to the first system disconnecting means or overcurrent device, or it shall be made at the source of a separately derived system that has no disconnecting means or overcurrent devices, in accordance with 250.30(A)(1)(a) or (A)(1)(b). The system bonding jumper shall remain within the enclosure where it originates. If the source is located outside the building or structure supplied, a system bonding jumper shall be installed at the grounding electrode connection in compliance with 250.30(C). *Exception No. 1: For systems installed in accordance with 450.6, a single system bonding jumper connection to the tie point of the grounded circuit conductors from each power source shall be permitted.* *Exception No. 2: If a building or structure is supplied by a feeder from an outdoor separately derived system, a system bonding jumper at both the source and the first disconnecting means shall be permitted if doing so does not establish a parallel path for the grounded conductor. If a grounded conductor is used in this manner, it shall not be smaller than the size specified for the*		

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	the size specified for the system bonding jumper but shall not be required to be larger than the ungrounded conductor(s). For the purposes of this exception, connection through the earth shall not be considered as providing a parallel path. *Exception No. 3: The size of the system bonding jumper for a system that supplies a Class 1, Class 2, or Class 3 circuit, and is derived from a transformer rated not more than 1000 volt-amperes, shall not be smaller than the derived ungrounded conductors and shall not be smaller than 14 AWG copper or 12 AWG aluminum.* (a) *Installed at the Source.* The system bonding jumper shall connect the grounded conductor to the supply-side bonding jumper and the normally non–current-carrying metal enclosure. (b) *Installed at the First Disconnecting Means.* The system bonding jumper shall connect the grounded conductor to the supply-side bonding jumper, the disconnecting means enclosure, and the equipment grounding conductor(s).		*system bonding jumper but shall not be required to be larger than the ungrounded conductor(s). For the purposes of this exception, connection through the earth shall not be considered as providing a parallel path.* *Exception No. 3: The size of the system bonding jumper for a system that supplies a Class 1, Class 2, or Class 3 circuit, and is derived from a transformer rated not more than 1000 volt-amperes, shall not be smaller than the derived ungrounded conductors and shall not be smaller than 14 AWG copper or 12 AWG aluminum.* (a) *Installed at the Source.* The system bonding jumper shall connect the grounded conductor to the supply-side bonding jumper and the normally non–current-carrying metal enclosure. (b) *Installed at the First Disconnecting Means.* The system bonding jumper shall connect the grounded conductor to the supply-side bonding jumper, the disconnecting means enclosure, and the equipment grounding conductor(s). *Exception: Separately derived systems consisting of multiple sources of the same type that are connected in parallel shall be permitted to have the system bonding jumper installed at the paralleling switchgear, switchboard, or other paralleling connection point instead of at the disconnecting means located at each separate source.*		

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250.30(A)(2)	**(A) Grounded Systems.** A separately derived ac system that is grounded shall comply with 250.30(A)(1) through (A)(8). Except as otherwise permitted in this article, a grounded conductor shall not be connected to normally non–current carrying metal parts of equipment, be connected to equipment grounding conductors, or be reconnected to ground on the load side of the system bonding jumper. Informational Note: See 250.32 for connections at separate buildings or structures and 250.142 for use of the grounded circuit conductor for grounding equipment. *Exception: Impedance grounded neutral system grounding connections shall be made as specified in 250.36 or 250.187, as applicable.* **(2) Supply-Side Bonding Jumper.** If the source of a separately derived system and the first disconnecting means are located in separate enclosures, a supply-side bonding jumper shall be installed with the circuit conductors from the source enclosure to the first disconnecting means. A supply-side bonding jumper shall not be required to be larger than the derived ungrounded conductors. The supply-side bonding jumper shall be permitted to be of nonflexible metal raceway type or of the wire or bus type as follows: (a) A supply-side bonding jumper of the wire type shall comply with 250.102(C), based on the size of the derived ungrounded conductors.	FR-8097, SR-7785	**(A) Grounded Systems.** A separately derived ac system that is grounded shall comply with 250.30(A)(1) through (A)(8). Except as otherwise permitted in this article, a grounded conductor shall not be connected to normally non–current-carrying metal parts of equipment, be connected to equipment grounding conductors, or be reconnected to ground on the load side of the system bonding jumper. Informational Note: See 250.32 for connections at separate buildings or structures and 250.142 for use of the grounded circuit conductor for grounding equipment. *Exception: Impedance grounded neutral system grounding connections shall be made as specified in 250.36 or 250.187, as applicable.* **(2) Supply-Side Bonding Jumper.** If the source of a separately derived system and the first disconnecting means are located in separate enclosures, a supply-side bonding jumper shall be installed with the circuit conductors from the source enclosure to the first disconnecting means enclosure. A supply-side bonding jumper shall not be required to be larger than the derived ungrounded conductors. The supply-side bonding jumper shall be permitted to be of nonflexible metal raceway type or of the wire or bus type as follows: (1) A supply-side bonding jumper of the wire type shall comply with 250.102(C), based on the size of the derived ungrounded conductors. (2) A supply-side bonding jumper of the bus type shall have a cross-sectional area not smaller than a supply-side	Revision to clarify the connection of the supply-side bonding jumper is to the disconnecting means enclosure. Impact: No negative impact.	2

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	(b) A supply-side bonding jumper of the bus type shall have a cross-sectional area not smaller than a supply-side bonding jumper of the wire type as determined in 250.102(C). *Exception: A supply-side bonding jumper shall not be required between enclosures for installations made in compliance with 250.30(A)(1), Exception No. 2.*		bonding jumper of the wire type as determined in 250.102(C). *Exception: A supply-side bonding jumper shall not be required between enclosures for installations made in compliance with 250.30(A)(1), Exception No. 2.*		
250.30(A)(3)	**(3) Grounded Conductor.** If a grounded conductor is installed and the system bonding jumper connection is not located at the source, 250.30(A)(3)(a) through (A)(3)(d) shall apply. (a) *Sizing for a Single Raceway.* The grounded conductor shall not be smaller than specified in Table 250.102(C)(1). (b) *Parallel Conductors in Two or More Raceways.* If the ungrounded conductors are installed in parallel in two or more raceways, the grounded conductor shall also be installed in parallel. The size of the grounded conductor in each raceway shall be based on the total circular mil area of the parallel derived ungrounded conductors in the raceway as indicated in 250.30(A)(3)(a), but not smaller than 1/0 AWG. Informational Note: See 310.10(H) for grounded conductors connected in parallel. (c) *Delta-Connected System.* The grounded conductor of a 3-phase, 3-wire delta system shall have an ampacity not less than that of the ungrounded conductors. (d) *Impedance Grounded System.* The grounded conductor of an impedance	FR-8097	**(3) Grounded Conductor.** If a grounded conductor is installed and the system bonding jumper connection is not located at the source, 250.30(A)(3)(a) through (A)(3)(d) shall apply. The grounded conductor shall not be required to be larger than the derived ungrounded conductors. (a) *Sizing for a Single Raceway.* The grounded conductor shall not be smaller than specified in Table 250.102(C)(1). (b) *Parallel Conductors in Two or More Raceways.* If the ungrounded conductors are installed in parallel in two or more raceways, the grounded conductor shall also be installed in parallel. The size of the grounded conductor in each raceway shall be based on the total circular mil area of the parallel derived ungrounded conductors in the raceway as indicated in 250.30(A)(3)(a), but not smaller than 1/0 AWG. (c) *Delta-Connected System.* The grounded conductor of a 3-phase, 3-wire delta system shall have an ampacity not less than that of the ungrounded conductors. (d) *Impedance Grounded System.* The grounded conductor of an impedance	Revision to recognize the grounded conductor is not required to be larger than the ungrounded conductors. Impact: No negative impact.	2

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	grounded neutral system shall be installed in accordance with 250.36 or 250.187, as applicable.		grounded neutral system shall be installed in accordance with 250.36 or 250.187, as applicable.		
250.30(A)(6), Exception	**(6) Grounding Electrode Conductor, Multiple Separately Derived Systems.** A common grounding electrode conductor for multiple separately derived systems shall be permitted. If installed, the common grounding electrode conductor shall be used to connect the grounded conductor of the separately derived systems to the grounding electrode as specified in 250.30(A)(4). A grounding electrode conductor tap shall then be installed from each separately derived system to the common grounding electrode conductor. Each tap conductor shall connect the grounded conductor of the separately derived system to the common grounding electrode conductor. This connection shall be made at the same point on the separately derived system where the system bonding jumper is connected.	FR-8097	**(6) Grounding Electrode Conductor, Multiple Separately Derived Systems.** A common grounding electrode conductor for multiple separately derived systems shall be permitted. If installed, the common grounding electrode conductor shall be used to connect the grounded conductor of each separately derived system to the grounding electrode as specified in 250.30(A)(4). A grounding electrode conductor tap shall then be installed from each separately derived system to the common grounding electrode conductor. Each tap conductor shall connect the grounded conductor of the separately derived system to the common grounding electrode conductor. This connection shall be made at the same point on the separately derived system where the system bonding jumper is connected. *Exception No. 3: If the source of a separately derived system is located within equipment listed and identified as suitable for use as service equipment, the grounding electrode conductor from the service or feeder equipment to the grounding electrode shall be permitted as the grounding electrode conductor for the separately derived system, if the grounding electrode conductor is*	New exception to 250.30(A)(6)(a)(1) and (b) to permit reduced sizing of grounding electrode conductors under the conditions stated and to correlate with 250.66. Impact: No negative impact.	2

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			of sufficient size for the separately derived system. If the equipment grounding bus internal to the equipment is not smaller than the required grounding electrode conductor for the separately derived system shall be permitted to be made to the bus.		
250.53(C)	**250.53 Grounding Electrode Installation (C) Bonding Jumper.** The bonding jumper(s) used to connect the grounding electrodes together to form the grounding electrode system shall be installed in accordance with 250.64(A), (B), and (E), shall be sized in accordance with 250.66, and shall be connected in the manner specified in 250.70.	SR-7818	**250.53 Grounding Electrode Installation (C) Bonding Jumper.** The bonding jumper(s) used to connect the grounding electrodes together to form the grounding electrode system shall be installed in accordance with 250.64(A), (B), and (E), shall be sized in accordance with 250.66, and shall be connected in the manner specified in 250.70. Rebar shall not be used as a conductor to interconnect the electrodes of grounding electrode systems.	Revision to prohibit utilizing rebar as a conductor to interconnect other electrodes. Impact: No negative impact	2
250.64(B)(2) and (3)	**250.64 Grounding Electrode Conductor Installation.** Grounding electrode conductors at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system shall be installed as specified in 250.64(A) through (F). **(B) Securing and Protection Against Physical Damage.** Where exposed, a grounding electrode conductor or its enclosure shall be securely fastened to the surface on which it is carried. Grounding electrode conductors shall be permitted to be installed on or through framing members. **(2) Exposed to Physical Damage.** A 6 AWG or larger copper or aluminum grounding electrode conductor exposed to physical damage shall be protected in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid polyvinyl chloride	FR-7898	**250.64 Grounding Electrode Conductor Installation.** Grounding electrode conductors at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system shall be installed as specified in 250.64(A) through (F). **(B) Securing and Protection Against Physical Damage.** Where exposed, a grounding electrode conductor or its enclosure shall be securely fastened to the surface on which it is carried. Grounding electrode conductors shall be permitted to be installed on or through framing members. **(2) Exposed to Physical Damage.** A 6 AWG or larger copper or aluminum grounding electrode conductor exposed to physical damage shall be protected in rigid metal conduit (RMC), intermediate metal conduit (IMC), Schedule 80 rigid polyvinyl chloride	Revision to require Schedule 80 when PVC is the wiring method employed. Impact: No negative impact. Improves protection of a grounding electrode conductor.	2

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	conduit (PVC), reinforced thermosetting resin conduit Type XW (RTRC-XW), electrical metallic tubing (EMT), or cable armor. **(3) Smaller Than 6 AWG.** Grounding electrode conductors smaller than 6 AWG shall be protected in RMC, IMC, PVC, RTRC-XW, EMT, or cable armor.		conduit (PVC), reinforced thermosetting resin conduit Type XW (RTRC-XW), electrical metallic tubing (EMT), or cable armor. **(3) Smaller Than 6 AWG.** Grounding electrode conductors smaller than 6 AWG shall be protected in RMC, IMC, Schedule 80 PVC, RTRC-XW, EMT, or cable armor.		
250.68(C)(3)	**250.68 Grounding Electrode Conductor and Bonding Jumper** Connection to Grounding Electrodes. The connection of a grounding electrode conductor at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system and associated bonding jumper(s) shall be made as specified 250.68(A) through (C). **(C) Grounding Electrode Conductor Connections.** Grounding electrode conductors and bonding jumpers shall be permitted to be connected at the following locations and used to extend the connection to an electrode(s): (3) A rebar-type concrete-encased electrode installed in accordance with 250.52(A)(3) with an additional rebar section extended from its location within the concrete to an accessible location that is not subject to corrosion shall be permitted for connection of grounding electrode conductors and bonding jumpers. The rebar extension shall not be exposed to contact with the earth without corrosion protection.	FR-7985	**250.68 Grounding Electrode Conductor and Bonding Jumper** Connection to Grounding Electrodes. The connection of a grounding electrode conductor at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system and associated bonding jumper(s) shall be made as specified 250.68(A) through (C). **(C) Grounding Electrode Conductor Connections.** Grounding electrode conductors and bonding jumpers shall be permitted to be connected at the following locations and used to extend the connection to an electrode(s): (3) A rebar-type concrete-encased electrode installed in accordance with 250.52(A)(3) with an additional rebar section extended from its location within the concrete foundation or footing to an accessible location that is not subject to corrosion shall be permitted for connection of grounding electrode conductors and bonding jumpers in accordance with the following: a. The additional rebar section shall be continuous with the grounding electrode rebar or shall be connected to the grounding electrode rebar and	Revision to specify methods of connecting the rebar extension to the grounding electrode rebar and prohibit utilizing rebar as a conductor to interconnect other electrodes. Impact: No negative impact. Improves safety of installation.	2

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			connected together by the usual steel tie wires, exothermic welding, welding, or other effective means. b. The rebar extension shall not be exposed to contact with the earth without corrosion protection. c. Rebar shall not be used as a conductor to interconnect the electrodes of grounding electrode systems.		
250.104(A)(1) (4)	**250.104 Bonding of Piping Systems and Exposed Structural Metal.** **(A) Metal Water Piping.** The metal water piping system shall be bonded as required in (A)(1), (A)(2), or (A)(3) of this section. **(1) General.** Metal water piping system(s) installed in or attached to a building or structure shall be bonded to any of the following: (1) Service equipment enclosure (2) Grounded conductor at the service (3) Grounding electrode conductor if of sufficient size (4) One or more grounding electrodes used, if the grounding electrode conductor or bonding jumper to the grounding electrode is of sufficient size The bonding jumper(s) shall be installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible. The bonding jumper(s) shall be sized in accordance with Table 250.102(C)(1) except as permitted in 250.104(A)(2) and 250.104(A)(3).	FR-8031	**250.104 Bonding of Piping Systems and Exposed Structural Metal.** **(A) Metal Water Piping.** The metal water piping system shall be bonded as required in 250.104(A)(1), (A)(2), or (A)(3). **(1) General.** Metal water piping system(s) installed in or attached to a building or structure shall be bonded to any of the following: (1) Service equipment enclosure (2) Grounded conductor at the service (3) Grounding electrode conductor, if of sufficient size (4) One or more grounding electrodes used, if the grounding electrode conductor or bonding jumper to the grounding electrode is of sufficient size The bonding jumper(s) shall be installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible. The bonding jumper(s) shall be sized in	Revision to prescribe a maximum size conductor. Impact: No negative impact.	2

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			accordance with Table 250.102(C)(1) except that it shall not be required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum and except as permitted in 250.104(A)(2) and 250.104(A)(3)		
250.104(C)	**(C) Structural Metal.** Exposed structural metal that is interconnected to form a metal building frame and is not intentionally grounded or bonded and is likely to become energized shall be bonded to any of the following: (1) Service equipment enclosure (2) Grounded conductor at the service (3) Disconnecting means for buildings or structures supplied by a feeder or branch circuit (4) Grounding electrode conductor, if of sufficient size (5) One or more grounding electrodes used, if the grounding electrode conductor or bonding jumper to the grounding electrode is of sufficient size The bonding conductor(s) or jumper(s) shall be sized in accordance with Table 250.102(C)(1) and installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible unless installed in compliance with 250.68(A) Exception No. 2.	FR-8034	**(C) Structural Metal.** Exposed structural metal that is interconnected to form a metal building frame, is not intentionally grounded or bonded, and is likely to become energized shall be bonded to any of the following: (1) Service equipment enclosure (2) Grounded conductor at the service (3) Disconnecting means for buildings or structures supplied by a feeder or branch circuit (4) Grounding electrode conductor, if of sufficient size (5) One or more grounding electrodes used, if the grounding electrode conductor or bonding jumper to the grounding electrode is of sufficient size The bonding conductor(s) or jumper(s) shall be sized in accordance with Table 250.102(C)(1), except that it shall not be required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum, and installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible unless installed in compliance with 250.68(A) Exception No. 2.	Revision to prescribe a maximum size conductor. Impact: No negative impact.	2

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250.104(D)(1) and (2)	**(D) Separately Derived Systems.** Metal water piping systems and structural metal that is interconnected to form a building frame shall be bonded to separately derived systems in accordance with 250.104(D)(1) through 250.104(D)(3). **(1) Metal Water Piping System(s).** The grounded conductor of each separately derived system shall be bonded to the nearest available point of the metal water piping system(s) in the area served by each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1) based on the largest ungrounded conductor of the separately derived system. *Exception No. 1: A separate bonding jumper to the metal water piping system shall not be required if the metal water piping system is used as the grounding electrode for the separately derived system and the water piping system is in the area served.* *Exception No. 2: A separate water piping bonding jumper shall not be required if the metal frame of a building or structure is used as the grounding electrode for a separately derived system and is bonded to the*	FR-8035	**(D) Separately Derived Systems.** Metal water piping systems and structural metal that is interconnected to form a building frame shall be bonded to separately derived systems in accordance with 250.104(D)(1) through 250.104(D)(3). **(1) Metal Water Piping System(s).** The grounded conductor of each separately derived system shall be bonded to the nearest available point of the metal water piping system(s) in the area served by each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1) based on the largest ungrounded conductor of the separately derived system except that it shall not be required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum. *Exception No. 1: A separate bonding jumper to the metal water piping system shall not be required if the metal water piping system is used as the grounding electrode for the separately derived system and the water piping system is in the area served.* *Exception No. 2: A separate water piping bonding jumper shall not be required if the metal frame of a building or structure is used as the grounding electrode for a separately derived system and is bonded to the metal water piping in the area served by the separately derived system.* **(2) Structural Metal.** If exposed structural metal that is interconnected to form the building frame exists in the area served by the separately derived system, it shall be bonded to	Revision to prescribe a maximum size conductor. Impact: No negative impact	2

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			the grounded conductor of each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1) based on the largest ungrounded conductor of the separately derived system except that it shall not be required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum. *Exception No. 1: A separate bonding jumper to the building structural metal shall not be required if the metal frame of a building or structure is used as the grounding electrode for the separately derived system.* *Exception No. 2: A separate bonding jumper to the building structural metal shall not be required if the water piping of a building or structure is used as the grounding electrode for a separately derived system and is bonded to the building structural metal in the area served by the separately derived system.*		
250.109	N/A	SR-7839	**250.109 Metal Enclosures.** Metal enclosures shall be permitted to be used to connect bonding jumpers or equipment grounding conductors, or both, together to become a part of an effective ground-fault current path. Metal covers and metal fittings attached to these metal enclosures shall be considered as being connected to bonding jumpers or equipment grounding conductors, or both.	New section to permit metal enclosures as a means to connect bonding jumpers or equipment grounding conductors and metal covers and fittings connected thereto. Impact: No negative impact	2
250.119	**250.119 Identification of Equipment Grounding Conductors.** Unless required elsewhere in this *Code*, equipment grounding conductors shall be	SR-7840	**250.119 Identification of Equipment Grounding Conductors.**	Revision to add a 60-volt dc threshold and delete the reference to 250.112(I) as this	2

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	permitted to be bare, covered, or insulated. Individually covered or insulated equipment grounding conductors shall have a continuous outer finish that is either green or green with one or more yellow stripes except as permitted in this section. Conductors with insulation or individual covering that is green, green with one or more yellow stripes, or otherwise identified as permitted by this section shall not be used for ungrounded or grounded circuit conductors. *Exception No. 1: Power-limited Class 2 or Class 3 cables, power-limited fire alarm cables, or communications cables containing only circuits operating at less than 50 volts where connected to equipment not required to be grounded in accordance with 250.112(I) shall be permitted to use a conductor with green insulation or green with one or more yellow stripes for other than equipment grounding purposes.*		Unless required elsewhere in this *Code,* equipment grounding conductors shall be permitted to be bare, covered, or insulated. Individually covered or insulated equipment grounding conductors shall have a continuous outer finish that is either green or green with one or more yellow stripes except as permitted in this section. Conductors with insulation or individual covering that is green, green with one or more yellow stripes, or otherwise identified as permitted by this section shall not be used for ungrounded or grounded circuit conductors. *Exception No. 1: Power-limited Class 2 or Class 3 cables, power-limited fire alarm cables, or communications cables containing only circuits operating at less than 50 volts ac or 60 volts dc where connected to equipment not required to be grounded in accordance with 250.112(I) shall be permitted to use a conductor with green insulation or green with one or more yellow stripes for other than equipment grounding purposes.*	section is only applicable to circuits. Impact: No negative impact	
250.121	**250.121 Use of Equipment Grounding Conductors.** An equipment grounding conductor shall not be used as a grounding electrode conductor. *Exception: A wire-type equipment grounding conductor installed in compliance with 250.6(A) and the applicable requirements for both the equipment grounding conductor and the grounding electrode conductor in Parts II, III, and VI of this article shall be permitted to serve as both an equipment grounding conductor and a grounding electrode conductor.*	FR-7544, SR-7757	**250.121 Restricted Use of Equipment Grounding Conductors.** **(A) Grounding Electrode Conductor.** An equipment grounding conductor shall not be used as a grounding electrode conductor. *Exception: A wire-type equipment grounding conductor installed in compliance with 250.6(A) and the applicable requirements for both the equipment grounding conductor and the grounding electrode conductor in Parts II, III, and VI of this article shall be permitted to serve as both an equipment grounding conductor and a grounding electrode conductor.* **(B) Metal Frame of Building or Structure.** The structural metal frame of a building or	Revision into two first-level subdivisions and to relocate prohibition for the structural metal frame of a building or structure from 250.136. Impact: No negative impact	2

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			structure shall not be used as an equipment grounding conductor.		
250.122(B)	**250.122 Size of Equipment Grounding Conductors.** **(A) General.** Copper, aluminum, or copper-clad aluminum equipment grounding conductors of the wire type shall not be smaller than shown in Table 250.122, but in no case shall they be required to be larger than the circuit conductors supplying the equipment. Where a cable tray, a raceway, or a cable armor or sheath is used as the equipment grounding conductor, as provided in 250.118 and 250.134(A), it shall comply with 250.4(A)(5) or (B)(4). Equipment grounding conductors shall be permitted to be sectioned within a multiconductor cable, provided the combined circular mil area complies with Table 250.122. **(B) Increased in Size.** Where ungrounded conductors are increased in size from the minimum size that has sufficient ampacity for the intended installation, wire-type equipment grounding conductors, where installed, shall be increased in size proportionately, according to the circular mil area of the ungrounded conductors.	FR-8114, SR-7760	**250.122 Size of Equipment Grounding Conductors.** **(A) General.** Copper, aluminum, or copper-clad aluminum equipment grounding conductors of the wire type shall not be smaller than shown in Table 250.122, The equipment grounding conductor shall not be required to be larger than the circuit conductors supplying the equipment. If a cable tray, a raceway, or a cable armor or sheath is used as the equipment grounding conductor, as provided in 250.118 and 250.134(A), it shall comply with 250.4(A)(5) or (B)(4). Equipment grounding conductors shall be permitted to be sectioned within a multiconductor cable, provided the combined circular mil area complies with Table 250.122. **(B) Increased in Size.** If ungrounded conductors are increased in size for any reason other than as required in 310.15(B) or 310.15(C), wire-type equipment grounding conductors. if installed, shall be increased in size proportionately to the increase in circular mil area, of the ungrounded conductors. *Exception: Equipment grounding conductors shall be permitted to be sized by a qualified person to provide an effective ground fault current path in accordance with 250.4(A)(5) or ((B)(4)* .	Revision to clarify that adjustment and/or correction factors do not require an increase in the size of the EGC. New exception to allow the EGC to be sized by a qualified person. Impact: No negative impact	2
Table 250.122		FR-8114, SR-7760	*Table change not shown – see description of change, on the right.*	Revision to sizes from 1200 kcmil to 1250 kcmil for aluminum and copper-clad aluminum for overcurrent devices rated at 5000 and 6000 amperes, respectively. Impact: No negative impact.	2

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250.184(C), Exception	**250.184 Solidly Grounded Neutral Systems.** Solidly grounded neutral systems shall be permitted to be either single point grounded or multigrounded neutral. **(C) Multigrounded Neutral Systems.** Where a multigrounded neutral system is used, the following shall apply: (1) The neutral conductor of a solidly grounded neutral system shall be permitted to be grounded at more than one point. Grounding shall be permitted at one or more of the following locations: a. Transformers supplying conductors to a building or other structure b. Underground circuits where the neutral conductor is exposed c. Overhead circuits installed outdoors (2) The multigrounded neutral conductor shall be grounded at each transformer and at other additional locations by connection to a grounding electrode. (3) At least one grounding electrode shall be installed and connected to the multigrounded neutral conductor every 400 m (1300 ft). (4) The maximum distance between any two adjacent electrodes shall not be more than 400 m (1300 ft). (5) In a multigrounded shielded cable system, the shielding	FR-7819	**250.184 Solidly Grounded Neutral Systems.** Solidly grounded neutral systems shall be permitted to be either single point grounded or multigrounded neutral. **(C) Multigrounded Neutral Systems.** Where a multigrounded neutral system is used, the following shall apply: (1) The neutral conductor of a solidly grounded neutral system shall be permitted to be grounded at more than one point. Grounding shall be permitted at one or more of the following locations: a. Transformers supplying conductors to a building or other structure b. Underground circuits where the neutral conductor is exposed c. Overhead circuits installed outdoors (2) The multigrounded neutral conductor shall be grounded at each transformer and at other additional locations by connection to a grounding electrode. (3) At least one grounding electrode shall be installed and connected to the multigrounded neutral conductor every 400 m (1300 ft). (4) The maximum distance between any two adjacent electrodes shall not be more than 400 m (1300 ft). (5) In a multigrounded shielded cable system, the shielding shall be grounded at each cable joint that is exposed to personnel contact. *Exception: In a multipoint grounded system, a grounding electrode shall not be required to bond the neutral conductor in an*	New exception for bonding to a grounding electrode for uninterrupted conductors exceeding 1300 ft. Impact: No negative impact.	2

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	shall be grounded at each cable joint that is exposed to personnel contact.		*uninterrupted conductor exceeding 400 m (1300 ft) if the only purpose for removing the cable jacket is for bonding the neutral conductor to a grounding electrode.*		
Article 280, Surge Arresters, Over 1000 Volts and Article 285, Surge-Protective Devices (SPDs), 1000 Volts or Less		FR-8116		Revision deletes both articles, which have been combined into new Article 242.	
Chapter 3	**Wiring Methods and Materials**				
Article 300	**General Requirements for Wiring Methods and Materials**				
300.25	N/A	FR-8742, SR-7888	**300.25 Exit Enclosures (Stair Towers).** Where an exit enclosure is required to be separated from the building, only electrical wiring methods serving equipment permitted by the authority having jurisdiction in the exit enclosure shall be installed within the exit enclosure.	New section to address requirements for electrical wiring located in an exit enclosure subject to AHJ approval. Impact: No negative impact. Correlates with the requirements in NFPA 101, Life Safety Code.	2
Article 310	**Conductors for General Wiring**				
310.1	**310.1 Scope.** This article covers general requirements for conductors and their type designations, insulations, markings, mechanical strengths, ampacity ratings, and uses. These requirements do not apply to conductors that form an integral part of equipment, such as motors, motor controllers, and similar equipment, or to conductors specifically provided for elsewhere in this *Code*.	Global FR-8030	**310.1 Scope.** This article covers general requirements for conductors rated up to and including 2000 volts and their type designations, insulations, markings, mechanical strengths, ampacity ratings, and uses. These requirements do not apply to conductors that form an integral part of equipment, such as motors, motor controllers, and similar equipment, or to conductors specifically provided for elsewhere in this *Code*.	Revision to Article 310 to relocate all of the medium voltage cable requirements to new Article 311 and to revise the scope to now cover conductors rated up to 2000 volts. Impact: No negative impact	1
310.10(B)	**310.10 Uses Permitted.** The conductors described in 310.4 shall be permitted for use in any of the wiring methods covered in Chapter 3 and as	Global FR-8030	**310.10 Uses Permitted.** The conductors described in 310.4 shall be permitted for use in any of the wiring methods covered in Chapter 3 and as	Revision to include Type XHHN, XHWN, and XHWN-2 insulated conductors. Impact: No negative impact	2

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	specified in their respective tables or as permitted elsewhere in this *Code*. **(B) Dry and Damp Locations.** Insulated conductors and cables used in dry and damp locations shall be Types FEP, FEPB, MTW, PFA, RHH, RHW, RHW-2, SA, THHN, THW, THW-2, THHW, THWN, THWN-2, TW, XHH, XHHW, XHHW-2, Z, or ZW.		specified in their respective tables or as permitted elsewhere in this *Code*. **(B) Dry and Damp Locations.** Insulated conductors and cables used in dry and damp locations shall be Types FEP, FEPB, MTW, PFA, RHH, RHW, RHW-2, SA, THHN, THW, THW-2, THHW, THWN, THWN-2, TW, XHH, XHHW, XHHW-2, XHHN, XHWN, XHWN-2, Z, or ZW.		
310.10(C)	**(C) Wet Locations.** Insulated conductors and cables used in wet locations shall comply with one of the following: (1) Be moisture-impervious metal-sheathed (2) Be types MTW, RHW, RHW-2, TW, THW, THW-2, THHW, THWN, THWN-2, XHHW, XHHW-2, or ZW (3) Be of a type listed for use in wet locations	Global FR-8030	**(C) Wet Locations.** Insulated conductors and cables used in wet locations shall comply with one of the following: (1) Be moisture-impervious metal-sheathed (2) Be types MTW, RHW, RHW-2, TW, THW, THW-2, THHW, THWN, THWN-2, XHHW, XHHW-2, XHWN, XHWN-2 or ZW (3) Be of a type listed for use in wet locations	Revision to include Type XHWN and XHWN-2 insulated conductors. Impact: No negative impact	2
Article 311	**Medium Voltage Conductors and Cable**				
311	N/A	Global FR-8030, SR-7577, SR-7574, SR-7576, SR-7578, SR-7579	*The new Article 311, Medium Voltage Conductors and Cables not copied.*	New article to cover installation requirements and ampacities for conductors and cables rated 2001 to 35,000 volts that were previously located in Articles 310 and 328. Impact: No negative impact	1
Article 312	**Cabinets, Cutout Boxes, and Meter Socket Enclosures**				
312.5(C), Exception No. 2	**312.5 Cabinets, Cutout Boxes, and Meter Socket Enclosures.** Conductors entering enclosures within the scope of this article shall be protected from abrasion and shall comply with 312.5(A) through (C).	FR-7511	**312.5 Cabinets, Cutout Boxes, and Meter Socket Enclosures.** Conductors entering enclosures within the scope of this article shall be protected from	New exception to correlate with 392.46(A) and (B) permitting single or multiconductor cables entering an enclosure.	2

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	(C) Cables. Where cable is used, each cable shall be secured to the cabinet, cutout box, or meter socket enclosure. *Exception: Cables with entirely nonmetallic sheaths shall be permitted to enter the top of a surface-mounted enclosure through one or more nonflexible raceways not less than 450 mm (18 in.) and not more than 3.0 m (10 ft) in length, provided all of the following conditions are met:* *(1) Each cable is fastened within 300 mm (12 in.), measured along the sheath, of the outer end of the raceway.* *(2) The raceway extends directly above the enclosure and does not penetrate a structural ceiling.* *(3) A fitting is provided on each end of the raceway to protect the cable(s) from abrasion and the fittings remain accessible after installation.* *(4) The raceway is sealed or plugged at the outer end using approved means so as to prevent access to the enclosure through the raceway.* *(5) The cable sheath is continuous through the raceway and extends into the enclosure beyond the fitting not less than 6 mm (¼ in.).* *(6) The raceway is fastened at its outer end and at other points in accordance with the applicable article.* *(7) Where installed as conduit or tubing, the cable fill does not exceed the amount that would be permitted for complete conduit or tubing systems by Table 1 of Chapter 9 of this Code and all applicable notes thereto. Note 2 to the tables in Chapter 9 does not apply to this condition.*		abrasion and shall comply with 312.5(A) through (C). **(C) Cables.** Where cable is used, each cable shall be secured to the cabinet, cutout box, or meter socket enclosure. *Exception No. 1: Cables with entirely nonmetallic sheaths shall be permitted to enter the top of a surface-mounted enclosure through one or more nonflexible raceways not less than 450 mm (18 in.) and not more than 3.0 m (10 ft) in length, provided all of the following conditions are met:* *(1) Each cable is fastened within 300 mm (12 in.), measured along the sheath, of the outer end of the raceway.* *(2) The raceway extends directly above the enclosure and does not penetrate a structural ceiling.* *(3) A fitting is provided on each end of the raceway to protect the cable(s) from abrasion and the fittings remain accessible after installation.* *(4) The raceway is sealed or plugged at the outer end using approved means so as to prevent access to the enclosure through the raceway.* *(5) The cable sheath is continuous through the raceway and extends into the enclosure beyond the fitting not less than 6 mm (¼ in.).* *(6) The raceway is fastened at its outer end and at other points in accordance with the applicable article.* *(7) Where installed as conduit or tubing, the cable fill does not exceed the amount that would be permitted for complete conduit or tubing systems*	Impact: No negative impact.	

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			by Table 1 of Chapter 9 of this Code and all applicable notes thereto. Note 2 to the tables in Chapter 9 does not apply to this condition. *Exception No. 2: Single conductors and multiconductor cables shall be permitted to enter enclosures in accordance with 392.46(A) or (B)* .		
Article 314	**Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handholes**				
314.16(B)(5)	**314.16 Number of Conductors in Outlet, Device, and Junction Boxes, and Conduit Bodies.** Boxes and conduit bodies shall be of an approved size to provide free space for all enclosed conductors. In no case shall the volume of the box, as calculated in 314.16(A), be less than the fill calculation as calculated in 314.16(B). The minimum volume for conduit bodies shall be as calculated in 314.16(C). The provisions of this section shall not apply to terminal housings supplied with motors or generators. Boxes and conduit bodies enclosing conductors 4 AWG or larger shall also comply with the provisions of 314.28. **(B) Box Fill Calculations.** The volumes in paragraphs 314.16(B)(1) through (B)(5), as applicable, shall be added together. No allowance shall be required for small fittings such as locknuts and bushings. Each space within a box installed with a barrier shall be calculated separately.	FR-7531	**314.16 Number of Conductors in Outlet, Device, and Junction Boxes, and Conduit Bodies.** Boxes and conduit bodies shall be of an approved size to provide free space for all enclosed conductors. In no case shall the volume of the box, as calculated in 314.16(A), be less than the fill calculation as calculated in 314.16(B). The minimum volume for conduit bodies shall be as calculated in 314.16(C). The provisions of this section shall not apply to terminal housings supplied with motors or generators. Boxes and conduit bodies enclosing conductors 4 AWG or larger shall also comply with the provisions of 314.28. Outlet and device boxes shall also comply with 314.24. **(B) Box Fill Calculations.** The volumes in paragraphs 314.16(B)(1) through (B)(5), as applicable, shall be added together. No allowance shall be required for small fittings such as locknuts and bushings. Each space	Revision to add a ¼ volume allowance for equipment grounding conductors and equipment bonding conductors where they exceed four. Impact: No negative impact.	2

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	(5) Equipment Grounding Conductor Fill. Where one or more equipment grounding conductors or equipment bonding jumpers enter a box, a single volume allowance in accordance with Table 314.16(B) shall be made based on the largest equipment grounding conductor or equipment bonding jumper present in the box. Where an additional set of equipment grounding conductors, as permitted by 250.146(D), is present in the box, an additional volume allowance shall be made based on the largest equipment grounding conductor in the additional set.		within a box installed with a barrier shall be calculated separately. **(5) Equipment Grounding Conductor Fill.** Where up to four equipment grounding conductors or equipment bonding jumpers enter a box, a single volume allowance in accordance with Table 314.16(B) shall be made based on the largest equipment grounding conductor or equipment bonding jumper entering the box. A $^1/_4$ volume allowance shall be made for each additional equipment grounding conductor or equipment bonding jumper that enters the box, based on the largest equipment grounding conductor or equipment bonding conductor.		
314.28(E)(1)	**314.28 Pull and Junction Boxes and Conduit Bodies.** Boxes and conduit bodies used as pull or junction boxes shall comply with 314.28(A) through (E). **(E) Power Distribution Blocks.** Power distribution blocks shall be permitted in pull and junction boxes over 1650 cm^3 (100 $in.^3$) for connections of conductors where installed in boxes and where the installation complies with 314.28(E)(1) through (E)(5). **(1) Installation.** Power distribution blocks installed in boxes shall be listed. Power distribution blocks installed on the line side of the service equipment shall be listed and marked "suitable for use on the line side of service equipment" or equivalent.	FR-7570	**314.28 Pull and Junction Boxes and Conduit Bodies.** Boxes and conduit bodies used as pull or junction boxes shall comply with 314.28(A) through (E). **(E) Power Distribution Blocks.** Power distribution blocks shall be permitted in pull and junction boxes over 1650 cm^3 (100 $in.^3$) for connections of conductors where installed in boxes and where the installation complies with 314.28(E)(1) through (E)(5). **(1) Installation.** Power distribution blocks installed in boxes shall be listed.	Revision to delete the requirement suitable for use on the line side of service equipment to correlate with 230.11. Impact: No negative impact	2
Article 320	**Armored Cable: Type AC**				

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320.80	**320.80 Ampacity.** The ampacity shall be determined in accordance with 310.15. **(A) Thermal Insulation.** Armored cable installed in thermal insulation shall have conductors rated at 90°C (194°F). The ampacity of cable installed in these applications shall not exceed that of a 60°C (140°F) rated conductor. The 90°C (194°F) rating shall be permitted to be used for ampacity adjustment and correction calculations; however, the ampacity shall not exceed that of a 60°C (140°F) rated conductor. **(B) Cable Tray.** The ampacity of Type AC cable installed in cable tray shall be determined in accordance with 392.80(A).	FR-7959	**320.80 Ampacity.** The ampacity shall be determined in accordance with 310.14. **(A) Thermal Insulation.** Armored cable installed in thermal insulation shall have conductors rated at 90°C (194°F). The ampacity of cable installed in these applications shall not exceed that of a 60°C (140°F) rated conductor. The 90°C (194°F) rating shall be permitted to be used for ampacity adjustment and correction calculations; however, the ampacity shall not exceed that of a 60°C (140°F) rated conductor. Where more than two Type AC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1). **(B) Cable Tray.** The ampacity of Type AC cable installed in cable tray shall be determined in accordance with 392.80(A).	Revision to cover ampacity adjustment of cables installed in direct contact with certain types of materials without maintaining spacing between cables. Impact: No negative impact	2
Article 330	**Metal-Clad Cable: Type MC**				
330.104	**330.104 Conductors.** Conductors shall be of copper, aluminum, copper-clad aluminum, nickel or nickel-coated copper, solid or stranded. The minimum conductor size shall be 18 AWG copper, nickel or nickel-coated copper, or 12 AWG aluminum or copper-clad aluminum.	SR-7736	**330.104 Conductors.** For ungrounded, grounded, and equipment grounding conductors, the minimum conductor sizes shall be 14 AWG copper, nickel, or nickel-coated copper and 12 AWG aluminum or copper-clad aluminum. For control and signal conductors minimum conductor sizes shall be 18 AWG copper, nickel, or nickel-coated copper, 14 AWG copper-clad aluminum, and 12 AWG aluminum.	Revision to permit 14 AWG as the minimum size copper-clad aluminum conductor for control and signaling circuits. Impact: No negative impact.	2

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330.130	N/A	FR-7883, SCR-47	**330.130 Hazardous (Classified) Locations.** Where required to be marked MC-HL, the cable shall be listed and shall have a gas/vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor	New requirement to cover cables used in hazardous (classified) locations. Impact: No negative impact.	2
Article 334	**Nonmetallic-Sheathed Cable: Type NM**				
334.104	**334.104 Conductors.** The 600-volt insulated conductors shall be sizes 14 AWG through 2 AWG copper conductors or sizes 12 AWG through 2 AWG aluminum or copper-clad aluminum conductors. The communications conductors shall comply with Part V of Article 800.	FR-8051	**334.104 Conductors.** The 600-volt insulated power conductors shall be sizes 14 AWG through 2 AWG copper conductors or sizes 12 AWG through 2 AWG aluminum or copper-clad aluminum conductors. Control and signaling conductors shall be no smaller than 18 AWG copper.	Revision to the types of circuit conductors that can be included in Types NM and NMC cables. Impact: No negative impact	2
Article 336	**Power and Control Tray Cable: Type TC**				
336.104	**336.104 Conductors.** The insulated conductors of Type TC cables shall be in sizes 18 AWG to 1000 kcmil copper, nickel, or nickel-coated copper, and sizes 12 AWG through 1000 kcmil aluminum or copper-clad aluminum. Insulated conductors of sizes 14 AWG, and larger copper, nickel, or nickel-coated copper, and sizes 12 AWG through 1000 kcmil aluminum or copper-clad aluminum shall be one of the types listed in Table 310.104(A) or Table 310.104(B) that is suitable for branch circuit and feeder circuits or one that is identified for such use.	SR-7739	**336.104 Conductors.** For ungrounded, grounded, and equipment grounding conductors, the conductor sizes shall be 14 AWG through 1000 kcmil copper, nickel, or nickel-coated copper and 12 AWG through 1000 kcmil aluminum or copper-clad aluminum. Insulation types shall be one of the types listed in Table 310.4(A) or Table 310.4(B) that is suitable for branch circuit and feeder circuits or one that is identified for such use. For control and signal conductors, the minimum conductor sizes shall be 18 AWG copper, nickel, or nickel-coated copper, 14 AWG copper-clad aluminum, and 12 AWG aluminum.	Revision to permit 14 AWG as the minimum size copper-clad aluminum conductor for control and signaling circuits. Impact: No negative impact	2
Article 337	N/A	Global FR-8036,	**Type P Cable** *New Article addressing Type P cables.*	New article to cover cable type for use specifically in hazardous (classified) locations.	2

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		SR-7729,		Impact: No negative impact	
Article 338	**Service-Entrance Cable: Type Se and USE**				
338.10(B)(4)	**338.10 Uses Permitted.** **(B) Branch Circuits or Feeders.** **(4) Installation Methods for Branch Circuits and Feeders.** (a) *Interior Installations.* In addition to the provisions of this article, Type SE service-entrance cable used for interior wiring shall comply with the installation requirements of Part II of Article 334, excluding 334.80. For Type SE cable with ungrounded conductor sizes 1 AWG and smaller, where installed in thermal insulation, the ampacity shall be in accordance with 60°C (140°F) conductor temperature rating. The maximum conductor temperature rating shall be permitted to be used for ampacity adjustment and correction purposes, if the final derated ampacity does not exceed that for a 60°C (140°F) rated conductor. refer to 310.15(B)(7). (b) *Exterior Installations.* In addition to the provisions of this article, service-entrance cable used for feeders or branch circuits, where installed as exterior wiring, shall be installed in accordance with Part I of Article 225. The cable shall be supported in accordance with 334.30. Type USE cable installed as underground feeder and branch circuit cable shall comply with Part II of Article 340. *Exception: Single-conductor Type USE and multi-rated USE conductors shall not be subject to the ampacity limitations of Part II of Article 340.*	FR-7955, SR-7678	**338.10 Uses Permitted.** **(B) Branch Circuits or Feeders.** **(4) Installation Methods for Branch Circuits and Feeders.** (a) *Interior Installations.* (1) In addition to the provisions of this article, Type SE service-entrance cable used for interior wiring shall comply with the installation requirements of Part II of Article 334, excluding 334.80. (2) Where more than two Type SE cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1). (3) For Type SE cable with ungrounded conductor sizes 10 AWG and smaller, where installed in contact with thermal insulation, the ampacity shall be in accordance with 60°C (140°F) conductor temperature rating. The maximum conductor temperature rating shall be permitted to be used for ampacity adjustment and correction purposes, if the final ampacity does	Revisions to cover ampacity adjustment of cables installed in direct contact with certain types of materials without maintaining spacing between cables, to clarify the condition under which thermal insulation impacts cable ampacity. Impact: No negative impact	2

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			not exceed that for a 60°C (140°F) rated conductor. (b) *Exterior Installations.* (1) In addition to the provisions of this article, service-entrance cable used for feeders or branch circuits, where installed as exterior wiring, shall be installed in accordance with Part I of Article 225. The cable shall be supported in accordance with 334.30. (2) Type USE cable installed as underground feeder and branch circuit cable shall comply with Part II of Article 340. *Exception: Single-conductor Type USE and multi-rated USE conductors shall not be subject to the ampacity limitations of Part II of Article 340.*		
338.100	**338.100 Construction.** Cabled, single-conductor, Type USE constructions recognized for underground use shall be permitted to have a bare copper conductor cabled with the assembly. Type USE single, parallel, or cabled conductor assemblies recognized for underground use shall be permitted to have a bare copper concentric conductor applied. These constructions shall not require an outer overall covering. Type SE or USE cable containing two or more conductors shall be permitted to have one conductor uninsulated.	FR-7950, SR-7680	**338.100 Construction.** **(A) Assemblies.** Cabled assemblies of multiple single-conductor Type USE conductors shall be permitted for direct burial. All conductors shall be insulated. **(B) Uninsulated Conductor.** Type SE or USE cable with an overall covering containing two or more conductors shall be permitted to have one conductor uninsulated.	Revisions to remove permission to include bare copper conductors in a cabled assembly of single Type USE conductors, to clarify condition under which an uninsulated conductor is permitted in an assembly of conductors with an overall outer covering, and to separate multiple requirements into first-level subdivisions. Impact: No negative impact.	2

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Article 342	**Intermediate Metal Conduit: Type IMC**				
342.10(E)	N/A	FR-8023	**342.10 Uses Permitted.** **(E) Severe Physical Damage.** IMC shall be permitted to be installed where subject to severe physical damage**.**	New section that specifies IMC is permitted to be installed where subject to severe physical damage. Impact: No negative impact.	2
Article 344	**Rigid Metal Conduit: Type RMC**				
344.10(E)	N/A	FR-7994	**344.10 Uses Permitted.** **(E) Severe Physical Damage.** RMC shall be permitted to be installed where subject to severe physical damage.	New section that specifies RMC is permitted to be installed where subject to severe physical damage. Impact: No negative impact.	2
344.14	**344.14 Dissimilar Metals.** Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Aluminum fittings and enclosures shall be permitted to be used with galvanized steel RMC, and galvanized steel fittings and enclosures shall be permitted to be used with aluminum RMC where not subject to severe corrosive influences. Stainless steel RMC shall only be used with stainless steel fittings and approved accessories, outlet boxes, and enclosures.	FR-8025	**344.14 Dissimilar Metals.** Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Stainless steel and aluminum fittings and enclosures shall be permitted to be used with galvanized steel RMC, and galvanized steel fittings and enclosures shall be permitted to be used with aluminum RMC where not subject to severe corrosive influences. Stainless steel rigid conduit shall only be used with the following: (1) Stainless steel fittings (2) Stainless steel boxes and enclosures (3) Steel (galvanized, painted, powder or PVC coated, and so forth) boxes and enclosures when not subject to severe corrosive influences (4) Stainless steel, nonmetallic, or approved accessories	Revision to clarify permitted fittings and enclosures for use with galvanized or stainless steel RMC. Impact: No negative impact.	2
Article 350	**Liquidtight Flexible Metal Conduit: Type LFMC**				

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350.10(1)	**350.10 Uses Permitted.** LFMC shall be permitted to be used in exposed or concealed locations as follows: (1) Where conditions of installation, operation, or maintenance require flexibility or protection from liquids, vapors, or solids.	FR-7923, SR-7610	**350.10 Uses Permitted.** LFMC shall be permitted to be used in exposed or concealed locations as follows: (2) Where conditions of installation, operation, or maintenance require flexibility or protection from machine oils, liquids, vapors, or solids.	Revision to add machine oils to the items requiring protection from. Impact: No negative impact	2
350.10(4)	N/A	FR-7923	(4) Conductors or cables rated at a temperature higher than the listed temperature rating of LFMC conduit shall be permitted to be installed in LFMC, provided the conductors or cables are not operated at a temperature higher than the listed temperature rating of the LFMC per 110.14(C).	New list item to permit higher temperature rated conductors or cables installed in LFMC. Impact: No negative impact	2
Article 356	**Liquidtight Flexible Nonmetallic Conduit: Type LFNC**				
356.10(2)	**356.10 Uses Permitted.** LFNC shall be permitted to be used in exposed or concealed locations for the following purposes: (1) Where flexibility is required for installation, operation, or maintenance. (2) Where protection of the contained conductors is required from vapors, liquids, or solids.	FR-7894, SR-7613	**356.10 Uses Permitted.** LFNC shall be permitted to be used in exposed or concealed locations for the following purposes: (3) Where flexibility is required for installation, operation, or maintenance. (4) Where protection of the contained conductors is required from vapors, machine oils, liquids, or solids.	Revision to add machine oils to the items requiring protection from. Impact: No negative impact	2
356.10(8)	N/A	FR-7894	(8) Conductors or cables rated at a temperature rating of LFNC conduit shall be permitted to be installed in LFNC, provided the conductors or cables are not operated at a	New list item to permit higher temperature rated conductors or cables installed in LFNC. Impact: No negative impact	2

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			temperature higher than the listed temperature rating of the LFNC.		
Article 358	**Electrical Metallic Tubing: Type EMT**				
358.10(E)	N/A	FR-8084	**358.10 Uses Permitted.** **(E) Physical Damage.** Steel and stainless steel EMT shall be permitted to be installed where subject to physical damage.	New section that specifies EMT is permitted to be installed where subject to physical damage. Impact: No negative impact.	2
358.14	**358.14 Dissimilar Metals.** Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Aluminum fittings and enclosures shall be permitted to be used with galvanized steel EMT, and galvanized steel fittings and enclosures shall be permitted to be used with aluminum EMT where not subject to severe corrosive influences. Stainless steel EMT shall only be used with stainless steel fittings and approved accessories, outlet boxes, and enclosures.	FR-8085	**358.14 Dissimilar Metals.** Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Stainless steel and aluminum fittings and enclosures shall be permitted to be used with galvanized steel EMT, and galvanized steel fittings and enclosures shall be permitted to be used with aluminum EMT where not subject to severe corrosive influences. Stainless steel EMT shall only be used with the following: (1) Stainless steel fittings (2) Stainless steel boxes and enclosures (3) Steel (galvanized, painted, powder or PVC coated, and so forth) boxes and enclosures when not subject to severe corrosive influences (4) Stainless steel, nonmetallic, or approved accessories	Revision to clarify permitted fittings and enclosures for use with galvanized or stainless steel EMT. Impact: No negative impact.	2
Article 366	**Auxiliary Gutters**				
366.23(B)	**366.23 Ampacity of Conductors.** **(B) Nonmetallic Auxiliary Gutters.** The adjustment factors specified in	FR-8090, SR-7593	**366.23 Ampacity of Conductors.** **(B) Nonmetallic Auxiliary Gutters.** The adjustment factors specified	Revision to specify the adjustment factors apply up to	2

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	310.15(B)(3)(a) shall be applicable to the current carrying conductors in the nonmetallic auxiliary gutter.		in 310.15(C)(1) shall be applicable to the current-carrying conductors up to and including the 20 percent fill specified in 366.22(B).	and including the 20% fill and to update reference section. Impact: No negative impact.	
Article 380	**Multioutlet Assembly**				
380.12	**380.12 Uses Not Permitted.** A multioutlet assembly shall not be installed as follows: (1) Where concealed, except that it shall be permissible to surround the back and sides of a metal multioutlet assembly by the building finish or recess a nonmetallic multioutlet assembly in a baseboard (2) Where subject to severe physical damage (3) Where the voltage is 300 volts or more between conductors unless the assembly is of metal having a thickness of not less than 1.02 mm (0.040 in.) (4) Where subject to corrosive vapors (5) In hoistways (6) In any hazardous (classified) location, except as permitted by other articles in this *Code*	FR-7903	**380.12 Uses Not Permitted.** A multioutlet assembly shall not be installed as follows: (1) Where concealed, except that it shall be permissible to surround the back and sides of a metal multioutlet assembly by the building finish or recess a nonmetallic multioutlet assembly in a baseboard (2) Where subject to severe physical damage (3) Where the voltage is 300 volts or more between conductors unless the assembly is of metal having a thickness of not less than 1.02 mm (0.040 in.) (4) Where subject to corrosive vapors (5) In hoistways (6) In any hazardous (classified) location, except as permitted by other articles in this *Code* (7) Where cord and plug connected	New list item to prohibit multioutlet assemblies to be cord and plug connected. Impact: No negative impact.	2
Article 392	**Cable Trays**				
392.30(B)	**392.30 Securing and Supporting.** **(B) Cables and Conductors.** Cables and conductors shall be secured to and supported by the cable tray system in accordance with (1), (2) and (3) as applicable: (1) In other than horizontal runs, the cables shall be fastened securely to transverse members of the cable runs.	FR-8010, SR-7540	**392.30 Securing and Supporting.** **(B) Cables and Conductors.** Cables and conductors shall be secured to and supported by the cable tray system in accordance with (1), (2), (3), and (4) as applicable:	Revision to add multiconductor cables to (B)(3) and to add new list item requiring cable ties to be listed and identified. Impact: No negative impact.	2

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	(2) Supports shall be provided to prevent stress on cables where they enter raceways from cable tray systems. (3) The system shall provide for the support of cables and raceway wiring methods in accordance with their corresponding articles. Where cable trays support individual conductors and where the conductors pass from one cable tray to another, or from a cable tray to raceway(s) or from a cable tray to equipment where the conductors are terminated, the distance between the cable trays or between the cable tray and the raceway(s) or the equipment shall not exceed 1.8 m (6 ft). The conductors shall be secured to the cable tray(s) at the transition, and they shall be protected, by guarding or by location, from physical damage.		(1) In other than horizontal runs, the cables shall be fastened securely to transverse members of the cable tray. (2) Supports shall be provided to prevent stress on cables where they enter raceways from cable tray systems. (3) The system shall provide for the support of cables and raceway wiring methods in accordance with their corresponding articles. Where cable trays support individual conductors or multiconductor cables and where the conductors or multiconductor cables pass from one cable tray to another, or from a cable tray to raceway(s) or from a cable tray to equipment where the conductors are terminated, the distance between the cable trays or between the cable tray and the raceway(s) or the equipment shall not exceed 1.8 m (6 ft). The conductors shall be secured to the cable tray(s) at the transition, and they shall be protected, by guarding or by location, from physical damage. (4) Cable ties shall be listed and identified for the application and for securement and support.		
392.44	N/A	FR-7964, SR-7543	**392.44 Expansion Splice Plates.** Expansion splice plates for cable trays shall be provided where necessary to compensate for thermal expansion and contraction.	New section to require expansion splice plates for thermal expansion and contraction. Impact: No negative impact	2
392.46	**392.46 Bushed Conduit and Tubing.**	FR-8013, SR-7544	**392.46 Bushed Conduit and Tubing.**	Revision to include transitions to a raceway wiring method	2

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	A box shall not be required where cables or conductors are installed in bushed conduit and tubing used for support or for protection against physical damage.		A box shall not be required where cables or conductors are installed in bushed conduit and tubing used for support or for protection against physical damage or where conductors or cables transition to a raceway wiring method from the cable tray. Conductors shall be permitted to enter equipment in accordance with 392.46(A) or (B).	and two new first level subdivisions. Impact: No negative impact	
392.46(A)	N/A	FR-8013	**(A) Through Bushed Conduit or Tubing.** Individual conductors or multiconductor cables with entirely nonmetallic sheaths shall be permitted to enter enclosures where they are terminated through nonflexible bushed conduit or tubing installed for their protection provided they are secured at the point of transition from the cable tray and the conduit or tubing is sealed at the outer end using an approved means so as to prevent debris from entering the equipment through the conduit or tubing.	New subdivision to address requirements where conductors or cables enter enclosures through bushed conduit or tubing. Impact: No negative impact	2
392.46(B)	N/A	FR-8013	**(B) Flanged Connections.** Individual conductors or multiconductor cables with entirely nonmetallic sheaths shall be permitted to enter enclosures through openings associated with flanges from cable trays where the cable tray is attached to the flange and the flange is mounted directly to the equipment. The openings shall be made such that the conductors are protected from abrasion and the opening shall be sealed or covered to prevent debris from entering the enclosure through the opening	New subdivision to address requirements where conductors or cables enter enclosures through openings associated with flanges. Impact: No negative impact	2
Chapter 4	**Equipment for General Use**				
Article 400	**Flexible Cords and Flexible Cables**				
400.12	**400.12 Uses Not Permitted.** Unless specifically permitted in 400.10, flexible cables, flexible cord sets, and power	FR-7907, SR-7732	**400.12 Uses Not Permitted.** Unless specifically permitted in 400.10, flexible cords, flexible cables, cord sets, and	Revision to add flexible cords, cables, and power supply cords	2

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	supply cords shall not be used for the following: (1) As a substitute for the fixed wiring of a structure (2) Where run through holes in walls, structural ceilings, suspended ceilings, dropped ceilings, or floors (3) Where run through doorways, windows, or similar openings (4) Where attached to building surfaces *Exception to (4): Flexible cord and flexible cable shall be permitted to be attached to building surfaces in accordance with 368.56(B) .* (5) Where concealed by walls, floors, or ceilings or located above suspended or dropped ceilings *Exception to (5): Flexible cord and flexible cable shall be permitted if contained within an enclosure for use in Other Spaces Used for Environmental Air as permitted by 300.22(C)(3).* (6) Where installed in raceways, except as otherwise permitted in this *Code* (7) Where subject to physical damage		power supply cords shall not be used for the following: (1) As a substitute for the fixed wiring of a structure (2) Where run through holes in walls, structural ceilings, suspended ceilings, dropped ceilings, or floors (3) Where run through doorways, windows, or similar openings (4) Where attached to building surfaces *Exception to (4): Flexible cord and flexible cable shall be permitted to be attached to building surfaces in accordance with 368.56(B) and 590.4.* (5) Where concealed by walls, floors, or ceilings or located above suspended or dropped ceilings *Exception to (5): Flexible cords, flexible cables, and power supply cords shall be permitted if contained within an enclosure for use in other spaces used for environmental air as permitted by 300.22(C)(3).* (6) Where installed in raceways, except as otherwise permitted in this *Code* (7) Where subject to physical damage	Impact: No negative impact	
Article 404	**Switches**				
404.7	**404.7 Indicating.** General-use and motor-circuit switches, circuit breakers, and molded case switches, where mounted in	FR-7621	**404.7 Indicating.** General-use and motor-circuit switches, circuit breakers, and molded case switches, where mounted in	Revision to require the open or closed position indication to be visible when accessing	2

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	an enclosure as described in 404.3, shall clearly indicate whether they are in the open (off) or closed (on) position. Where these switch or circuit breaker handles are operated vertically rather than rotationally or horizontally, the up position of the handle shall be the closed (on) position.		an enclosure as described in 404.3, shall indicate, in the 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.	the operating means. Impact: No negative impact	
404.14(A)	**404.14 Rating and Use of Switches.** Switches shall be used within their ratings and as indicated in 404.14(A) through (F). Informational Note No. 1: For switches on signs and outline lighting, see 600.6. Informational Note No. 2: For switches controlling motors, see 430.83, 430.109, and 430.110. **(A) Alternating-Current General-Use Snap Switch.** A form of general-use snap switch suitable only for use on ac circuits for controlling the following: (1) Resistive and inductive loads not exceeding the ampere rating of the switch at the voltage applied (2) Tungsten-filament lamp loads not exceeding the ampere rating of the switch at 120 volts (3) Motor loads not exceeding 80 percent of the ampere rating of the switch at its rated voltage	FR-7674, SCR-32	**404.14 Rating and Use of Switches.** Switches shall be listed and used within their ratings. Switches of the types covered in 404.14(A) through (E) 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(F). Informational Note No. 1: For switches for signs and outline lighting, see 600.6. Informational Note No. 2: For switches controlling motors, see 430.83, 430.109, and 430.110. **(A) Alternating-Current General-Use Snap Switch.** 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	Revision to add two new permitted uses for alternating current general-use snap switches. Impact: No negative impact.	2

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			(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		
404.14(B)	**(B) Alternating-Current or Direct-Current General-Use Snap Switch.** A form of general-use snap switch suitable for use on either ac or dc circuits for controlling the following: (1) Resistive loads not exceeding the ampere rating of the switch at the voltage applied. (2) Inductive loads not exceeding 50 percent of the ampere rating of the switch at the applied voltage. Switches rated in horsepower are suitable for controlling motor loads within their rating at the voltage applied. (3) Tungsten-filament lamp loads not exceeding the ampere rating of the switch at the applied voltage if T-rated.	FR-7674, SCR-32	**(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.	Revision to add a new permitted use for alternating current or direct-current general-use snap switches. Impact: No negative impact.	2

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Article 406	**Receptacles, Cord Connectors, and Attachment Plugs (Caps)**				
406.4(D)(7)	**406.4 General Installation Requirements.** Receptacle outlets shall be located in branch circuits in accordance with Part III of Article 210. General installation requirements shall be in accordance with 406.4(A) through (F). **(D) Replacements.** Replacement of receptacles shall comply with 406.4(D)(1) through (D)(6), as applicable. Arc-fault circuit-interrupter type and ground-fault circuit-interrupter type receptacles shall be installed in a readily accessible location.	FR-8319, SR-8211	**406.4 General Installation Requirements.** Receptacle outlets shall be located in branch circuits in accordance with Part III of Article 210. General installation requirements shall be in accordance with 406.4(A) through (F). **(D) Replacements.** Replacement of receptacles shall comply with 406.4(D)(1) through (D)(7), as applicable. Arc-fault circuit-interrupter type and ground-fault circuit-interrupter type receptacles shall be installed in a readily accessible location. **(7) Controlled Receptacles.** Automatically controlled receptacles shall be replaced with equivalently controlled receptacles. If automatic control is no longer required, the receptacle and any associated receptacles marked in accordance with 406.3(E) shall be replaced with a receptacle and faceplate not marked in accordance with 406.3(E).	New requirement to cover replacement of controlled receptacles. Impact: No negative impact.	
406.7	**406.7 Attachment Plugs, Cord Connectors, and Flanged Surface Devices.** All attachment plugs, cord connectors, and flanged surface devices (inlets and outlets) shall be listed and marked with the manufacturer's name or identification and voltage and ampere ratings.	SR-8189	**406.7 Attachment Plugs, Cord Connectors, and Flanged Surface Devices.** All attachment plugs, cord connectors, and flanged surface devices (inlets and outlets) shall be listed and marked with the manufacturer's name or identification and voltage and ampere ratings. Attachment plugs, cord connectors, and flanged surface devices shall not be permitted to be reconditioned.	Revision to add requirement prohibiting reconditioning of attachment plugs, cord connectors, and flanged surface devices. Impact: No negative impact	2
406.9(C)	**406.9 Receptacles in Damp or Wet Locations.** **(C) Bathtub and Shower Space.** Receptacles shall not be installed within or directly over a bathtub or shower stall.	FR-8350	**406.9 Receptacles in Damp or Wet Locations.** **(C) Bathtub and Shower Space.** Receptacles shall not be installed within a zone measured 900 mm (3 ft) horizontally and 2.5 m (8 ft) vertically from the top of the bathtub rim or shower stall threshold. The identified zone is	Revision and new exception to cover the area in bathrooms where receptacles cannot be installed. Impact: No negative impact.	2

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			all-encompassing and shall include the space directly over the tub or shower stall. *Exception: In bathrooms with less than the required zone the receptacle(s) shall be permitted to be installed opposite the bathtub rim or shower stall threshold on the farthest wall within the room.*		
406.13	N/A	FR-8378	**406.13 Single-Pole Separable-Connector Type.** Single-pole separable connectors shall be listed and labeled and shall comply with 406.13(A) through (D). **(A) Locking or Latching Type.** Single-pole separable connectors shall be of either the locking or latching type and marked with the manufacturer's name or identification and voltage and ampere ratings. **(B) Identification.** Connectors designated for connection to the grounded circuit conductor shall be identified by a white-colored housing; connectors designated for connection to the grounding circuit conductor shall be identified by a green-colored housing. **(C) Interchangeability.** Single-pole separable connectors shall be permitted to be interchangeable for ac or dc use or for different current ratings or voltages on the same premises, provided they are listed for ac/dc use and marked in a suitable manner to identify the system to which they are intended to be connected. **(D) Connecting and Disconnecting.** The use of single-pole separable connectors shall be performed by a qualified person and shall comply with at least one of the following conditions: (1) Connection and disconnection of connectors are only possible	New requirement to cover the construction, identification, connecting and disconnecting of single-pole separable connectors. Impact: No negative impact.	2

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			where the supply connectors are interlocked to the source, and it is not possible to connect or disconnect connectors when the supply is energized. (2) Line connectors are of the listed sequential-interlocking type so that load connectors are connected in the following sequence and that disconnection is in the reverse sequence: (a) Equipment grounding conductor connection (b) Grounded circuit conductor connection, if provided (c) Ungrounded conductor connection (3) A caution notice that complies with 110.21(B) is provided on the equipment employing single-pole separable connectors, adjacent to the line connectors, indicating that connections are to be performed in the following sequence and that disconnection is in the reverse sequence: (a) Equipment grounding conductor connectors (b) Grounded circuit-conductor connectors, if provided (c) Ungrounded conductor connectors Informational Note: A single-pole locking-type separable connector is investigated in		

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			accordance with ANSI/UL 1691-2014, *Single Pole Locking-Type Separable Connectors*.		
Article 408	**Switchboards, Switchgear, and Panelboards**				
408.4(A)	**408.4 Field Identification Required.** **(A) Circuit Directory or Circuit Identification.** Every circuit and circuit modification shall be legibly identified as to its clear, evident, and specific purpose or use. The identification shall include an approved degree of detail that allows each circuit to be distinguished from all others. Spare positions that contain unused overcurrent devices or switches shall be described accordingly. The identification shall be included in a circuit directory that is located on the face or inside of the panel door in the case of a panelboard and at each switch or circuit breaker in a switchboard or switchgear. No circuit shall be described in a manner that depends on transient conditions of occupancy.	FR-7661	**408.4 Field Identification Required.** **(A) Circuit Directory or Circuit Identification.** Every circuit and circuit modification shall be legibly identified as to its clear, evident, and specific purpose or use. The identification shall include an approved degree of detail that allows each circuit to be distinguished from all others. Spare positions that contain unused overcurrent devices or switches shall be described accordingly. The identification shall be included in a circuit directory that is located on the face, inside of, or in an approved location adjacent to the panel door in the case of a panelboard and at each switch or circuit breaker in a switchboard or switchgear. No circuit shall be described in a manner that depends on transient conditions of occupancy.	Revision to permit circuit directory or identification to be located in an approved location adjacent to the panel door. Impact: No negative impact.	2
408.6	N/A	FR-7663, SR-8171	**408.6 Short-Circuit Current Rating.** Switchboards, switchgear, and panelboards shall have a short-circuit current rating not less than the available fault current. In other than one- and two-family dwelling units, the available fault current and the date the calculation was performed shall be field marked on the enclosure at the point of supply. The marking shall comply with 110.21(B)(3).	New requirement for documentation and availability of short-circuit current calculation for other than one- and two-family dwelling units. Impact: No negative impact.	2
408.8	N/A	SR-8172	**408.8 Reconditioning of Equipment.** Reconditioning of equipment within the scope of this article shall be limited as described in 408.8(A) and (B). The reconditioning process shall use design qualified parts verified under applicable standards and be performed in accordance with any instructions provided by the	New section to address requirements for reconditioning of equipment Impact: No negative impact.	2

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			manufacturer. 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. **(A) Panelboards.** Panelboards shall not be permitted to be reconditioned. This shall not prevent the replacement of a panelboard within an enclosure. In the event the replacement has not been listed for the specific enclosure and the available fault current is greater than 10,000 amperes, the completed work shall be field labeled, and any previously applied listing marks on the cabinet that pertain to the panelboard shall be removed. **(B) Switchboards and Switchgear.** Switchboards and switchgear, or sections of switchboards or switchgear, shall be permitted to be reconditioned. Reconditioned switchgear shall be listed or field labeled as *reconditioned*, and previously applied listing marks, if any, within the portions reconditioned shall be removed.		
408.18(C)	N/A	FR-7675, SR-8180	**408.18 Clearances.** **(C) Connections.** Each section of equipment that requires rear or side access to make field connections shall be so marked by the manufacturer on the front. Section openings requiring rear or side access shall comply with 110.26. Load terminals for field wiring shall comply with 408.18(C)(1), (C)(2), or (C)(3) as applicable. **(1) Equipment Grounding Conductors.** Load terminals for field wiring shall be so located that it is not necessary to reach across uninsulated ungrounded bus in order to make connections. **(2) Grounded Circuit Conductors.** Where multiple branch or feeder grounded circuit conductor load terminals for field wiring are	New requirement for access for making field connections and location with respect to uninsulated ungrounded bus. Impact: No negative impact. Places additional requirements on manufacturers of switchboards and switchgear	2

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			grouped together in one location, they shall be so located that it is not necessary to reach across uninsulated ungrounded bus, whether or not energized, in order to make connections. Where only one branch or feeder set of load terminals for field wiring are grouped with its associated ungrounded load terminals, they shall be so located that it is not necessary to reach across energized uninsulated bus including other branch or feeder bus in order to make connections. Bus on the line side of service, branch, or feeder disconnects is considered energized with respect to its associated load side circuits. **(3) Ungrounded Conductors.** Load terminals for ungrounded conductors shall be so located that it is not necessary to reach across energized uninsulated bus in order to make connections. Bus on the line side of service, branch, or feeder disconnects is considered energized with respect to its associated load side circuits.		
Article 410	**Luminaires, Lampholders, and Lamps**				
410.62(C)(1)(a)	**410.62 Cord-Connected Lampholders and Luminaires.** **(C) Electric-Discharge and LED Luminaires.** Electric discharge and LED luminaires shall comply with (1), (2), and (3) as applicable. **(1) Cord-Connected Installation.** A luminaire or a listed assembly in compliance with any of the conditions in (a) through (c) shall be permitted to be cord connected provided the luminaire is located directly below the outlet or busway, the cord is not subject to strain or physical damage, and the cord is visible over its entire length except at terminations.	FR-8482	**410.62 Cord-Connected Lampholders and Luminaires.** **(C) Electric-Discharge and LED Luminaires.** Electric-discharge and LED luminaires shall comply with 410.62(C)(1), (C)(2), and (C)(3), as applicable. **(1) Cord-Connected Installation.** A luminaire or a listed assembly in compliance with any of the conditions in 410.62(C)(1)(a) through (C)(1)(c) shall be permitted to be cord connected provided the luminaire is located directly below the outlet or busway, the cord is not subject to strain or physical damage, and the cord is visible over its entire length except at terminations.	Revision to permit polarized cord cap for cord- and plug-connected luminaires that comply with 410.42. Impact: No negative impact.	2

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	(a) A luminaire shall be permitted to be connected with a cord terminating in a grounding-type attachment plug or busway plug.		(a) A luminaire shall be permitted to be connected with a cord terminating in a grounding-type attachment plug or busway plug. If grounding is not required in accordance with 410.42, a polarized-type plug shall be permitted.		
410.69	N/A	FR-8512, SR-8179	**410.69 Identification of Control Conductor Insulation.** Where control conductors are spliced, terminated or connected in the same luminaire or enclosure as the branch-circuit conductors, the field-connected control conductor shall not be of a color reserved for the grounded branch-circuit conductor or the equipment grounding conductor. The requirement shall become effective January 1, 2022. *Exception: A field-connected gray-colored control conductor shall be permitted if the insulation is permanently re-identified by marking tape, painting, or other effective means at its termination and at each location where the conductor is visible and accessible. The identification shall encircle the insulation and shall be a color other than white, gray, or green.*	New requirement to prohibit the use of conductors with certain insulation colors to be used for luminaire control circuits that share the same wiring compartment with the branch circuit conductors with exception to permit field re-identification of field-connected gray control conductors. Impact: No negative impact	2
Article 422	**Appliances**				
422.5(A)	**422.5 Ground-Fault Circuit-Interrupter (GFCI) Protection for Personnel.** **(A) General.** Appliances identified in 422.5(A)(1) through (5) rated 250 volts or less and 60 amperes or less, single- or 3-phase, shall be provided with GFCI protection for personnel. Multiple GFCI protective	FR-8143, SR-8124	**422.5 Ground-Fault Circuit-Interrupter (GFCI) Protection for Personnel.** **(A) General.** Appliances identified in 422.5(A)(1) through (A)(7) rated 150 volts or less to ground and 60 amperes or less, single- or 3-phase, shall be provided with Class A GFCI protection for personnel. Multiple Class A GFCI protective devices shall be permitted but shall not be required.	Revisions to expand the types of appliances and conditions of use under which GFCI protection is required, to specify the voltage to ground rating of impacted appliances, to specify Class A GFCI protection, and to correlate with 210.8. Editorial revision for clarity made to list item 3.	2

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	devices shall be permitted but shall not be required. (1) Automotive vacuum machines provided for public use (2) Drinking water coolers (3) High-pressure spray washing machines — cord-and-plug connected (4) Tire inflation machines provided for public use (5) Vending machines **(B) Type.** The GFCI shall be readily accessible, listed, and located in one or more of the following locations: (1) Within the branch circuit overcurrent device (2) A device or outlet within the supply circuit (3) An integral part of the attachment plug (4) Within the supply cord not more than 300 mm (12 in.) from the attachment plug (5) Factory installed within the appliance		(1) Automotive vacuum machines (2) Drinking water coolers and bottle fill stations (3) Cord-and-plug-connected high-pressure spray washing machines (4) Tire inflation machines (5) Vending machines (6) Sump pumps (7) Dishwashers **(B) Type and Location.** The GFCI shall be readily accessible, listed, and located in one or more of the following locations: (1) Within the branch-circuit overcurrent device (2) A device or outlet within the supply circuit (3) An integral part of the attachment plug (4) Within the supply cord not more than 300 mm (12 in.) from the attachment plug (5) Factory installed within the appliance	Impact: No negative impact	
Article 425	**Fixed Resistance and Electrode Industrial Process Heating Equipment**				
425.22(B)	**425.22** **(B) Resistance Elements.** Resistance-type heating elements in fixed industrial process heating equipment shall be protected at not more than 60 amperes. Equipment rated more than 48 amperes and employing such elements shall have the heating elements subdivided, and each subdivided load shall not exceed 48 amperes. Where a subdivided load is less than 48 amperes, the rating of the supplementary overcurrent protective	FR-8547	**425.22** **(B) Resistance Elements.** Resistance-type heating elements in fixed industrial process heating equipment shall be protected at not more than 60 amperes. Equipment rated more than 48 amperes and employing such elements shall have the heating elements subdivided, and each subdivided load shall not exceed 48 amperes. Resistance-type heating elements in fixed industrial process heating equipment shall be permitted to be subdivided into circuits not	Revision to allow larger subdivided loads and higher rated overcurrent protection under specific application conditions. Impact: No negative impact	2

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	device shall comply with 425.3(B). A boiler employing resistance-type immersion heating elements contained in an ASME-rated and stamped vessel shall be permitted to comply with 425.72(A).		exceeding 120 amperes and protected at not more than 150 amperes where one of the following is met: (1) Elements are integral with and enclosed within a process heating surface. (2) Elements are completely contained within an enclosure identified as suitable for this use. (3) Elements are contained within an ASME-rated and stamped vessel. Where a subdivided load is less than 48 amperes, the rating of the supplementary overcurrent protective device shall comply with 425.4(B). A boiler employing resistance-type immersion heating elements contained in an ASME-rated and stamped vessel shall be permitted to comply with 425.72(A).		
425.82	**425.82 Branch-Circuit Requirements.** The size of branch-circuit conductors and overcurrent protective devices shall be calculated on the basis of 125 percent of the total load (motors not included). A contactor, relay, or other device, approved for continuous operation at 100 percent of its rating, shall be permitted to supply its full-rated load. See 210.19(A). *Exception: The provisions of this section shall not apply to conductors that form an integral part of an approved boiler.* *Where an electrode boiler is rated 50 kW or more, the conductors supplying the boiler electrode(s) shall be permitted to be sized at not less than 100 percent of the nameplate rating of the electrode boiler, provided all the following conditions are met:*	FR-8570, SR-7948	**425.82 Branch-Circuit Requirements.** The size of branch-circuit conductors and overcurrent protective devices shall be calculated on the basis of 125 percent of the total load (motors not included). A contactor, relay, or other device, listed for continuous operation at 100 percent of its rating, shall be permitted to supply its full-rated load. See 210.19(A)(1)(a), Exception No. 1. This section shall not apply to conductors that form an integral part of an approved boiler. Where an electrode boiler is rated 50 kW or more, the conductors supplying the boiler electrode(s) shall be permitted to be sized at not less than 100 percent of the nameplate rating of the electrode boiler, provided all the following conditions are met:	Revision to exempt conductors forming an integral part of an *approved* boiler from the requirement on sizing branch circuit conductors. Impact: No negative impact	2

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	(1) The electrode boiler is marked with a minimum conductor size. *(2) The conductors are not smaller than the marked minimum size.* *(3) A temperature- or pressure-actuated device controls the cyclic operation of the equipment.*		(1) The electrode boiler is marked with a minimum conductor size. (2) The conductors are not smaller than the marked minimum size. (3) A temperature- or pressure-actuated switch controls the cyclic operation of the equipment.		
Article 430	**Motors, Motor Circuits, and Controllers**				
430.122(B)	N/A	FR-8000, SR-7641	**430.122 Conductors — Minimum Size and Ampacity.** **(B) Output Conductors.** The conductors between the power conversion equipment and the motor shall have an ampacity equal to or larger than 125 percent of the motor full-load current as determined by 430.6(A) or (B). *Exception: If the power conversion equipment is listed and marked as "Suitable for Output Motor Conductor Protection," the conductor between the power conversion equipment and the motor shall have an ampacity equal to or greater than the larger of:* *(1) 125 percent of the motor full load current as determined by 430.6(A) or (B)* *(2) The ampacity of the minimum conductor size marked on the power conversion equipment*	New requirement to address ampacity of output conductors from power conversion equipment and exception for power conversion equipment that is listed and marked as "Suitable for Output Motor Conductor Protection." Impact: No negative impact	2
430.122(D)	N/A	FR-7989, SR-7688	**(D) Several Motors or a Motor and Other Loads.** Conductors supplying several motors or a motor and other loads, including power conversion equipment, shall have ampacity in accordance with 430.24, using the rated input current of the power conversion equipment for purposes of calculating ampacity.	New requirement for sizing conductors supplying several motors and other loads, including power conversion equipment. Impact: No negative impact	2

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430.130(A)(1)	**430.130 Branch-Circuit Short-Circuit and Ground-Fault Protection for Single Motor Circuits Containing Power Conversion Equipment.** **(A) Circuits Containing Power Conversion Equipment.** Circuits containing power conversion equipment shall be protected by a branch-circuit short-circuit and ground-fault protective device in accordance with the following: (1) The rating and type of protection shall be determined by 430.52(C)(1), (C)(3), (C)(5), or (C)(6), using the fullload current rating of the motor load as determined by 430.6.	FR-7999, SR-7677	**430.130 Branch-Circuit Short-Circuit and Ground-Fault Protection for Single Motor Circuits Containing Power Conversion Equipment.** **(A) Circuits Containing Power Conversion Equipment.** (1) Circuits containing power conversion equipment shall be protected by a branch circuit short-circuit and ground-fault protective device in accordance with all of the following: (2) The rating and type of protection shall be determined by 430.52(C)(1), (C)(3), (C)(5), or (C)(6), using the full-load current rating of the motor load as determined by 430.6(A) or (B). *Exception to 1: The rating and type of protection shall be permitted to be determined by Table 430.52 using the power conversion equipment's rated input current where the power conversion equipment is listed and marked "Suitable for Output Motor Conductor Protection."*	New exception to permit the rating and protection to be based on the ratings in Table 530.52 where the power conversion equipment is listed and marked as "Suitable for Output Motor Conductor Protection." Impact: No negative impact	2
Article 440	**Air-Conditioning and Refrigerating Equipment**				
440.10(A)	**440.10 Short-Circuit Current Rating.** **(A) Installation.** Motor controllers of multimotor and combination-load equipment shall not be installed where the available short-circuit current exceeds its short-circuit current rating as marked in accordance with 440.4(B).	FR-7927	**440.10 Short-Circuit Current Rating.** **(A) Installation.** Motor controllers or industrial control panels of multimotor and combination-load equipment shall not be installed where the available short-circuit current exceeds its fault current rating as marked in accordance with 440.4(B).	Revision to add industrial control panels and to revise *available short-circuit current* to *fault current* to correlate with the new definition of *available fault current*. Impact: No negative impact.	2
440.10(B)	**(B) Documentation.** When motor controllers or industrial control panels of multimotor and combination load equipment are required to be marked with	FR-7939	**(B) Documentation.** When motor controllers or industrial control panels of multimotor and combination load equipment are required to be marked with a short circuit current rating,	Revision to correlate with the new definition of *available fault current* and to add a requirement for	2

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	a short circuit current rating, the available short circuit current and the date the short circuit current calculation was performed shall be documented and made available to those authorized to inspect the installation.		the available fault current and the date the available fault current calculation was performed shall be documented and made available to those authorized to inspect, install, or maintain the installation.	documentation to be made available to installers and maintainers. Impact: No negative impact.	
Article 445	**Generators**				
445.6	N/A	SR-7639	**445.6 Listing.** Stationary generators 600 volts and less shall be listed. *Exception: One of a kind or custom manufactured generators shall be permitted to be field labeled by a field evaluation body.*	New requirement and exception, to cover listing or field evaluation of stationary generators. Impact: No negative impact.	2
445.18(A)	**445.18 Disconnecting Means and Shutdown of Prime Mover.** **(A) Disconnecting Means.** Generators other than cord-and plug-connected portable shall have one or more disconnecting means. Each disconnecting means shall simultaneously open all associated ungrounded conductors. Each disconnecting means shall be lockable in the open position in accordance with 110.25.	FR-7770	**445.18 Disconnecting Means and Emergency Shutdown.** **(A) Disconnecting Means.** Generators other than cord-and-plug-connected portable generators shall have one or more disconnecting means. Each disconnecting means shall simultaneously open all associated ungrounded conductors. Each disconnecting means shall be lockable open in accordance with 110.25.	Revision to correlate with general requirement for lockable disconnecting means specified by 110.25. Impact: No negative impact	2
445.18(B)	**(B) Shutdown of Prime Mover.** Generators shall have provisions to shut down the prime mover. The means of shutdown shall comply with all of the following: (1) Be equipped with provisions to disable all prime mover start control circuits to render the prime mover incapable of starting (2) Initiate a shutdown mechanism that requires a mechanical reset	SR-7645	**(B) Emergency Shutdown of Prime Mover.** Generators shall have provisions to shut down the prime mover. The means of shutdown shall comply with all of the following: (1) Be equipped with provisions to disable all prime mover start control circuits to render the prime mover incapable of starting (2) Initiate a shutdown mechanism that requires a mechanical reset	Revision to title to better align with requirement and to correlate with NFPA 110. Impact: No negative impact	2

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	The provisions to shut down the prime mover shall be permitted to satisfy the requirements of 445.18(A) where it is capable of being locked in the open position in accordance with 110.25. Generators with greater than 15 kW rating shall be provided with an additional requirement to shut down the prime mover. This additional shutdown means shall be located outside the equipment room or generator enclosure and shall also meet the requirements of 445.18(B)(1) and (B)(2).		The provisions to shut down the prime mover shall be permitted to satisfy the requirements of 445.18(A) where it is capable of being locked in the open position in accordance with 110.25.		
445.18(C)	**(C) Generators Installed in Parallel.** Where a generator is installed in parallel with other generators, the provisions of 445.18(A) shall be capable of isolating the generator output terminals from the paralleling equipment. The disconnecting means shall not be required to be located at the generator.	SR-7645	**(C) Remote Emergency Shutdown.** Generators with greater than 15 kW rating shall be provided with a remote emergency stop switch to shut down the prime mover. The remote emergency stop switch shall be located outside the equipment room or generator enclosure and shall also meet the requirements of 445.18(B)(1) and (B)(2).	New subdivision to cover remote emergency shutdown device required for certain generators. Impact: No negative impact	2
Article 450	**Transformers and Transformer Vaults (Including Secondary Ties)**				
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. 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.	FR-7774	**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. 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.	Revision to add marking requirements to prohibit storage on horizontal transformer surfaces. Impact: No negative impact	2
Article 480	**Storage Batteries**				

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480.7(C)	**480.7 DC Disconnect Methods.**	Global FR-8979, SR-7721	**480.7 DC Disconnect Methods.** **(C) Disconnection of Series Battery Circuits.** Battery circuits exceeding 240 volts dc nominal between conductors or to ground and subject to field servicing shall have provisions to disconnect the series-connected strings into segments not exceeding 240 volts dc nominal for maintenance by qualified persons. Non-load-break bolted or plug-in disconnects shall be permitted.	Relocation from Article 706 and revision to clarify the voltage conditions specified in the requirement. Impact: No negative impact	2
480.7(F)	**(D) Notification.** The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the battery if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following: (1) Nominal battery voltage (2) Maximum available short-circuit current derived from the stationary battery system (3) Date the short-circuit current calculation was performed (4) The battery disconnecting means shall be marked in accordance with 110.16.	SR-7721	**(F) Notification.** The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the battery if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following: (1) Nominal battery voltage (2) Available fault current derived from the stationary battery system (3) An arc flash label in accordance with acceptable industry practice (4) Date the calculation was performed	Revisions to correlate with the use of the term *available fault current* throughout the *Code* and to add requirement for arc flash labeling. Impact: No negative impact	2
480.7(G)	N/A	FR-8089, SR-7721	**(G) Identification of Power Sources.** Battery systems shall be indicated by 480.7(G)(1) and (G)(2). **(1) Facilities with Utility Services and Battery Systems.** Plaques or directories shall be installed in accordance with 705.10 and 712.10. *Exception: This requirement does not apply where a disconnect in 480.7(A) is not required.*	New requirement to cover identification of battery systems and other power sources that reference the plaque or directory requirements in 710.10. Impact: No negative impact	2

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			(2) Facilities with Stand-Alone Systems. A permanent plaque or directory shall be installed in accordance with 710.10.		
Article 490	**Equipment Over 1000 Volts, Nominal**				
490.21(A)(5)	N/A	FR-7827	**490.21 Circuit-Interrupting Devices.** **(A) Circuit Breakers.** **(5) Retrofit Trip Units.** Retrofit trip units shall be listed for use with the specific circuit breaker with which it is installed.	New requirement for listing of retrofit trip units. Impact: No negative impact.	2
490.49	N/A	SR-8222	**490.49 Reconditioned Switchgear.** Switchgear, or sections of switchgear, within the scope of this article shall be permitted to be reconditioned. The reconditioning process shall use design qualified parts verified under applicable standards and be performed in accordance with any instructions provided by the manufacturer. Reconditioned switchgear shall be listed or field labeled as *reconditioned*, and previously applied listing marks, if any, within the portions reconditioned shall be removed. 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.	New section to address requirements for reconditioned switchgear. Impact: No negative impact.	2
Chapter 5	**Special Occupancies**				
Article 500	**Hazardous (Classified) Locations, Class I, II, and III, Divisions 1 and 2**				
500.5(C)(1)(3)	**500.5 Classifications of Locations.** **(C) Class II Locations.** Class II locations are those that are hazardous because of the presence of combustible dust. Class II locations shall include those specified in 500.5(C)(1) and (C)(2). **(1) Class II, Division 1.** A Class II, Division 1 location is a location:	FR-7522	**500.5 Classifications of Locations.** **(C) Class II Locations.** Class II locations are those that are hazardous because of the presence of combustible dust. Class II locations shall include those specified in 500.5(C)(1) and (C)(2). **(1) Class II, Division 1.** A Class II, Division 1 location is a location:	Revisions to require that all conditions involving Group E dusts require Division 1 area classification. Impact: No negative impact.	2

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	(3) In which Group E combustible dusts may be present in quantities sufficient to be hazardous.		(3) In which Group E combustible dusts may be present in quantities sufficient to be hazardous in normal or abnormal operating conditions.		
500.7	**500.7 Protection Techniques.** Section 500.7(A) through (L) shall be acceptable protection techniques for electrical and electronic equipment in hazardous (classified) locations. **(K) Combustible Gas Detection System.** A combustible gas detection system shall be permitted as a means of protection in industrial establishments with restricted public access and where the conditions of maintenance and supervision ensure that only qualified persons service the installation. Where such a system is installed, equipment specified in 500.7(K)(1), (K)(2), or (K)(3) shall be permitted. The type of detection equipment, its listing, installation location(s), alarm and shutdown criteria, and calibration frequency shall be documented where combustible gas detectors are used as a protection technique. **(1) Inadequate Ventilation.** In a Class I, Division 1 location that is so classified due to inadequate ventilation, electrical equipment suitable for Class I, Division 2 locations shall be permitted. Combustible gas detection equipment shall be listed for Class I, Division 1, for the appropriate material group, and for the detection of the specific gas or vapor to be encountered. **(2) Interior of a Building.** In a building located in, or with an opening into, a Class I, Division 2 location where the	FR-7865, SR-7917	**500.7 Protection Techniques.** Electrical and electronic equipment in hazardous (classified) locations shall be protected by one or more of the techniques in 500.7(A) through (P). **(K) Combustible Gas Detection System.** A combustible gas detection system shall be permitted as a means of protection in industrial establishments with restricted public access and where the conditions of maintenance and supervision ensure that only qualified persons service the installation. **(1) General.** Any gas detection system utilized as a protection technique shall meet all of the requirements in 500.7(K)(1)(a) through (K)(1)(e). (a) The gas detection equipment used shall be listed for Class I, Division 1 and listed for the detection of the specific gas or vapor to be encountered. (b) The gas detection system shall not utilize portable or transportable equipment or temporary wiring methods. (c) The gas detection system shall only use point-type sensors. The system shall be permitted to be augmented with open-path (line-of-sight)–type sensors, but open-path–type sensors shall not be the basis for this protection technique. (d) The type of detection equipment, its listing, installation location(s), alarm and shutdown criteria, and	Revisions to include new protection techniques and for compliance with the *NEC Style Manual*. Revisions to provide more detail on the installation of combustible gas detection systems and to update edition date of referenced document. Revision to add new protection technique covering skin-effect trace heating. Impact: No negative impact.	2

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	interior does not contain a source of flammable gas or vapor, electrical equipment for unclassified locations shall be permitted. Combustible gas detection equipment shall be listed for Class I, Division 1 or Class I, Division 2, for the appropriate material group, and for the detection of the specific gas or vapor to be encountered. **(3) Interior of a Control Panel.** In the interior of a control panel containing instrumentation utilizing or measuring flammable liquids, gases, or vapors, electrical equipment suitable for Class I, Division 2 locations shall be permitted. Combustible gas detection equipment shall be listed for Class I, Division 1, for the appropriate material group, and for the detection of the specific gas or vapor to be encountered. **(L) Other Protection Techniques.** Other protection techniques used in equipment identified for use in hazardous (classified) locations.		calibration frequency shall be documented where combustible gas detectors are used as a protection technique. (e) The applications for the use of combustible gas detection systems as a protection technique shall be limited to 500.7(K)(2), (K)(3), or (K)(4). **(2) Inadequate Ventilation.** A location, enclosed space, or building that is classified as a Class I, Division 1 location due to inadequate ventilation, that is provided with a combustible gas detection system shall be permitted to utilize electrical equipment, installation methods, and wiring practices suitable for Class I, Division 2 installations. Sensing a gas concentration of not more than 40 percent of the lower flammable limit or a gas detector system malfunction shall activate an alarm (audible or visual, or both, as most appropriate for the area). **(3) Interior of a Building or Enclosed Space.** Any building or enclosed space that does not contain a source of flammable gas or vapors that is located in, or with an opening into, a Class I, Division 2 hazardous (classified) location that is provided with a combustible gas detection system shall be permitted to utilize electrical equipment, installation methods, and wiring practices suitable for unclassified installations under all of the following conditions: (1) An alarm (audible or visual, or both) shall be sounded at not more than 20 percent of the lower flammable limit. (2) Sensing a gas concentration of not more than 40 percent of the lower flammable limit or a gas detector system malfunction shall both		

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			activate an alarm (audible or visual, or both, as most appropriate for the area) and initiate automatic disconnection of power from all electrical devices in the area that are not suitable for Class I, Division 2. (3) The power disconnecting device(s) shall be suitable for Class I, Division 1 if located inside the building or enclosed space. If the disconnecting device(s) is located outside the building or enclosed space, it shall be suitable for the location in which it is installed. Redundant or duplicate equipment (such as sensors) shall be permitted to be installed to avoid disconnecting electrical power when equipment malfunctions are indicated. When automatic shutdown could introduce additional or increased hazard, this technique shall not be permitted. **(4) Interior of a Control Panel.** Inside the interior of a control panel containing instrumentation or other equipment utilizing or measuring flammable liquids, gases, or vapors, which is provided with combustible gas detection equipment shall be permitted to utilize electrical equipment, installation methods, and wiring practices suitable for Class I, Division 2 installations. An alarm (audible or visual, or both) shall be sounded at not more than 40 percent of the lower flammable limit. **(L) Inherently Safe Optical Radiation "op is."** This protection technique shall be permitted for equipment in Class I or II,		

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			Division 1 or 2 locations for which the equipment is identified. **(M) Protected Optical Radiation "op pr."** This protection technique shall be permitted for equipment in Class I or II, Division 2 locations for which the equipment is identified. **(N) Optical System With Interlock "op sh."** This protection technique shall be permitted for equipment in Class I or II, Division 1 or 2 locations for which the equipment is identified. **(O) Protection by Skin Effect Trace Heating "IEEE 844.1".** This protection technique shall be permitted for skin effect trace heating equipment in Class I, Division 2; Class II, Division 2; or Class III, Division 2 for which it is listed. **(P) Other Protection Techniques.** Other protection techniques used in equipment identified for use in hazardous (classified) locations.		
500.8(G)	**500.8 Equipment.** Articles 500 through 504 require equipment construction and installation that ensure safe performance under conditions of proper use and maintenance.	FR-7869, SR-7918	**500.8 Equipment.** Articles 500 through 504 require equipment construction and installation that ensure safe performance under conditions of proper use and maintenance. (G) Equipment Involving Optical Radiation. For equipment involving sources of optical radiation (such as laser or LED sources) in the wavelength range from 380 nm 10 10 µm, the risk of ignition from optical radiation shall be considered for all electrical parts and circuits that may be exposed to the radiation, both inside and outside the optical equipment. This includes optical equipment, which itself is located outside the explosive atmosphere, but its emitted optical radiation enters such atmospheres.	New requirement to cover optical radiation equipment. Impact: No negative impact	2

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			Exception: All luminaires (fixed, portable, or transportable) and hand lights intended to be supplied by mains (with or without galvanic isolation) or powered by batteries, with any continuous divergent light source, including LEDs, shall be excluded from this requirement.		
Article 501	**Class I Locations**				
501.105(B)(6)	**501.105 Meters, Instruments, and Relays.** **(B) Class I, Division 2.** In Class I, Division 2 locations, meters, instruments, and relays shall comply with 501.105(B)(2) through (B)(6). **(6) Connections.** To facilitate replacements, process control instruments shall be permitted to be connected through flexible cord by means of attachment plug and receptacle, provided that all of the following conditions apply: (1) The attachment plug and receptacle are listed for use in Class I, Division 2 locations and for use with flexible cords and shall be of the locking and grounding type. *Exception: A Class I, Division 2 listing shall not be required if the circuit is nonincendive field wiring.* (2) Unless the attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated, a switch complying with 501.105(B)(2) is provided so that the attachment plug or receptacle is not depended on to interrupt current.	FR-7632	**501.105 Meters, Instruments, and Relays.** **(B) Class I, Division 2.** In Class I, Division 2 locations, meters, instruments, and relays shall comply with 501.105(B)(2) through (B)(6). **(6) Connections.** To facilitate replacements, process control instruments shall be permitted to be connected through flexible cord, attachment plug and receptacle, provided that all of the following conditions apply: (1) The attachment plug and receptacle are listed for use in Class I, Division 2 locations and listed for use with flexible cords. *Exception No. 1: A Class I, Division 2 listing is not required if the circuit involves only nonincendive field wiring.* *Exception No. 2: In industrial establishments where the conditions of maintenance and supervision ensure that only qualified individuals service the installation, the Class I, Division 2 listing is not required when the requirements of 501.105(B)(6)(2), (B)(6)(3), and (B)(6)(4) are satisfied and the receptacle carries a label*	Revision to introduce additional product certification requirement, to provide a limited alternative to using listed devices, and to remove a current limitation that is not required by the product certification standard. Impact: No negative impact.	2

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	Exception: The switch shall not be required if the circuit is nonincendive field wiring. (3) The flexible cord does not exceed 900 mm (3 ft) and is of a type listed for extra-hard usage or for hard usage if protected by location, if applicable. (4) Only necessary receptacles are provided. (5) The circuit has a maximum current of 3 amps.		*warning against plugging or unplugging when energized.* (2) The flexible cord does not exceed 900 mm (3 ft), is of a type listed for extra-hard usage, or if listed for hard usage is protected by location. (3) Only necessary receptacles are provided. (4) Unless the attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated, a switch complying with 501.105(B)(2) shall be provided so that the attachment plug or receptacle is not depended on to interrupt current. *Exception: The switch shall not be required if the circuit is nonincendive field wiring.*		
Article 505	**Zone 0, 1, and 2 Locations**				
505.8(I)	**505.8 Protection Techniques.** Acceptable protection techniques for electrical and electronic equipment in hazardous (classified) locations shall be as described in 505.8(A) through (I). **(I) Combustible Gas Detection System.** A combustible gas detection system shall be permitted as a means of protection in industrial establishments	FR-7821, SR-8043	**505.8 Protection Techniques.** Acceptable protection techniques for electrical and electronic equipment in hazardous (classified) locations shall be as described in 505.8(A) through (N). **(I) Combustible Gas Detection System.** A combustible gas detection system shall be permitted as a means of protection in industrial establishments with restricted public access and where the conditions of maintenance and	Revision to provide more detail on the installation of combustible gas detection systems. Impact: No negative impact.	2

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	with restricted public access and where the conditions of maintenance and supervision ensure that only qualified persons service the installation. Where such a system is installed, equipment specified in 505.8(I)(1), (I)(2), or (I)(3) shall be permitted. The type of detection equipment, its listing, installation location(s), alarm and shutdown criteria, and calibration frequency shall be documented when combustible gas detectors are used as a protection technique. **(1) Inadequate Ventilation.** In a Class I, Zone 1 location that is so classified due to inadequate ventilation, electrical equipment suitable for Class I, Zone 2 locations shall be permitted. Combustible gas detection equipment shall be listed for Class I, Zone 1, for the appropriate material group, and for the detection of the specific gas or vapor to be encountered. **(2) Interior of a Building.** In a building located in, or with an opening into, a Class I, Zone 2 location where the interior does not contain a source of flammable gas or vapor, electrical equipment for unclassified locations shall be permitted. Combustible gas detection equipment shall be listed for Class I, Zone 1 or Class I, Zone 2, for the appropriate material group, and for the detection of the specific gas or vapor to be encountered. **(3) Interior of a Control Panel.** In the interior of a control panel containing		supervision ensure that only qualified persons service the installation. **(1) General.** Any gas detection system utilized as a protection technique shall meet all of the requirements in 505.8(I)(1)(a) through (I)(1)(e). (a) The gas detection equipment used shall be listed for Zone 1 and listed for the detection of the specific gas or vapor to be encountered. (b) The gas detection system shall not utilize portable or transportable equipment, or temporary wiring methods. (c) The gas detection system shall only use point-type sensors. The system shall be permitted to be augmented with open-path (line-of-sight)–type sensors, but open-path type sensors shall not be the basis for this protection technique. (d) The type of detection equipment, its listing, installation location(s), alarm and shutdown criteria, and calibration frequency shall be documented where combustible gas detectors are used as a protection technique. (e) The applications for the use of combustible gas detection systems as a protection technique shall be limited to 505.8(I)(2), (I)(3), or (I)(4). **(2) Inadequate Ventilation.** A location, enclosed space, or building that is classified as a Zone 1 location due to inadequate ventilation, that is provided with a combustible gas detection system will be allowed to utilize		

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	instrumentation utilizing or measuring flammable liquids, gases, or vapors, electrical equipment suitable for Class I, Zone 2 locations shall be permitted. Combustible gas detection equipment shall be listed for Class I, Zone 1, for the appropriate material group, and for the detection of the specific gas or vapor to be encountered.		electrical equipment, installation methods, and wiring practices suitable for Zone 2 installations. Sensing a gas concentration of not more than 40 percent of the lower flammable limit or a gas detector system malfunction shall activate an alarm (audible or visual, or both, as most appropriate for the area). **(3) Interior of a Building or Enclosed Space.** Any building or enclosed space that does not contain a source of flammable gas or vapors that is located in, or with an opening into, a Zone 2 hazardous (classified) location that is provided with a combustible gas detection system will be permitted to utilize electrical equipment, installation methods, and wiring practices suitable for unclassified installations under all of the following conditions: (1) An alarm (audible or visual, or both) shall be sounded at not more than 20 percent of the lower flammable limit. (2) Sensing a gas concentration of not more than 40 percent of the lower flammable limit or a gas detector system malfunction shall both activate an alarm (audible or visual, or both, as most appropriate for the area) and initiate automatic disconnection of power from all electrical devices in the area that are not suitable for Zone 2. (3) The power disconnecting device(s) shall be suitable for Zone 1 if located inside the building or enclosed space. If the disconnecting device(s) is located outside the building or enclosed space, it shall be suitable for the location in which it is installed.		

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			Redundant or duplicate equipment (such as sensors) shall be permitted to be installed to avoid disconnecting electrical power when equipment malfunctions are indicated. When automatic shutdown could introduce additional or increased hazard, this technique shall not be permitted.		
505.8(J)	N/A	FR-7812	**(J) Protection by Electrical Resistance Trace Heating "60079-30-1".** This protection technique shall be permitted for electrical resistance trace heating equipment in Zone 1 or Zone 2 for which it is listed.	New requirement to identify acceptable protection technique for skin effect heat tracing. Impact: No negative impact.	2
505.8(K)	N/A	FR-7875	**(K) Inherently Safe Optical Radiation "op is".** This protection technique shall be permitted for equipment in Zone 0, Zone 1, or Zone 2 locations for which the equipment is identified.	New requirement to identify acceptable protection technique for optical radiation. Impact: No negative impact.	2
505.8(L)	N/A	FR-7875	**(L) Protected Optical Radiation "op pr".** This protection technique shall be permitted for equipment in Zone 1 or Zone 2 locations for which the equipment is identified.	New requirement to identify acceptable protection technique for optical radiation. Impact: No negative impact.	2
505.8(M)	N/A	FR-7875	**(M) Optical System With Interlock "op sh".** This protection technique shall be permitted for equipment in Zone 0, Zone 1, or Zone 2 locations for which the equipment is identified.	New requirement to identify acceptable protection technique for optical radiation. Impact: No negative impact.	2
505.8(N)	N/A	SR-8043	**(N) Protection by Skin Effect Trace Heating "IEEE 844.1".** This protection technique shall be permitted for skin effect trace heating equipment in Zone 1 or Zone 2 for which it is listed.	New requirement to identify acceptable protection technique for skin effect trace heating. Impact: No negative impact.	2

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505.9(G)	**505.9 Equipment.**	FR-7878, SR-8051	**505.9 Equipment.** **(G) Equipment Involving Optical Radiation.** For equipment involving sources of optical radiation (such as laser or LED sources) in the wavelength range from 380 nm to 10 µm, the risk of ignition from optical radiation shall be considered for all electrical parts and circuits that may be exposed to the radiation, both inside and outside the optical equipment. This includes optical equipment, which itself is located outside the explosive atmosphere, but its emitted optical radiation enters such atmospheres. *Exception: All luminaires (fixed, portable, or transportable) and hand lights, intended to be supplied by mains (with or without galvanic isolation) or powered by batteries, with any continuous divergent light source, including LEDs, shall be excluded from this requirement.*	New requirement to cover optical radiation equipment. Impact: No negative impact.	2
Article 506	**Zone 20,21, and 22 Locations for Combustible Dusts and Ignitable Fibers/Flyings**				
506.8(N)	**506.8 Protection Techniques.** Acceptable protection techniques for electrical and electronic equipment in hazardous (classified) locations shall be as described in 506.8(A) through (I).	SR-8076	**506.8 Protection Techniques.** Acceptable protection techniques for electrical and electronic equipment in hazardous (classified) locations shall be as described in 506.8(A) through (N). **(N) Protection by Skin Effect Trace Heating "IEEE 844.1".** This protection technique shall be permitted for skin effect trace heating equipment in Zone 21 or Zone 22 for which it is listed.	Revision to add new protection technique for skin effect heat tracing. Impact: No negative impact.	2
Article 514	**Motor Fuel Dispensing Facilities**				

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514.11	**514.11 Circuit Disconnects.** **(A) Emergency Electrical Disconnects.** Fuel dispensing systems shall be provided with one or more clearly identified emergency shutoff devices or electrical disconnects. Such devices or disconnects shall be installed in approved locations but not less than 6 m (20 ft) or more than 30 m (100 ft) from the fuel dispensing devices that they serve. Emergency shutoff devices or electrical disconnects shall disconnect power to all dispensing devices; to all remote pumps serving the dispensing devices; to all associated power, control, and signal circuits; and to all other electrical equipment in the hazardous (classified) locations surrounding the fuel dispensing devices. When more than one emergency shutoff device or electrical disconnect is provided, all devices shall be interconnected. Resetting from an emergency shutoff condition shall require manual intervention and the manner of resetting shall be approved by the authority having jurisdiction. [**30A:**6.7] *Exception: Intrinsically safe electrical equipment need not meet this requirement. [**30A:**6.7]*	FR-7743	**514.11 Circuit Disconnects.** **(A) Emergency Electrical Disconnects.** Fuel dispensing systems shall be provided with one or more clearly identified emergency shutoff devices or electrical disconnects. Such devices or disconnects shall be installed in approved locations but not less than 6 m (20 ft) or more than 30 m (100 ft) from the fuel dispensing devices that they serve. Emergency shutoff devices or electrical disconnects shall disconnect power to all dispensing devices; to all remote pumps serving the dispensing devices; to all associated power, control, and signal circuits; and to all other electrical equipment in the hazardous (classified) locations surrounding the fuel dispensing devices. When more than one emergency shutoff device or electrical disconnect is provided, all devices shall be interconnected. Resetting from an emergency shutoff condition shall require manual intervention and the manner of resetting shall be approved by the authority having jurisdiction. [**30A:**6.7] The emergency shutoff device shall disconnect simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor, if any. Equipment grounding conductors shall remain connected. *Exception: Intrinsically safe electrical equipment need not meet this requirement. [**30A:**6.7]*	Revision to restore requirement for disconnecting the grounded (neutral) conductor and to provide requirement covering connection of equipment grounding conductor. Impact: No negative impact.	2
Article 518	**Assembly Occupancies**				
518.6	N/A	FR8823	**518.6 Illumination.** Illumination shall be provided for all working spaces about fixed service equipment, switchboards, switchgear, panelboards, or motor control centers installed outdoors that serve assembly occupancies. Control by automatic means only shall not be permitted.	New requirement for illumination and control requirements for working spaces for specific types of equipment installed outdoors. Impact: No negative impact.	2

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			Additional lighting outlets shall not be required where the workspace is illuminated by an adjacent light source.		
Article 545	**Manufactured Buildings and Relocatable Structures**				
545.20.	N/A	Global FR8993	**545.20 Application Provisions.** Relocatable structures shall comply with Part II of this article and the applicable sections of Part I.	New section that provides guidance on the applicability and rules that may supplement or modify the preceding sections of Article 545. Impact: No negative impact.	2
545.22	N/A	Global FR8993, SR7529, SR7541, SR7548, SR 7550	**545.22 Power Supply.** **(A) Feeder.** The feeder shall include four insulated color-coded conductors, one of which shall be an equipment grounding conductor. The equipment grounding conductor shall be permitted to be uninsulated if part of a listed cable assembly. **(B) Number of Supplies.** Where two or more relocatable structures are structurally connected to form a single unit and there is a factory-installed panelboard in each relocatable structure, each panelboard shall be permitted to be supplied by a separate feeder. **(C) Identification.** The identification requirements in 225.37 shall not apply to relocatable structures structurally connected provided the following conditions are met: (1) The relocatable structures are located on an industrial or commercial establishment where the conditions of maintenance and supervision ensure qualified individuals will service the installation. (2) The individual panelboard enclosures or covers have been marked to indicate to location of their supply disconnecting means.	New section that provides installation requirements for power supplies to relocatable structures, including number of supplies, identification, grounding and wiring methods. Impact: No negative impact.	2

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			The marking shall be visible without removing the cover and shall be of sufficient durability to withstand the environment involved. **(D) Grounding.** The feeder(s) shall be grounded in accordance with Parts I, II, and III of Article 250. Where two or more relocatable structures are structurally connected to form a single unit, and a common grounding electrode conductor and tap arrangement as specified in 250.64(D)(1) is utilized, it shall be permissible to use the chassis bonding conductor specified in 545.26 as the tap conductor.		
545.24	N/A	Global FR8993, SR7561, SR7570	**545.24 Disconnecting Means and Branch-Circuit Overcurrent Protection.** **(A) Disconnecting Means.** A single disconnecting means consisting of a circuit breaker, or a switch and fuses and its accessories, shall be provided in a readily accessible location for each relocatable structure. **(B) Branch-Circuit Protective Equipment and Panelboards.** Branch-circuit distribution equipment shall be installed in each relocatable structure and shall include overcurrent protection for each branch circuit consisting of either circuit breakers or fuses. Panelboards shall be installed in a readily accessible location.	New section that relocates requirements from section 550.11(A) and (B) for disconnecting means and branch-circuit overcurrent protection. Impact: No negative impact.	2
545.26	N/A	Global FR8993	**545.26 Bonding of Exposed Non–Current-Carrying Metal Parts.** All exposed non–current-carrying metal parts that are likely to become energized shall be effectively bonded to the grounding terminal or enclosure of the panelboard. A bonding conductor shall be connected between the	New section that relocates requirements from 550.16(C) for bonding of exposed non-current-carrying metal parts. Impact: No negative impact.	2

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			panelboard and an accessible terminal on the chassis.		
545.27	N/A	SR7533	**545.27 Intersystem Bonding.** Where two or more relocatable structures are structurally connected to form a single unit, it shall be permissible to install one communication system bonding termination in accordance with 250.94 provided all the following conditions are met: (1) There is a factory-installed panelboard in each relocatable structure. (2) There is a bonding conductor between the grounding terminal in each panelboard and chassis in accordance with 545.26. (3) There is a minimum 6 AWG copper conductor that extends from the communication system bonding termination that is connected to each chassis bonding conductor required by 545.26. The communication bonding termination shall be permitted to be located in the same area as the primary protector or common communications equipment supplying the relocatable structures.	New section contains requirements for intersystem bonding where two or more relocatable structures are structurally connected to form a single unit. Impact: No negative impact.	2
545.28	N/A	Global FR8993, SR7524	**545.28 Ground-Fault Circuit-Interrupters (GFCI).** In addition to the requirements of 210.8(B), all receptacle outlets installed in compartments accessible from outside the relocatable structure shall have GFCI protection for personnel.	New section that relocates GFCI protection requirements from 550.13(B)(1) and (2) for relocatable structures and revised to clarify applicable requirements in 210.8(B). Impact: No negative impact.	2
Article 590	**Temporary Installations**				

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590.4(G), Exception No. 2	**590.4 General.** **(G) Splices.** A box, conduit body, or other enclosure, with a cover installed, shall be required for all splices.	FR8770, SR7894	**590.4 General.** **(G) Splices.** A box, conduit body, or other enclosure, with a cover installed, shall be required for all splices. *Exception No. 2: On construction sites, branch-circuits that are permanently installed in framed walls and ceilings and are used to supply temporary power or lighting,and that are GFCI protected, the following shall be permitted:* *(1) A box cover shall not be required for splices installed completely inside of junction boxes with plaster rings.* *(2) Listed pigtail-type lampholders shall be permitted to be installed in ceiling-mounted junction boxes with plaster rings.* *(3) Finger safe devices shall be permitted for supplying and connection of devices.*	New exception to permit omission of a cover for splices where permanent wiring is used for temporary power. Impact: No negative impact.	2
590.6(B)(2)	**590.6 Ground-Fault Protection for Personnel.** Ground-fault protection for personnel for all temporary wiring installations shall be provided to comply with 590.6(A) and (B). This section shall apply only to temporary wiring installations used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities. This section shall apply to power derived from an electric utility company or from an on-site-generated power source.	SR7904	**590.6 Ground-Fault Protection for Personnel.** Ground-fault protection for personnel for all temporary wiring installations shall be provided to comply with 590.6(A) and (B). This section shall apply only to temporary wiring installations used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities. This section shall apply to power derived from an electric utility company or from an on-site-generated power source. **(B) Other Receptacle Outlets.** For temporary wiring installations, receptacles, other than those covered by 590.6(A)(1) through (A)(3)	New requirement to document and make available to the AHJ the assured equipment grounding conductor program. Impact: No negative impact.	2

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	(B) Use of Other Outlets. For temporary wiring installations, receptacles, other than those covered by 590.6(A)(1) through (A)(3) used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, or equipment, or similar activities, shall have protection in accordance with (B)(1), (B)(2), or the assured equipment grounding conductor program in accordance with (B)(3). **(3) Assured Equipment Grounding Conductor Program.** A written assured equipment grounding conductor program continuously enforced at the site by one or more designated persons to ensure that equipment grounding conductors for all cord sets, receptacles that are not a part of the permanent wiring of the building or structure, and equipment connected by cord and plug are installed and maintained in accordance with the applicable requirements of 250.114, 250.138, 406.4(C), and 590.4(D). (a) The following tests shall be performed on all cord sets, receptacles that are not part of the permanent wiring of the building or structure, and cord-and-plug-connected equipment required to be connected to an equipment grounding conductor: (1) All equipment grounding conductors shall be tested for continuity and shall be electrically continuous. (2) Each receptacle and attachment plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.		used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, or equipment, or similar activities, shall have protection in accordance with 590.6(B)(1) or the assured equipment grounding conductor program in accordance with 590.6(B)(2). **(2) Assured Equipment Grounding Conductor Program.** A written assured equipment grounding conductor program continuously enforced at the site by one or more designated persons to ensure that equipment grounding conductors for all cord sets, receptacles that are not a part of the permanent wiring of the building or structure, and equipment connected by cord and plug are installed and maintained in accordance with the applicable requirements of 250.114, 250.138, 406.4(C), and 590.4(D). (a) The following tests shall be performed on all cord sets, receptacles that are not part of the permanent wiring of the building or structure, and cord-and-plug-connected equipment required to be connected to an equipment grounding conductor: (1) All equipment grounding conductors shall be tested for continuity and shall be electrically continuous. (2) Each receptacle and attachment plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.		

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	(3) All required tests shall be performed as follows: a. Before first use on site b. When there is evidence of damage c. Before equipment is returned to service following any repairs d. At intervals not exceeding 3 months (b) The tests required in item (3)(a) shall be recorded and made available to the authority having jurisdiction.		(3) All required tests shall be performed as follows: a. Before first use on site b. When there is evidence of damage c. Before equipment is returned to service following any repairs d. At intervals not exceeding 3 months (b) The tests required in 590.6(B)(2)(a) shall be recorded and made available to the authority having jurisdiction. The assured equipment grounding conductor program shall be documented and made available to the authority having jurisdiction.		
590.8	**N/A**	**SR7919**	**590.8 Overcurrent Protective Devices.** **(A) Where Reused.** Where overcurrent protective devices that have been previously used are installed in a temporary installation, these overcurrent protective devices shall be examined to ensure these devices have been properly installed, properly maintained, and there is no evidence of impending failure. **(B) Service Overcurrent Protective Devices.** Overcurrent protective devices for solidly grounded wye electrical services of more than 150 volts to ground but not exceeding 1000 volts phase-to-phase shall be current limiting. Informational Note: The phrase “evidence of impending failure” means that there is evidence such as arcing, overheating, loose or bound equipment parts, visible damage, or deterioration. The phrase “properly maintained” means that the equipment has	New section addresses requirements for the reuse of overcurrent and service overcurrent protective devices. Impact: No negative impact.	2

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			been maintained in accordance with the manufacturers' recommendations and applicable industry codes and standards. References for manufacturers' recommendations and applicable industry codes and standards include but are not limited to NEMA AB 4-2017, *Guidelines for Inspection and Preventative Maintenance of Molded-Case Circuit Breakers Used in Commercial and Industrial Applications*; NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance*; NEMA GD 1-2016, *Evaluating Water-Damaged Electrical Equipment*; and IEEE 1458-2017, *IEEE Recommended Practice for the Selection, Field Testing, and Life Expectancy of Molded-Case Circuit Breakers for Industrial Applications*.		
Chapter 6	**Special Equipment**				
Article 620	**Elevators, Dumbwaiters, Escalators, Moving Walks, Platform Lifts, and Stairway Chairlifts**				
620.6	*From 620.85* **620.85 Ground-Fault Circuit-Interrupter Protection for Personnel.** Each 125-volt, single-phase, 15- and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters associated with wind turbine tower elevators, on the platforms or in the runways and machinery spaces of platform lifts and stairway chairlifts, and in escalator and moving walk wellways shall be of the ground-fault circuit-interrupter type. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in machine rooms, control spaces, and control rooms shall have ground-fault circuit-interrupter protection for personnel.	FR-8322, SR-7769	**620.6 Ground-Fault Circuit-Interrupter Protection for Personnel.** Each 125-volt, single-phase, 15- and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters associated with wind turbine tower elevators, on the platforms or in the runways and machinery spaces of platform lifts and stairway chairlifts, and in escalator and moving walk wellways shall be of the ground-fault circuit-interrupter type. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in machine rooms, control spaces, machinery spaces, and control rooms shall have ground-fault circuit-interrupter protection for personnel.	Revision to relocate requirement from 620.85 and revision to specify the conditions where GFCI protection is required for permanently installed sump pumps. Impact: No negative impact.	2

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	A single receptacle supplying a permanently installed sump pump shall not require ground-fault circuit-interrupter protection.		A permanently installed sump pump shall be permanently wired or shall be supplied by a single receptacle that is ground-fault circuit-interrupter protected.		
620.62	**620.62 Selective Coordination.** Where more than one driving machine disconnecting means is supplied by a single feeder, the overcurrent protective devices in each disconnecting means shall be selectively coordinated with any other supply side overcurrent protective devices. Selective coordination shall be selected by a licensed professional engineer or other qualified person engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.	FR-8309	**620.62 Selective Coordination.** Where more than one driving machine disconnecting means is supplied by the same source, the overcurrent protective devices in each disconnecting means shall be selectively coordinated with any other supply side overcurrent protective devices. Selective coordination shall be selected by a licensed professional engineer or other qualified person engaged primarily in the design, installation, or maintenance of electrical systems. The selection and device settings shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system. *Exception No. 1: Selective coordination shall not be required between transformer primary and secondary overcurrent protective devices where only one overcurrent device or set of overcurrent devices exists on the transformer secondary.* *Exception No. 2: Selective coordination shall not be required between overcurrent protective devices of the same rating located in series where no loads are connected in parallel with the downstream device.*	Revision to clarify that selective coordination is required between all overcurrent protective devices in the elevator supply circuit where more than one elevator is supplied by a service or feeder. Revision to add two exceptions to not require overcurrent protective devices to be selectively coordinated under specific conditions. Impact: No negative impact.	2
620.65	N/A	FR-8317	**620.65 Signage.** Equipment enclosures containing selectively coordinated overcurrent devices shall be legibly marked in the field to indicate that the overcurrent devices are selectively	New requirement to label equipment enclosures containing selectively coordinated overcurrent protective devices.	2

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			coordinated. The marking shall meet the requirements of 110.21(B), shall be readily visible, and shall state the following: CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED. EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED.	Impact: No negative impact.	
Article 645	**Information Technology Equipment**				
645.5(E)(2)(5)	**645.5 Supply Circuits and Interconnecting Cables** **(E) Under Raised Floors.** Where the area under the floor is accessible and openings minimize the entrance of debris beneath the floor, power cables, communication cables, connecting cables, interconnecting cables, cord-and-plug connections, and receptacles associated with the information technology equipment shall be permitted under a raised floor of approved construction. The installation requirement shall comply with 645.5(E)(1) through (3). **(2) Installation Requirements for Electrical Supply Cords, Data Cables, Interconnecting Cables, and Grounding Conductors Under a Raised Floor.** The following cords, cables, and conductors shall be permitted to be installed under a raised floor: (1) Supply cords of listed information technology equipment in accordance with 645.5(B) (2) Interconnecting cables enclosed in a raceway (3) Equipment grounding conductors (4) In addition to wiring installed in compliance with 725.135(C), Types CL2R, CL3R, CL2, and CL3 and substitute	FR-8348	**645.5 Supply Circuits and Interconnecting Cables.** **(E) Under Raised Floors.** Where the area under the floor is accessible and openings minimize the entrance of debris beneath the floor, power cables, communications cables, connecting cables, interconnecting cables, cord-and-plug connections, and receptacles associated with the information technology equipment shall be permitted under a raised floor of approved construction. The installation requirement shall comply with 645.5(E)(1) through (E)(3). **(2) Installation Requirements for Electrical Supply Cords, Data Cables, Interconnecting Cables, and Grounding Conductors Under a Raised Floor.** The following cords, cables, and conductors shall be permitted to be installed under a raised floor: (1) Supply cords of listed information technology equipment in accordance with 645.5(B). (2) Interconnecting cables enclosed in a raceway. (3) Equipment grounding conductors.	Revision to specify the permitted cable types if the air space under a raised floor is not protected by an automatic fire suppression system. Impact: No negative impact.	2

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	cables including CMP, CMR, CM, and CMG installed in accordance with 725.154(A), shall be permitted under raised floors. Informational Note: Figure 725.154(A) illustrates the cable substitution hierarchy for Class 2 and Class 3 cables. (5) Listed Type DP cable having adequate fire-resistant characteristics suitable for use under raised floors of an information technology equipment room		(4) Where the air space under a raised floor is protected by an automatic fire suppression system, in addition to wiring installed in compliance with 725.135(C), Types CL2R, CL3R, CL2, and CL3 and substitute cables including CMP, CMR, CM, and CMG installed in accordance with 725.154(A) shall be permitted under raised floors. Informational Note: Figure 725.154(A) illustrates the cable substitution hierarchy for Class 2 and Class 3 cables. (5) Where the air space under a raised floor is not protected by an automatic fire suppression system, in addition to wiring installed in compliance with 725.135(C), substitute cable Type CMP installed in accordance with 725.154(A) shall be permitted under raised floors. (6) Listed Type DP cable having adequate fire-resistant characteristics suitable for use under raised floors of an information technology equipment room.		
645.5(E)(3)(1)	**(3) Installation Requirements for Optical Fiber Cables Under a Raised Floor.** In addition to optical fiber cables installed in accordance with 770.113(C), Types OFNR, OFCR, OFN, and OFC shall be permitted under raised floors.	FR-8348	**(3) Installation Requirements for Optical Fiber Cables Under a Raised Floor.** The installation of optical fiber cables shall comply with either of the following: (1) Where the air space under a raised floor is protected by an automatic fire suppression system, optical fiber cables installed in accordance with 770.113(C), Types OFNR,	Revision to specify the permitted cable types if the air space under a raised floor is protected by an automatic fire suppression system. Impact: No negative impact.	2

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			OFCR, OFN, and OFC shall be permitted under raised floors.		
645.5(E)(3)(2)	**(3) Installation Requirements for Optical Fiber Cables Under a Raised Floor.** In addition to optical fiber cables installed in accordance with 770.113(C), Types OFNR, OFCR, OFN, and OFC shall be permitted under raised floors.	FR-8348	**(3) Installation Requirements for Optical Fiber Cables Under a Raised Floor.** The installation of optical fiber cables shall comply with either of the following: (2) Where the air space under a raised floor is not protected by an automatic fire suppression system, only optical fiber cables installed in accordance with 770.113(C) shall be permitted under raised floors.	Revision to specify the permitted cable types if the air space under a raised floor is not protected by an automatic fire suppression system. Impact: No negative impact.	2
645.27	**645.27 Selective Coordination.** Critical operations data system(s) overcurrent protective devices shall be selectively coordinated with all supply-side overcurrent protective devices.	FR-8371	**645.27 Selective Coordination.** Critical operations data system(s) overcurrent protective devices shall be selectively coordinated with all supply-side overcurrent protective devices. Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.	Revision to include requirement covering those who design selectively coordinated systems and to require documentation on the selection of devices used in the system. Impact: No negative impact.	2
Article 690	**Solar Photovoltaic (PV) Systems**				
690.7	**690.7 Maximum Voltage.** The maximum voltage of PV system dc circuits shall be the highest voltage between any two circuit conductors or any conductor and ground. PV system dc circuits	FR-8158, SR_8132	**690.7 Maximum Voltage.** The maximum voltage of PV system dc circuits shall be the highest voltage between any two conductors of a circuit or any conductor and ground. The maximum voltage shall be used to determine the voltage and	Revision to clarify how the maximum PV system voltage is determined. Impact: No negative impact.	2

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	on or in one- and two-family dwellings shall be permitted to have a maximum voltage of 600 volts or less. PV system dc circuits on or in other types of buildings shall be permitted to have a maximum voltage of 1000 volts or less. Where not located on or in buildings, listed dc PV equipment, rated at a maximum voltage of 1500 volts or less, shall not be required to comply with Parts II and III of Article 490.		voltage to ground of circuits in the application of this *Code*. Maximum voltage shall be used for conductors, cables, equipment, working space, and other applications where voltage limits and ratings are used. PV system dc circuits on or in buildings shall be permitted to have a maximum voltage no greater than 1000 volts. PV system dc circuits on or in one- and two-family dwellings shall be permitted to have a maximum voltage no greater than 600 volts. Where not located on or in buildings, listed dc PV equipment, rated at a maximum voltage no greater than 1500 volts, shall not be required to comply with Parts II and III of Article 490.		
690.7(B)(1)	**(B) DC-to-DC Converter Source and Output Circuits.** In a dc to-dc converter source and output circuit, the maximum voltage shall be calculated in accordance with 690.7(B)(1) or (B)(2). **(1) Single DC-to-DC Converter.** For circuits connected to the output of a single dc-to-dc converter, the maximum voltage shall be the maximum rated voltage output of the dc-to-dc converter.	FR-8179	**(B) DC-to-DC Converter Source and Output Circuits.** In a dc-to-dc converter source and output circuit, the maximum voltage shall be calculated in accordance with 690.7(B)(1) or (B)(2). **(1) Single DC-to-DC Converter.** For circuits connected to the output of a single dc-to-dc converter, the maximum voltage shall be determined in accordance with the instructions included in the listing or labeling of the dc-to-dc converter. If the instructions do not provide a method to determine the maximum voltage, the maximum voltage shall be the maximum rated voltage output of the dc-to-dc converter.	Revision to align the requirements of 690.7(B)(1) and (B)(2). Impact: No negative impact.	1
690.7(B)(2)	**(2) Two or More Series Connected DC-to-DC Converters.** For circuits connected to the output of two or more series connected dc-to-dc converters, the maximum voltage shall be determined in accordance with the instructions included in the listing or labeling of the dc-to-dc converter. If these instructions do not state the rated voltage of series-connected dc-to-	FR-8183	**(2) Two or More Series-Connected DC-to-DC Converters.** For circuits connected to the output of two or more series-connected dc-to-dc converters, the maximum voltage shall be determined in accordance with the instructions included in the listing or labeling of the dc-to-dc converter. If the instructions do not provide a method to determine the maximum voltage, the maximum voltage shall be the sum of the	Revision to align the requirements of 690.7(B)(1) and (B)(2) and for clarity. Impact: No negative impact.	1

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	dc converters, the maximum voltage shall be the sum of the maximum rated voltage output of the dc-to-dc converters in series.		maximum rated voltage output of the dc-to-dc converters in series.		
690.9(A)(1)	**690.9 Overcurrent Protection.** **(A) Circuits and Equipment.** PV system dc circuit and inverter output conductors and equipment shall be protected against overcurrent. Overcurrent protective devices shall not be required for circuits with sufficient ampacity for the highest available current. Circuits connected to current limited supplies (e.g., PV modules, dc-to-dc converters, interactive inverter output circuits) and also connected to sources having higher current availability (e.g., parallel strings of modules, utility power) shall be protected at the higher current source connection. *Exception: An overcurrent device shall not be required for PV modules or PV source circuit or dc-to-dc converters source circuit conductors sized in accordance with 690.8(B) where one of the following applies:* *(1) There are no external sources such as parallel-connected source circuits, batteries, or backfeed from inverters.* *(2) The short-circuit currents from all sources do not exceed the ampacity of the conductors and the maximum overcurrent protective device size rating specified for the PV module or dc-to-dc converter.*	FR-8226, SR-7952	**690.9 Overcurrent Protection.** **(A) Circuits and Equipment.** PV system dc circuit and inverter output conductors and equipment shall be protected against overcurrent. Circuits sized in accordance with 690.8(A)(2) are required to be protected against overcurrent with overcurrent protective devices. Each circuit shall be protected from overcurrent in accordance with 690.9(A)(1), (A)(2), or (A)(3). **(1) Circuits Where Overcurrent Protection Not Required.** Overcurrent protective devices shall not be required where both of the following conditions are met: (1) The conductors have sufficient ampacity for the maximum circuit current. (2) The currents from all sources do not exceed the maximum overcurrent protective device rating specified for the PV module or electronic power converter.	New subdivision containing requirements for circuits not requiring overcurrent protection. Impact: No negative impact.	2
690.9(A)(2)	N/A	FR-8226, SR-7959	**(2) Circuits Where Overcurrent Protection is Required on One End.** A circuit conductor connected at one end to a current-limited supply, where the conductor is rated for the maximum circuit current from that supply, and also connected to sources having an available maximum circuit current greater than the ampacity of the conductor, shall be protected	New subdivision containing requirements for circuits requiring overcurrent protection on one end of the circuit. Impact: No negative impact.	2

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			from overcurrent at the point of connection to the higher current source. Informational Note: Photovoltaic system dc circuits and electronic power converter outputs powered by these circuits are current-limited and in some cases do not need overcurrent protection. Where these circuits are connected to higher current sources, such as parallel-connected PV system dc circuits, energy storage systems, or a utility service, the overcurrent device is often installed at the higher current source end of the circuit conductor.		
690.9(A)(3)	N/A	FR-8226, SCR-1	**(3) Other Circuits.** Circuits that do not comply with 690.9(A)(1) or (A)(2) shall be protected with one of the following methods: (1) Conductors not greater than 3 m (10 ft) in length and not in buildings, protected from overcurrent on one end (2) Conductors not greater than 3 m (10 ft) in length and in buildings, protected from overcurrent on one end and in a raceway or metal clad cable (3) Conductors protected from overcurrent on both ends (4) Conductors not installed on or in buildings are permitted to be protected from overcurrent on one end of the circuit where the circuit complies with all of the following conditions: a. The conductors are installed in metal raceways or metal-clad cables, or installed in enclosed metal cable trays, or	New subdivision containing requirements that provide other options for overcurrent protection, including where there are sources of overcurrent at both ends of the conductor. Impact: No negative impact.	2

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			underground, or where directly entering pad-mounted enclosures. b. The conductors for each circuit terminate on one end at a single circuit breaker or a single set of fuses that limit the current to the ampacity of the conductors. c. The overcurrent device for the conductors is an integral part of a disconnecting means or shall be located within 3 m (10 ft) of conductor length of the disconnecting means. d. The disconnecting means for the conductors is installed outside of a building, or at a readily accessible location nearest the point of entrance of the conductors inside of a building, including installations complying with 230.6.		
690.9(B)	**(B) Overcurrent Device Ratings.** Overcurrent devices used in PV system dc circuits shall be listed for use in PV systems. Overcurrent devices, where required, shall be rated in accordance with one of the following: (1) Not less than 125 percent of the maximum currents calculated in 690.8(A). (2) An assembly, together with its overcurrent device(s), that is listed for continuous operation at 100 percent of its	FR-8232, SR-7981	**(B) Device Ratings.** Overcurrent devices used in PV system dc circuits shall be listed for use in PV systems. Electronic devices that are listed to prevent backfeed current in PV system dc circuits shall be permitted to prevent overcurrent of conductors on the PV array side of the device. Overcurrent devices, where required, shall be rated in accordance with one of the following and permitted to be rounded up to the next higher standard size in accordance with 240.4(B):	Revision to cover electronic devices listed to prevent backfeed current and to permit rounding up to the next standard rating of overcurrent protective devices. Impact: No negative impact.	2

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	rating shall be permitted to be used at 100 percent of its rating. (3) Adjustable electronic overcurrent protective devices rated or set in accordance with 240.6.		(1) Not less than 125 percent of the maximum currents calculated in 690.8(A). (2) An assembly, together with its overcurrent device(s), that is listed for continuous operation at 100 percent of its rating shall be permitted to be used at 100 percent of its rating.		
690.9(C)	**(C) Photovoltaic Source and Output Circuits.** A single overcurrent protective device, where required, shall be permitted to protect the PV modules and conductors of each source circuit or the conductors of each output circuit. Where single overcurrent protection devices are used to protect PV source or output circuits, all overcurrent devices shall be placed in the same polarity for all circuits within a PV system. The overcurrent devices shall be accessible but shall not be required to be readily accessible.	FR-8233	**(C) Source and Output Circuits.** A single overcurrent protective device, where required, shall be permitted to protect the PV modules, dc-to-dc converters, and conductors of each source circuit or the conductors of each output circuit. Where single overcurrent protection devices are used to protect source or output circuits, all overcurrent devices shall be placed in the same polarity for all circuits within a PV system. The overcurrent devices shall be accessible but shall not be required to be readily accessible.	Revision to expand requirement to cover dc-to-dc converter source and output circuits. Impact: No negative impact.	2
690.12(A)	**690.12 Rapid Shutdown of PV Systems on Buildings.** PV system circuits installed on or in buildings shall include a rapid shutdown function to reduce shock hazard for emergency responders in accordance with 690.12(A) through (D). *Exception: Ground mounted PV system circuits that enter buildings, of which the sole purpose is to house PV system equipment, shall not be required to comply with 690.12.* **(A) Controlled Conductors.** Requirements for controlled conductors shall apply to PV circuits supplied by the PV system.	FR-8242, SR-7998	**690.12 Rapid Shutdown of PV Systems on Buildings.** PV system circuits installed on or in buildings shall include a rapid shutdown function to reduce shock hazard for emergency responders in accordance with 690.12(A) through (D). *Exception: Ground mounted PV system circuits that enter buildings, of which the sole purpose is to house PV system equipment, shall not be required to comply with 690.12.* **(A) Controlled Conductors.** Requirements for controlled conductors shall apply to the following: (1) PV system DC circuits	Revisions to specify the dc and ac circuits that are subject to rapid shutdown. Impact: No negative impact	2

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			(2) Inverter output circuits originating from inverters located within the array boundary		
690.12(B)(2)	**(B) Controlled Limits.** The use of the term *array boundary* in this section is defined as 305 mm (1 ft) from the array in all directions. Controlled conductors outside the array boundary shall comply with 690.12(B)(1) and inside the array boundary shall comply with 690.12(B)(2). **(1) Outside the Array Boundary.** Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 30 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. **(2) Inside the Array Boundary.** The PV system shall comply with one of the following: (1) The PV array shall be listed or field labeled as a rapid shutdown PV array. Such a PV array shall be installed and used in accordance with the instructions included with the rapid shutdown PV array listing or field labeling.	FR-8253, SR-8025	**(B) Controlled Limits.** The use of the term *array boundary* in this section is defined as 305 mm (1 ft) from the array in all directions. Controlled conductors outside the array boundary shall comply with 690.12(B)(1) and inside the array boundary shall comply with 690.12(B)(2). **(1) Outside the Array Boundary.** Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 30 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. **(2) Inside the Array Boundary.** The PV system shall comply with one of the following: (1) A PV hazard control system listed for the purpose shall be installed in accordanc4 with the instructions included with the listing or field labeling. Where a hazard control system requires initiation to transition to a controlled state, the rapid shutdown initiation device required in 690.12(C) shall perform this initiation.	Revisions to specify requirements for PV hazard control systems, to clarify requirements for initiation device, to provide correlation with relevant product certification standards, and to avoid confusion with the array boundary requirement specified in 690.12(B)(1). Impact: No negative impact	2
690.12(C)	**C) Initiation Device.** The initiation device(s) shall initiate the rapid shutdown function of the PV system. The device "off" position shall indicate that the rapid shutdown function has been initiated for all PV systems connected to that device. For one-family and two-family dwellings, an initiation device(s)	FR-8249, SR-8005	**C) Initiation Device.** The initiation device(s) shall initiate the rapid shutdown function of the PV system. The device's "off" position shall indicate that the rapid shutdown function has been initiated for all PV systems connected to that device. For one-family and two-family dwellings, an initiation device(s) shall be located at a readily accessible location outside the building.	Revisions to allow multiple rapid shutdown initiation devices provided any individual device will initiate rapid shutdown and deletion of the undefined term *auxiliary initiation device* in order to not create a possible conflict within this section.	2

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	shall be located at a readily accessible location outside the building. The rapid shutdown initiation device(s) shall consist of at least one of the following: (1) Service disconnecting means (2) PV system disconnecting means (3) Readily accessible switch that plainly indicates whether it is in the "off" or "on" position Where multiple PV systems are installed with rapid shutdown functions on a single service, the initiation device(s) shall consist of not more than six switches or six sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, or in a group of separate enclosures. These initiation device(s) shall initiate the rapid shutdown of all PV systems with rapid shutdown functions on that service. Where auxiliary initiation devices are installed, these auxiliary devices shall control all PV systems with rapid shutdown functions on that service.		For a single PV system, the rapid shutdown initiation shall occur by the operation of any single initiation device. Devices shall consist of at least one or more of the following: (1) Service disconnecting means (2) PV system disconnecting means (3) Readily accessible switch that plainly indicates whether it is in the "off" or "on" position Where multiple PV systems are installed with rapid shutdown functions on a single service, the initiation device(s) shall consist of not more than six switches or six sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, or in a group of separate enclosures. These initiation device(s) shall initiate the rapid shutdown of all PV systems with rapid shutdown functions on that service. Where auxiliary initiation devices are installed, these auxiliary devices shall control all PV systems with rapid shutdown functions on that service.	Impact: No negative impact.	
690.13(A)	**690.13 Photovoltaic System Disconnecting Means.** Means shall be provided to disconnect the PV system from all wiring systems including power systems, energy storage systems, and utilization equipment and its associated premises wiring. **(A) Location.** The PV system disconnecting means shall be installed at a readily accessible location. Informational Note: PV systems installed in accordance with 690.12 address the concerns	FR-8264	**690.13 Photovoltaic System Disconnecting Means.** Means shall be provided to disconnect the PV system from all wiring systems including power systems, energy storage systems, and utilization equipment and its associated premises wiring. **(A) Location.** The PV system disconnecting means shall be installed at a readily accessible location. Where disconnecting means of systems above 30 V are readily accessible to unqualified persons, any enclosure door or	Revision to add requirement to restrict access by unqualified persons to exposed live parts within disconnecting means operating above 30 volts. Impact: No negative impact.	2

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	related to energized conductors entering a building.		hinged cover that exposes live parts when open shall be locked or require a tool to open. Informational Note: PV systems installed in accordance with 690.12 address the concerns related to energized conductors entering a building.		
690.15(A)	**690.15 Disconnection of Photovoltaic Equipment.** Isolating devices shall be provided to isolate PV modules, ac PV modules, fuses, dc-to-dc converters inverters, and charge controllers from all conductors that are not solidly grounded. An equipment disconnecting means or a PV system disconnecting means shall be permitted in place of an isolating device. Where the maximum circuit current is greater than 30 amperes for the output circuit of a dc combiner or the input circuit of a charge controller or inverter, an equipment disconnecting means shall be provided for isolation. Where a charge controller or inverter has multiple input circuits, a single equipment disconnecting means shall be permitted to isolate the equipment from the input circuits. Informational Note: The purpose of these isolating devices are for the safe and convenient replacement or service of specific PV system equipment without exposure to energized conductors. **(A) Location.** Isolating devices or equipment disconnecting means shall be installed in circuits connected to equipment at a location within the equipment, or within sight and within 3 m (10 ft) of the equipment. An equipment disconnecting means shall be permitted to be remote from the equipment where the	FR-8307	**690.15 Disconnecting Means for Isolating Photovoltaic Equipment.** Disconnecting means of the type required in 690.15(D) shall be provided to disconnect ac PV modules, fuses, dc-to-dc converters, inverters, and charge controllers from all conductors that are not solidly grounded. **(A) Location.** Isolating devices or equipment disconnecting means shall be installed in circuits connected to equipment at a location within the equipment, or within sight and within 3 m (10 ft) of the equipment. An equipment disconnecting means shall be permitted to be remote from the equipment where the equipment disconnecting means can be remotely operated from within 3 m (10 ft) of the equipment. Where disconnecting means of equipment operating above 30 volts are readily accessible to unqualified persons, any enclosure door or hinged cover that exposes live parts when open shall be locked or require a tool to open	Revision to add requirement to restrict access by unqualified persons to exposed live parts within disconnecting means operating above 30 volts. Impact: No negative impact.	2

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	equipment disconnecting means can be remotely operated from within 3 m (10 ft) of the equipment.				
690.15(B), formerly 690.15(C)	**(C) Isolating Device.** An isolating device shall not be required to simultaneously disconnect all current-carrying conductors of a circuit. The isolating device shall be one of the following: (1) A connector meeting the requirements of 690.33 and listed and identified for use with specific equipment (2) A finger safe fuse holder (3) An isolating switch that requires a tool to open (4) An isolating device listed for the intended application An isolating device shall be rated to open the maximum circuit current under load or be marked "Do Not Disconnect Under Load" or "Not for Current Interrupting."	FR-8316, SR-8039	**(B) Isolating Device.** An isolating device shall not be required to have an interrupting rating. Where an isolating device is not rated for interrupting the circuit current, it shall be marked "Do Not Disconnect Under Load" or "Not for Current Interrupting." An isolating device shall not be required to simultaneously disconnect all current-carrying conductors of a circuit. The isolating device shall be one of the following: (1) A mating connector meeting the requirements of 690.33 and listed and identified for use with specific equipment (2) A finger-safe fuse holder (3) An isolating device that requires a tool to place the device in the open (off) position (4) An isolating device listed for the intended application	Revisions to clarify the required ratings of isolating devices, to specify required marking of isolating devices not rated for interrupting the circuit current, and to clarify that this section covers the opening of the isolating device and not the enclosure containing the isolating device. Impact: No negative impact.	2
690.15(C), formerly 690.15(D)	**(D) Equipment Disconnecting Means.** An equipment disconnecting means shall simultaneously disconnect all current carrying conductors that are not solidly grounded of the circuit to which it is connected. An equipment disconnecting means shall be externally operable without exposing the operator to contact with energized parts, shall indicate whether in the open (off) or closed (on) position, and shall be lockable in accordance with 110.25. An equipment disconnecting means shall be one of the following devices: (1) A manually operable switch or circuit breaker	FR-8327, SR-8045	**(C) Equipment Disconnecting Means.** Equipment disconnecting means shall have ratings sufficient for the maximum circuit current, available fault current, and voltage that is available at the terminals. Equipment disconnecting means shall simultaneously disconnect all current-carrying conductors that are not solidly grounded to the circuit to which it is connected. Equipment disconnecting means shall be externally operable without exposing the operator to contact with energized parts and shall indicate whether in the open (off) or closed (on) position. Where not within sight or not within 3 m (10 ft) of the equipment, the disconnecting means or its remote operating device or the enclosure	Revisions to add requirements covering electrical ratings of disconnecting means, to specify the conditions where a lockable disconnecting means is required, to clarify the marking requirement, to reference 690.13(E) in respect to permitted types of disconnecting means, and to add new informational note covering common industry practice of connecting PV source-side dc conductors to the line side terminals of disconnecting means.	2

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	(2) A connector meeting the requirements of 690.33(E)(1) (3) A load break fused pull out switch (4) A remote-controlled circuit breaker that is operable locally and opens automatically when control power is interrupted For equipment disconnecting means, other than those complying with 690.33, where the line and load terminals can be energized in the open position, the device shall be marked in accordance with the warning in 690.13(B).		providing access to the disconnecting means shall be capable of being locked in accordance with 110.25. Equipment disconnecting means, where used, shall be one of the types in 690.13(E)(1) through (E)(5). Equipment disconnecting means, other than those complying with 690.33, shall be marked in accordance with the warning in 690.13(B) if the line and load terminals can be energized in the open position. Informational Note: A common installation practice is to terminate PV source-side dc conductors in the same manner that utility source-side ac conductors are generally connected on the line side of a disconnecting means. This practice is more likely to de-energize load-side terminals, blades, and fuses when the disconnect is in the open position and no energized sources are connected to the load side of the disconnect.	Impact: No negative impact.	
690.15(D)	N/A	SR-8042	**(D) Type of Disconnecting Means.** Where disconnects are required to isolate equipment, the disconnecting means shall be one of the following applicable types: (1) An equipment disconnecting means in accordance with 690.15(C) shall be required to isolate dc circuits with a maximum circuit current over 30 amperes. (2) An isolating device in accordance with 690.15(B) shall be permitted for circuits other than those covered by 690.15(D)(1).	Revision to specify the current level at which isolation of equipment can be accomplished through the use of an isolating device and when it is required to use a disconnecting means of the type covered in 690.15(C). Impact: No negative impact.	2
690.31(A)	**690.31 Methods Permitted.** **(A) Wiring Systems.** All raceway and cable wiring methods included in this *Code*, other wiring systems and fittings	FR-8645, SR-8050	**690.31 Wiring Methods.** **(A) Wiring Systems.** All raceway and cable wiring methods included in this *Code*, other wiring systems and fittings specifically listed	Revisions to ambient correction factor table to only provide correction factors for 105ºC and 125ºC rated	2

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	specifically listed for use on PV arrays, and wiring as part of a listed system shall be permitted. Where wiring devices with integral enclosures are used, sufficient length of cable shall be provided to facilitate replacement. Where PV source and output circuits operating at voltages greater than 30 volts are installed in readily accessible locations, circuit conductors shall be guarded or installed in Type MC cable or in raceway. For ambient temperatures exceeding 30°C (86°F), conductor ampacities shall be corrected in accordance with Table 690.31(A).		for use in PV arrays, and wiring as part of a listed system shall be permitted. Where wiring devices with integral enclosures are used, sufficient length of cable shall be provided to facilitate replacement. Where PV source and output circuits operating at voltages greater than 30 volts are installed in readily accessible locations, circuit conductors shall be guarded or installed in Type MC cable or in raceway. The ampacity of 105°C (221°F) and 125°C (257°F) conductors shall be permitted to be determined by Table 690.31(A)(b). For ambient temperatures greater than 30°C (86°F), the ampacities of these conductors shall be corrected in accordance with Table 690.31(A)(a).	conductors and to include new ampacity table for 105ºC and 125ºC rated conductors. Impact: No negative impact.	
690.31(B)	**(B) Identification and Grouping.** PV source circuits and PV output circuits shall not be contained in the same raceway, cable tray, cable, outlet box, junction box, or similar fitting as conductors, feeders, branch circuits of other non-PV systems, or inverter output circuits, unless the conductors of the different systems are separated by a partition. PV system circuit conductors shall be identified and grouped as required by 690.31(B)(1) through (2). The means of identification shall be permitted by separate color coding, marking tape, tagging, or other approved means.	FR-8647,SR-8053	**(B) Identification and Grouping.** PV system dc circuits and Class 1 remote control, signaling, and power-limited circuits of a PV system shall be permitted to occupy the same equipment wiring enclosure, cable, or raceway. PV system dc circuits shall not occupy the same equipment wiring enclosure, cable, or raceway. as other non-PV systems, or inverter output circuits, unless the PV system dc circuits are separated from other circuits by a barrier or partition. PV system circuit conductors shall be identified and grouped as required by 690.31(B)(1) and (B)(2). *Exception: PV system dc circuits utilizing multiconductor jacketed cable or metal-clad cable assemblies or listed wiring harnesses identified for the application shall be permitted to occupy the same wiring method as inverter output circuits and other non-PV systems. All conductors, harnesses, or assemblies shall have an insulation rating equal to at least the maximum circuit voltage applied to any*	Revisions to clarify separation requirements between dc system conductors and inverter output conductors and new exception covering the comingling of dc and ac circuit conductors in the same wiring method. Impact: No negative impact.	2

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			conductor within the enclosure, cable, or raceway.		
690.31(B)(1)	**(1) Identification.** PV system circuit conductors shall be identified at all accessible points of termination, connection, and splices. The means of identification shall be permitted by separate color coding, marking tape, tagging, or other approved means. Only solidly grounded PV system circuit conductors, in accordance with 690.41(A)(5), shall be marked in accordance with 200.6. *Exception: Where the identification of the conductors is evident by spacing or arrangement, further identification shall not be required.*	FR-8648, SR-8055	**(1) Identification.** PV system dc circuit conductors shall be identified at all termination, connection, and splice points by color coding, marking tape, tagging, or other approved means. Conductors relying on other than color coding for polarity identification shall be identified by an approved permanent marking means such as labeling, sleeving, or shrink-tubing that is suitable for the conductor size. The permanent marking means for nonsolidly grounded positive conductors shall include imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, or gray. The permanent marking means for nonsolidly grounded negative conductors shall include imprinted negative signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red. Only solidly grounded PV system dc circuit conductors shall be marked in accordance with 200.6. *Exception: Where the identification of the conductors is evident by spacing or arrangement, further identification shall not be required.*	Revisions to permit marking of dc system conductors with words or symbols as an alternative to color coding Impact: No negative impact.	2
690.31(B)(2)	**(2) Grouping.** Where the conductors of more than one PV system occupy the same junction box or raceway with a removable cover(s), the ac and dc conductors of each system shall be grouped separately by cable ties or similar means at least once and shall then be grouped at intervals not to exceed 1.8 m (6 ft).	FR-8648	**(2) Grouping.** Where the conductors of more than one PV system occupy the same junction box or raceway with a removable cover(s), the PV system conductors of each system shall be grouped separately by cable ties or similar means at least once and shall then be grouped at intervals not to exceed 1.8 m (6 ft). *Exception: The requirement for grouping shall not apply if the circuit enters from a cable or*	Revision for consistent use of the term *PV system conductors* throughout Article 690. Impact: No negative impact.	2

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	Exception: The requirement for grouping shall not apply if the circuit enters from a cable or raceway unique to the circuit that makes the grouping obvious.		*raceway unique to the circuit that makes the grouping obvious.*		
690.31(C)	**(C) Single-Conductor Cable.**	Global SR-8149	**(C) Cables.** Type PV wire or cable and Type distributed generation (DG) cable shall be listed. Informational Note: See UL 4703, *Standard for Photovoltaic Wire*, for PV wire and UL 3003, *Distributed Generation Cables*, for DG cable.	New requirement covering the listing of Type PV cable or wire and distributed generation (DG) cable. Impact: No negative impact.	2
690.31(C)(1)	(1) **General.** Single-conductor cable Type USE-2 and single conductor cable listed and identified as photovoltaic (PV) wire shall be permitted in exposed outdoor locations in PV source circuits within the PV array. PV wire shall be installed in accordance with 338.10(B)(4)(b) and 334.30.	FR-8650, SR-8056	**(1) Single-Conductor Cable.** Single-conductor cable in exposed outdoor locations in PV system dc circuits within the PV array shall be permitted to be one of the following: (1) PV wire or cable (2) Single-conductor cable marked sunlight resistant and Type USE-2 and Type RHW-2 Exposed cables shall be supported and secured at intervals not to exceed 600 mm (24 in.) by cable ties, straps, hangers, or similar fittings listed and identified for securement and support in outdoor locations. PV wire or cable shall be permitted in all locations where RHW-2 is permitted. *Exception: PV systems meeting the requirements of 691.4 shall be permitted to have support and securement intervals as defined in the engineered design.*	Revisions to clarify permitted single conductors, to add another permitted single conductor type, and to add supporting and securing requirements with an exception for engineered designs for Article 691 applications. Impact: No negative impact.	2
690.31(C)(2)	**Cable Tray.** PV source circuits and PV output circuits using single-conductor cable listed and identified as photovoltaic	FR-8650, SR-8060	**Cable Tray.** Single-conductor PV wire or cable of all sizes or distributed generation (DG) cable of all sizes, with or without a cable	Revisions to requirement and informational note to include distributed generation (DG)	2

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	(PV) wire of all sizes, with or without a cable tray marking/rating, shall be permitted in cable trays installed in outdoor locations, provided that the cables are supported at intervals not to exceed 300 mm (12 in.) and secured at intervals not to exceed 1.4 m (4½ ft).		tray rating, shall be permitted in cable trays installed in outdoor locations, provided that the cables are supported at intervals not to exceed 300 mm (12 in.) and secured at intervals not to exceed 1.4 m (4½ ft).	cable as a permitted cable for installation in cable trays and to recognize PV wire and cables. Impact: No negative impact.	
690.31(C)(3)	**(D) Multiconductor Cable.** Jacketed multiconductor cable assemblies listed and identified for the application shall be permitted in outdoor locations. The cable shall be secured at intervals not exceeding 1.8 m (6 ft).	FR-8940, SR-8062	**(3) Multiconductor Jacketed Cables.** Where part of a listed PV assembly, multiconductor jacketed cables shall be installed in accordance with the included instructions. Where not part of a listed assembly, or where not otherwise covered in this *Code*, multiconductor jacketed cables, including DG cable, shall be installed in accordance with the product listing and shall be permitted in PV systems. These cables shall be installed in accordance with the following: (1) In raceways, where on or in buildings other than rooftops (2) Where not in raceways, in accordance with the following: a. Marked sunlight resistant in exposed outdoor locations b. Protected or guarded, where subject to physical damage c. Closely follow the surface of support structures d. Secured at intervals not exceeding 1.8 m (6 ft) e. Secured within 600 mm (24 in.) of mating connectors or entering enclosures f. Marked direct burial, where buried in the earth	Revisions to include distributed generation (DG) cable, to add requirements for cables not installed on rooftops, and to specify the requirements for installing cables that are not in a raceway. Impact: No negative impact.	2

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690.41(B)	**690.41 System Grounding.** **(B) Ground-Fault Protection.** DC PV arrays shall be provided with dc ground-fault protection meeting the requirements of 690.41(B)(1) and (2) to reduce fire hazards. *Exception: PV arrays with not more than two PV source circuits and with all PV system dc circuits not on or in buildings shall be permitted without ground-fault protection where solidly grounded.*	FR-8398, SR-8092	**690.41 System Grounding.** **(B) Ground-Fault Protection.** PV system dc circuits that exceed 30 volts or 8 amperes shall be provided with dc ground-fault protection meeting the requirements of 690.41(B)(1) and (B)(2) to reduce fire hazards. Solidly grounded PV source circuits with not more than two modules in parallel and not on or in buildings shall be permitted without ground-fault protection.	Revisions to specify a level of voltage and current at which dc ground-fault protection is required, to make the former exception a positive statement, to clarify when source circuits are permitted without GFCI protection. Impact: No negative impact.	2
690.41(B)(1)	**(1) Ground-Fault Detection.** The ground fault protective device or system shall detect ground fault(s) in the PV array dc current–carrying conductors and components, including any functional grounded conductors, and be listed for providing PV ground-fault protection.	FR-8041	**(1) Ground-Fault Detection.** The ground-fault protection device or system shall detect ground fault(s) in the PV system dc circuit conductors, including any functional grounded conductors, and be listed for providing PV ground-fault protection. For dc-to-dc converters not listed as providing ground-fault protection, where required, listed ground fault protection equipment identified for the combination of the dc-to-dc converter and ground-fault protection device shall be installed to protect the circuit.	Revisions to cover adding dc-to-dc converters to existing circuits having ground-fault protection. Impact: No negative impact.	2
690.41(B)(2)	**(2) Isolating Faulted Circuits.** The faulted circuits shall be isolated by one of the following methods: (1) The current-carrying conductors of the faulted circuit shall be automatically disconnected. (2) The inverter or charge controller fed by the faulted circuit shall automatically cease to supply power to output circuits and isolate the PV system dc circuits from the ground reference in a functional grounded system.	FR-8402	**(2) Faulted Circuits.** The faulted circuits shall be controlled by one of the following methods: (1) The current-carrying conductors of the faulted circuit shall be automatically disconnected. (2) The device providing ground-fault protection fed by the faulted circuit shall automatically cease to supply power to output circuits and interrupt the faulted PV system dc circuits from the ground reference in a functionally grounded system.	Revisions to clarify that the requirement is about the control of faulted circuits and to expand requirement to any device that provides ground-fault protection. Impact: No negative impact.	2

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690.41(B)(3)	N/A	FR-8402, SR-8099	**(3) Indication of Faults.** Ground-fault protection equipment shall provide indication of ground faults at a readily accessible location.	New requirement covering remote indication of ground faults for equipment that is not in a readily accessible location. Impact: No negative impact.	2
690.47(A)	**690.47 Grounding Electrode System.** **(A) Buildings or Structures Supporting a PV Array.** A building or structure supporting a PV array shall have a grounding electrode system installed in accordance with Part III of Article 250. PV array equipment grounding conductors shall be connected to the grounding electrode system of the building or structure supporting the PV array in accordance with Part VII of Article 250. This connection shall be in addition to any other equipment grounding conductor requirements in 690.43(C). The PV array equipment grounding conductors shall be sized in accordance with 690.45. For PV systems that are not solidly grounded, the equipment grounding conductor for the output of the PV system, connected to associated distribution equipment, shall be permitted to be the connection to ground for ground-fault protection and equipment grounding of the PV array. For solidly grounded PV systems, as permitted in 690.41(A)(5), the grounded conductor shall be connected to a grounding electrode system by means of a grounding electrode conductor sized in accordance with 250.166.	FR-8417	**690.47 Grounding Electrode System.** **(A) Buildings or Structures Supporting a PV System.** A building or structure(s) supporting a PV system shall utilize a grounding electrode system installed in accordance with Part III of Article 250. PV array equipment grounding conductors shall be connected to a grounding electrode system in accordance with Part VII of Article 250. This connection shall be in addition to any other equipment grounding conductor requirements in 690.43(C). The PV array equipment grounding conductors shall be sized in accordance with 690.45. For specific PV system grounding configurations permitted in 690.41(A), one of the following conditions shall apply: (1) For PV systems that are not solidly grounded, the equipment grounding conductor for the output of the PV system, where connected to associated distribution equipment connected to a grounding electrode system, shall be permitted to be the only connection to ground for the system. (2) For solidly grounded PV systems, as permitted in 690.41(A)(5), the grounded conductor shall be connected to a grounding electrode system by means of a grounding	Revisions to requirement to clarify connection of functionally and solidly grounded PV systems to a grounding electrode system. Impact: No negative impact.	2

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			electrode conductor sized in accordance with 250.166.		
690.47(B)	**(B) Additional Auxiliary Electrodes for Array Grounding.** Grounding electrodes shall be permitted to be installed in accordance with 250.52 and 250.54 at the location of ground and roof-mounted PV arrays. The electrodes shall be permitted to be connected directly to the array frame(s) or structure. The grounding electrode conductor shall be sized according to 250.66. The structure of a ground-mounted PV array shall be permitted to be considered a grounding electrode if it meets the requirements of 250.52. Roof mounted PV arrays shall be permitted to use the metal frame of a building or structure if the requirements of 250.52(A)(2) are met.	FR-8419	**(B) Grounding Electrodes and Grounding Electrode Conductors.** Additional grounding electrodes shall be permitted to be installed in accordance with 250.52 and 250.54. Grounding electrodes shall be permitted to be connected directly to the PV module frame(s) or support structure. A grounding electrode conductor shall be sized according to 250.66. A support structure for a ground-mounted PV array shall be permitted to be considered a grounding electrode if it meets the requirements of 250.52. PV arrays mounted to buildings shall be permitted to use the metal structural frame of the building if the requirements of 250.68(C)(2) are met.	Revisions to clarify requirement permitting the connection of PV system equipment to auxiliary grounding electrodes and to metal structural frames of buildings and structures. Impact: No negative impact.	2
Article 695	**Fire Pumps**				
695.3(B)(2) Exception	**695.3 Power Source(s) for Electric Motor-Driven Fire Pumps.** Electric motor-driven fire pumps shall have a reliable source of power. **(B) Multiple Sources.** If reliable power cannot be obtained from a source described in 695.3(A), power shall be supplied by one of the following: [**20:**9.3.2] **(1) Individual Sources.** An approved combination of two or more of the sources from 695.3(A). **(2) Individual Source and On-site Standby Generator.** An approved combination of one or more of the sources in 695.3(A) and an on-site standby generator complying with 695.3(D). [**20:**9.3.4]	FR-7722	**695.3 Power Source(s) for Electric Motor-Driven Fire Pumps.** Electric motor-driven fire pumps shall have a reliable source of power. **(B) Multiple Sources.** If reliable power cannot be obtained from a source described in 695.3(A), power shall be supplied by one of the following: [**20:**9.3.2] **(1) Individual Sources.** An approved combination of two or more of the sources from 695.3(A). **(2) Individual Source and On-site Standby Generator.** An approved combination of one or more of the sources in 695.3(A) and an on-site standby generator complying with 695.3(D). [**20:**9.3.4] *Exception to 695.3(B)(1) and (B)(2): An alternate source of power shall not be required*	Revision to permit use of back-up electric motor-driven fire pump with independent power source. Impact: No negative impact.	2

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	Exception to (B)(1) and (B)(2): An alternate source of power shall not be required where a back-up engine-driven		*where a back-up engine-driven fire pump, back-up steam turbine-driven fire pump , or back-up electric motor-driven fire pump with an independent power source in accordance with 695.3(A) or (C) is installed.*		
695.3(C)(3)	**(C) Multibuilding Campus-Style Complexes.** If the sources in 695.3(A) are not practicable and the installation is part of a multibuilding campus-style complex, feeder sources shall be permitted if approved by the authority having jurisdiction and installed in accordance with either (C)(1) and (C)(3) or (C)(2) and (C)(3). **(3) Selective Coordination.** The overcurrent protective device(s) in each disconnecting means shall be selectively coordinated with any other supply-side overcurrent protective device(s).	FR-7729	**(C) Multibuilding Campus-Style Complexes.** If the sources in 695.3(A) are not practicable and the installation is part of a multibuilding campus-style complex, feeder sources shall be permitted if approved by the authority having jurisdiction and installed in accordance with either 695.3(C)(1) and (C)(3) or (C)(2) and (C)(3). **(3) Selective Coordination.** Overcurrent protective device(s) shall be selectively coordinated with all supply-side overcurrent protective device(s). Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, maintain, and operate the system. *Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.*	Revision to add requirement on qualifications of those designing selectively coordinated overcurrent protective devices and to provide exception on overcurrent protective devices connected in series. Impact: No negative impact.	2
Chapter 7	**Special Conditions**				
Article 700	**Emergency Systems**				

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700.5(A)	**(A) General.** Transfer equipment, including automatic transfer switches, shall be automatic, identified for emergency use, and approved by the authority having jurisdiction. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and emergency sources of supply in any operation of the transfer equipment. Transfer equipment and electric power production systems installed to permit operation in parallel with the normal source shall meet the requirements of Article 705.	FR-7507	**(A) General.** Transfer equipment shall be automatic, listed, and marked for emergency use, and approved by the authority having jurisdiction. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and emergency sources of supply in any operation of the transfer equipment. Transfer equipment and electric power production systems installed to permit operation in parallel with the normal source shall meet the requirements of Article 705. Meter-mounted transfer switches shall not be permitted for emergency system use.	Revision to add requirement covering the use of meter-mounted transfer switches for emergency systems. Impact: No negative impact.	2
700.10(D)(4)	**(3) Generator Control Wiring.** Control conductors installed between the transfer equipment and the emergency generator shall be kept entirely independent of all other wiring and shall meet the conditions of 700.10(D)(1). The integrity of the generator control wiring shall be continuously monitored. Loss of integrity of the remote start circuit(s) shall initiate visual and audible annunciation of generator malfunction at the generator local and remote annunciator(s) and start the generator(s).	FR-7658	**(4) Generator Control Wiring.** Control conductors installed between the transfer equipment and the emergency generator shall be kept entirely independent of all other wiring and shall meet the conditions of 700.10(D)(2). The integrity of the generator remote start circuit shall be monitored for broken, disconnected, or shorted wires. Loss of integrity shall start the generator(s).	Revision to require monitoring of generator start circuit and necessary action upon sensing compromise of start circuit integrity. Impact: No negative impact.	2
700.12(I)(2)(3)	**700.12 General Requirements.** Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings concerned, emergency lighting, emergency power, or both shall be available within the time required for the application but not to exceed 10 seconds. The supply system for emergency purposes, in addition to the normal services to the building and meeting the general requirements of this section, shall be one or more of the types of systems	FR-8095, SR-7605	**700.12 General Requirements.** Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings concerned, emergency lighting, emergency power, or both shall be available within the time required for the application but not to exceed 10 seconds. The supply system for emergency purposes, in addition to the normal services to the building and meeting the general requirements of this section, shall be one or more of the types of systems described in	Revision to permit unit equipment to be supplied by a separate branch circuit regardless of the number of normal lighting branch circuits serving an area if the branch circuit disconnecting means is capable of being locked in the open (off) position. Impact: **This change will result in an unsafe**	**3**

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	described in 700.12(A) through (E). Unit equipment in accordance with 700.12(F) shall satisfy the applicable requirements of this article. In selecting an emergency source of power, consideration shall be given to the occupancy and the type of service to be rendered, whether of minimum duration, as for evacuation of a theater, or longer duration, as for supplying emergency power and lighting due to an indefinite period of current failure from trouble either inside or outside the building. Equipment shall be designed and located so as to minimize the hazards that might cause complete failure due to flooding, fires, icing, and vandalism. Equipment for sources of power as described in 700.12(A) through (E) shall be installed either in spaces fully protected by approved automatic fire suppression systems (sprinklers, carbon dioxide systems, and so forth) or in spaces with a 1-hour fire rating where located within the following: (1) Assembly occupancies for more than 1000 persons (2) Buildings above 23 m (75 ft) in height with any of the following occupancy classes − assembly, educational, residential, detention and correctional, business, and mercantile (3) Health care occupancies where persons are not capable of self-preservation (4) Educational occupancies with more than 300 occupants **(F) Unit Equipment.** **(1) Components of Unit Equipment.** Individual unit equipment		700.12(A) through (E). Unit equipment in accordance with 700.12(F) shall satisfy the applicable requirements of this article. In selecting an emergency source of power, consideration shall be given to the occupancy and the type of service to be rendered, whether of minimum duration, as for evacuation of a theater, or longer duration, as for supplying emergency power and lighting due to an indefinite period of current failure from trouble either inside or outside the building. Equipment shall be designed and located so as to minimize the hazards that might cause complete failure due to flooding, fires, icing, and vandalism. Equipment for sources of power as described in 700.12(A) through (E) shall be installed either in spaces fully protected by approved automatic fire suppression systems (sprinklers, carbon dioxide systems, and so forth) or in spaces with a 1-hour fire rating where located within the following: (1) Assembly occupancies for more than 1000 persons (2) Buildings above 23 m (75 ft) in height with any of the following occupancy classes − assembly, educational, residential, detention and correctional, business, and mercantile (3) Health care occupancies where persons are not capable of self-preservation (4) Educational occupancies with more than 300 occupants **(I) Unit Equipment.** **(1) Components of Unit Equipment.** Individual unit equipment for emergency illumination shall consist of the following: (1) A rechargeable battery (2) A battery charging means	**condition**. Opening of a branch circuit breaker in an area where general lighting is served by a single branch circuit will result in a loss of lighting, with emergency lighting unit equipment not activated if not fed from the same branch circuit. This is not consistent with NFPA 101, Life Safety Code, Section 7.9.2.3(2).	

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	for emergency illumination shall consist of the following: (1) A rechargeable battery (2) A battery charging means (3) Provisions for one or more lamps mounted on the equipment, or shall be permitted to have terminals for remote lamps, or both (4) A relaying device arranged to energize the lamps automatically upon failure of the supply to the unit equipment **(2) Installation of Unit Equipment.** Unit equipment shall be installed in accordance with 700.12(F)(2)(1) through (6). (1) The batteries shall be of suitable rating and capacity to supply and maintain the total lamp load associated with the unit in accordance with (a) or (b): (a) For a period of at least 11/2 hours without the voltage falling below 871/2 percent of normal battery voltage (b) The unit equipment shall supply and maintain not less than 60 percent of the initial emergency illumination for a period of at least 11/2 hours (2) Unit equipment shall be permanently fixed (i.e., not portable) in place and shall have all wiring to each unit installed in accordance with the requirements of any of the wiring methods in Chapter 3. Flexible cord-and-plug connection shall be permitted, provided that the cord does not exceed 900 mm (3 ft) in length. (3) The branch circuit feeding the unit equipment shall be the same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.		(3) Provisions for one or more lamps mounted on the equipment, or shall be permitted to have terminals for remote lamps, or both (4) A relaying device arranged to energize the lamps automatically upon failure of the supply to the unit equipment **(2) Installation of Unit Equipment.** Unit equipment shall be installed in accordance with the following (1) The batteries shall be of suitable rating and capacity to supply and maintain the total lamp load associated with the unit in accordance with the following: (a) For a period of at least 1 ½ hours without the voltage falling below 87 ½ percent of normal battery voltage. (b) The unit equipment shall supply and maintain not less than 60 percent of the initial emergency illumination for a period of at least 1 ½ hours. (2) Unit equipment shall be permanently fixed (i.e., not portable) in place and shall have all wiring to each unit installed in accordance with the requirements of any of the wiring methods in Chapter 3. Flexible cord-and-plug connection shall be permitted, provided that the cord does not exceed 900 mm (3 ft) in length. (3) The branch circuit feeding the unit equipment shall be one of the following: a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches b. Where the normal lighting circuit is served by one or more branch circuits, a separate branch circuit, provided with a lock-on feature, that originates from the same panelboard as the normal lighting circuits. The branch circuit disconnecting means for		

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	Exception: In a separate and uninterrupted area supplied by a minimum of three normal lighting circuits that are not part of a multiwire branch circuit, a separate branch circuit for unit equipment shall be permitted if it originates from the same panelboard as that of the normal lighting circuits and is provided with a lock-on feature.		this branch circuit shall be provided with a lock-on feature.		
Article 701	**Legally Required Standby Systems**				
701.5(A)	**701.5 Transfer Equipment.** **(A) General.** Transfer equipment, including automatic transfer switches, shall be automatic and identified for standby use and approved by the authority having jurisdiction. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and alternate sources of supply in any operation of the transfer equipment. Transfer equipment and electric power production systems installed to permit operation in parallel with the normal source shall meet the requirements of Article 705.	FR-7580	**701.5 Transfer Equipment.** **(A) General.** Transfer equipment shall be automatic, listed, and marked for emergency system or legally required standby use, and approved by the authority having jurisdiction. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and alternate sources of supply in any operation of the transfer equipment. Transfer equipment and electric power production systems installed to permit operation in parallel with the normal source shall meet the requirements of Article 705. Meter-mounted transfer switches shall not be permitted for legally required system use.	Revision by adding requirement covering the use of meter-mounted transfer switches for legally required standby systems. Impact: No negative impact.	2
Article 702	**Optional Standby Systems**				
702.5(A)	**702.5 Transfer Equipment.** Transfer equipment shall be suitable for the intended use and designed and installed so as to prevent the inadvertent interconnection of normal and alternate sources of supply in any operation of the transfer equipment. Transfer equipment and electric power production systems installed to permit operation in parallel with the normal source shall meet the requirements of Article 705.	FR-7830, SR-7588	**702.5 Transfer Equipment.** **(A) General.** Transfer equipment shall be required for all standby systems subject to the requirements of this article and for which an electric utility supply is either the normal or standby source. Transfer switches shall not be permitted to be reconditioned. *Exception: Temporary connection of a portable generator without transfer equipment shall be permitted where conditions of*	Revision to delete requirement covered by product certification standard and to provide requirement on reconditioning of transfer switches. Impact: No negative impact.	2

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	Transfer equipment, located on the load side of branch circuit protection, shall be permitted to contain supplemental overcurrent protection having an interrupting rating sufficient for the available fault current that the generator can deliver. The supplementary overcurrent protection devices shall be part of a listed transfer equipment. Transfer equipment shall be required for all standby systems subject to the provisions of this article and for which an electric utility supply is either the normal or standby source. *Exception: Temporary connection of a portable generator without transfer equipment shall be permitted where conditions of maintenance and supervision ensure that only qualified persons service the installation and where the normal supply is physically isolated by a lockable disconnecting means or by disconnection of the normal supply conductors.* The short-circuit current rating of the transfer equipment, based on the specific overcurrent protective device type and settings protecting the transfer equipment, shall be field marked on the exterior of the transfer equipment.		*maintenance and supervision ensure that only qualified persons service the installation and where the normal supply is physically isolated by a lockable disconnecting means or by disconnection of the normal supply conductors.*		
702.5(B)	*See above.*	FR-7830, SR-7588	**702.5 Transfer Equipment.** **(B) Meter-Mounted Transfer Switches.** Transfer switches installed between the utility meter and the meter enclosure shall be listed meter-mounted transfer switches and shall be approved. Meter-mounted transfer switches	Revision to add requirement covering the use of meter-mounted transfer switches. Impact: No negative impact.	2

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			shall be of the manual type unless rated as determined by 702.4(B)(2). Informational Note: For more information, see UL 1008M, *Transfer Switch Equipment, Meter Mounted*.		
702.5(D)	*See above.*	FR-7830, SR-7588	**(D) Inadvertent Interconnection.** Transfer equipment shall be suitable for the intended use and shall be listed, designed, and installed so as to prevent the inadvertent interconnection of all sources of supply in any operation of the transfer equipment.	Revision to require that transfer equipment be listed and to apply the inadvertent connection requirement for transfer equipment to all available alternate sources. Impact: No negative impact.	2
702.5(E)	N/A	SR-7588	**(E) Parallel Installation.** Transfer equipment and electric power production systems installed to permit operation in parallel with the normal source shall also meet the requirements of Article 705.	New requirement covering the parallel operation of normal source with alternate source(s). Impact: No negative impact.	2
Article 705	**Interconnected Electric Power Production Sources**				
705.11	N/A	SR-8155, SR-8156, SR-8159, SR-8176, SR-8178	**705.11 Supply-Side Source Connections.** An electric power production source, where connected on the supply side of the service disconnecting means as permitted in 230.82(6), shall comply with 705.11(A) through (E). **(A) Output Rating.** The sum of the power source continuous current output ratings on a service, other than those controlled in accordance with 705.13, shall not exceed the ampacity of the service conductors. **(B) Conductors.** The power source output circuit conductors from the service conductors point of connection to the first overcurrent protection device shall be sized in accordance with 705.28 and in no case sized smaller than 6	New requirement covering the interconnection of power production source(s) to the supply system of the building or structure service disconnecting means. Impact: No negative impact.	2

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			AWG copper or 4 AWG aluminum. These conductors shall be installed in accordance with 230.30 or 230.43. **(C) Overcurrent Protection.** The power source output circuit conductors shall be protected from overcurrent in accordance with 705.30. If fuses are not integral with the disconnecting means, the disconnecting means shall be located on the service side of the fuses. Where the power source output circuit conductors make their connection to the service outside of a building, they shall be protected by overcurrent devices in a readily accessible location outside the building or at the first readily accessible location where the power source conductors enter the building. Where the power source output circuit conductors make their connection to the service inside a building, they shall be protected with one of the following methods: (1) With an overcurrent device located within 3 m (10 ft) of conductor length in dwelling units and 5 m (16.5 ft) in other than dwelling units from the point of connection to the service (2) In other than a dwelling unit, with an overcurrent device located within 20 m (71 ft)of conductor length from the point of connection to the service, provided that cable limiters installed in all ungrounded conductors are located within 5 m (16.5 ft) of conductor length from the point of connection to the service **(D) Connections.** The connection of power source output circuit conductors to the service conductors shall be made using listed connectors as described in 110.14 and comply		

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			with all enclosure fill requirements Any modifications to existing equipment shall be made in accordance with the manufacturer's instructions or the modification must be evaluated for the application and have a field label applied. For meter socket enclosures or other equipment under the exclusive control of the electric utility, only connections approved by the electric utility shall be permitted. **(E) Ground-Fault Protection.** For connections rated 1000 amperes or more to solidly grounded wye services exceeding 150 volts to ground but not exceeding 1000 volts, phase-to-phase, ground-fault protection meeting the requirements of 230.95 shall be provided.		
705.13	N/A	SR-8151	**705.13 Power Control Systems.** A power control system (PCS) shall be listed and evaluated to control the output of one or more power production sources, energy storage systems (ESS), and other equipment. The PCS shall limit current and loading on the busbars and conductors supplied by the PCS. For the circuits connected to a PCS, the PCS shall limit the current to the ampacity of the conductors or the ratings of the busbars to which it is connected in accordance with 705.13(A) through (E). **(A) Monitoring.** The PCS controller shall monitor all currents within the PCS. Any busbar or conductor on the load side of the service disconnecting means that is not monitored by the PCS shall comply with 705.12. Where the PCS is connected in accordance with 705.11, the PCS shall monitor the service conductors and prevent overload of these conductors.	New requirement covering the use of power control systems to limit current and loading on distribution equipment busbars and feeder circuit conductors. Impact: No negative impact.	2

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			(B) Settings. The sum of all PCS-controlled currents plus all monitored currents from other sources of supply shall not exceed the ampacity of any busbar or conductor supplied by the power production sources. Where the PCS is connected to an overcurrent device protecting any busbar or conductor not monitored by the PCS, the setting of the PCS controller shall be set within the ratings of that overcurrent device. **(C) Overcurrent Protection.** The PCS shall provide overcurrent protection either by overcurrent devices or by the PCS including the functionality as an overcurrent device in the product listing. Informational Note: Some PCS are listed to provide overcurrent protection. **(D) Single Power Source Rating.** The rating of the overcurrent device for any single power source controlled by the PCS shall not exceed the rating of the busbar or the ampacity of the conductors to which it is connected. **(E) Access to Settings.** The access to settings of the PCS shall be restricted to qualified personnel in accordance with the requirements of 240.6(C).		
705.25	N/A	FR-8660	**705.25 Wiring Methods.** **(A) General.** All raceway and cable wiring methods included in Chapter 3 of this *Code* and other wiring systems and fittings specifically listed, intended, and identified for use with power production systems and equipment shall be permitted. Where wiring devices with integral enclosures are used, sufficient length of cable shall be provided to facilitate replacement.	New section containing requirements on wiring methods for electric power productions systems and equipment. Impact: No negative impact.	2

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			(B) Flexible Cords and Cables. Flexible cords and cables, where used to connect the moving parts of a power production system or where used for ready removal for maintenance and repair, shall comply with Article 400 and shall be listed and identified as DG Cable, Distributed Generation Cable, hard service cord, or portable power cable, shall be suitable for extra-hard usage, shall be listed for outdoor use, and shall be water resistant. Cables exposed to sunlight shall be sunlight resistant. Flexible, fine-stranded cables shall be terminated only with terminals, lugs, devices, or connectors in accordance with 110.14(A). **(C) Multiconductor Cable Assemblies.** Multiconductor cable assemblies used in accordance with their listings shall be permitted.		
705.28	N/A	SR-8190	**(A) Calculation of Maximum Circuit Current.** Where not elsewhere required or permitted in this *Code*, the maximum current for the circuit shall be the continuous output current rating of the power production equipment. **(B) Conductor Ampacity.** Where not elsewhere required or permitted in this *Code*, the circuit conductors shall be sized to carry not less than the largest of the following: (1) The maximum currents in 705.28(A) multiplied by 125 percent without adjustment or correction factors (2) The maximum currents in 705.28(A) with adjustment and correction factors (3) Where connected to feeders, if smaller than the feeder conductors, the ampacity as calculated	New section containing relocated and revised requirements on circuit and conductor sizing formerly contained in Sections 705.60 and 705.95. The revision expands applicability to other than inverter supplied systems. Impact: No negative impact.	2

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			in 240.21(B) based on the over-current device protecting the feeder **(C) Neutral Conductors.** Neutral conductors shall be permitted to be sized in accordance with either 705.28(C)(1) or (C)(2). **(1) Single-Phase Line-to-Neutral Power Sources.** Where not elsewhere required or permitted in this *Code*, the ampacity of a neutral conductor to which a single-phase line-to-neutral power source is connected shall not be smaller than the ampacity in 705.28(B). **(2) Neutral Conductor Used Solely for Instrumentation, Voltage, Detection, or Phase Detection.** A power production equipment neutral conductor used solely for instrumentation, voltage detection, or phase detection shall be permitted to be sized in accordance with 250.102.		
705.45	N/A	SR-8196	**705.45 Unbalanced Interconnections.** **(A) Single Phase.** Single-phase power sources in interactive systems shall be connected to 3-phase power systems in order to limit unbalanced voltages at the point of interconnection to not more than 3 percent. **(B) Three Phase.** Three-phase power sources in interactive systems shall have all phases automatically de-energized upon loss of, or unbalanced, voltage in one or more phases unless the interconnected system is designed so that significant unbalanced voltages will not result.	New section containing requirements formerly located in 705.100. Impact: No negative impact.	2
Article 706	**Energy Storage Systems**				
706.7	N/A	FR-8924	**706.7 Maintenance.** Energy storage systems shall be maintained in proper and safe operating condition. The required maintenance shall be in accordance with the manufacturer's requirements and industry standards. A written record of the	New requirement covering the maintenance of ESS. Impact: No negative impact.	2

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			system maintenance shall be kept and shall include records of repairs and replacements necessary to maintain the system in proper and safe operating condition.		
706.15(A)	**706.7 Disconnecting Means.** **(A) ESS Disconnecting Means.** A disconnecting means shall be provided for all ungrounded conductors derived from an ESS. A disconnecting means shall be readily accessible and located within sight of the ESS. Informational Note: See 240.21(H) for information on the location of the overcurrent device for conductors.	SR-7700	**706.15 Disconnecting Means.** **(A) ESS Disconnecting Means.** A disconnecting means shall be provided for all ungrounded conductors derived from an ESS and shall be permitted to be integral to listed ESS equipment. The disconnecting means shall comply with all of the following: (1) The disconnecting means shall be readily accessible. (2) The disconnecting means shall be located within sight of the ESS. Where it is impractical to install the disconnecting means within sight of the ESS, the disconnect shall be installed as close as practicable, and the location of the disconnecting means shall be field marked on or immediately adjacent to the ESS. The marking shall be of sufficient durability to withstand the environment involved and shall not be handwritten. (3) The disconnecting means shall be lockable open in accordance with 110.25. For one-family and two-family dwellings, a disconnecting means or its remote control shall be located at a readily accessible location outside the building.	Revision to cover ESS disconnecting means where it cannot be installed within sight of the ESS and to provide new requirement for ESS disconnecting means at one- and two-family dwellings. Impact: No negative impact.	2

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706.15(B)	**(B) Remote Actuation.** Where controls to activate the disconnecting means of an ESS are not located within sight of the system, the disconnecting means shall be capable of being locked in the open position, in accordance with 110.25, and the location of the controls shall be field marked on the disconnecting means.	FR-8942	**(B) Remote Actuation.** Where controls to activate the disconnecting means of an ESS are used and are not located within sight of the system, the location of the controls shall be field marked on the disconnecting means.	Revision to correlate with changes on lockable disconnecting means added to 705.15(A). Impact: No negative impact.	2
706.15(C)	**(D) Notification.** The disconnecting means shall be legibly marked in the field. The marking shall meet the requirements of 110.21(B) and shall include the following: (1) Nominal ESS voltage (2) Maximum available short-circuit current derived from the ESS (3) The associated clearing time or arc duration based on the available short-circuit current from the ESS and associated overcurrent protective devices if applicable (4) Date the calculation was performed *Exception: The labeling in 706.7(D)(1) through (D)(4) shall not be required if an arc flash label is applied in accordance with acceptable industry practice.*	SR-7731	**(C) Notification and Marking.** Each ESS disconnecting means shall plainly indicate whether it is in the open (off) or closed (on) position and be permanently marked "ENERGY STORAGE SYSTEM DISCONNECT." The disconnecting means shall be legibly marked in the field to indicate the following: (1) Nominal ESS ac voltage and maximum ESS dc voltage (2) Available fault current derived from the ESS (3) An arc-flash label applied in accordance with acceptable industry practice (4) Date the calculation was performed *Exception: List items (2), (3), and (4) shall not apply to one- and two-family dwellings.*	Revision to require markings on ESS, provide exception to certain markings for ESS installed at one- and two-family dwellings, and add requirement covering disconnecting means that may have energized line or load terminals when disconnecting means is in open position. Impact: No negative impact.	2
706.15(D)	**(E) Partitions and Distance.** Where energy storage system input and output terminals are more than 1.5 m (5 ft) from connected equipment, or where the circuits from these terminals pass through a wall or partition, the installation shall comply with the following: (1) A disconnecting means shall be provided at the energy storage system end of the circuit. Fused disconnecting	FR-8942	**(D) Partitions Between Components.** Where circuits from the input or output terminals of energy storage components in an ESS pass through a wall, floor, or ceiling, a readily accessible disconnecting means shall be provided within sight of the energy storage component. Fused disconnecting means or circuit breakers shall be permitted to be used.	Revision to requirement for disconnecting means location where ESS input or output conductors pass through a floor, wall, or ceiling. Impact: No negative impact.	2

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	means or circuit breakers shall be permitted to be used.				
Article 708	**Critical Operations Power Systems**				
708.24(D)	**(B) Bypass Isolation Switches.** Means shall be permitted to bypass and isolate the transfer equipment. Where bypass isolation switches are used, inadvertent parallel operation shall be avoided.	FR-8872	**708.24 Transfer Equipment.** **(D) Bypass Isolation Automatic Transfer Switches.** Where loads are supplied by only one automatic transfer switch, the automatic transfer switch shall include a bypass isolation switch to facilitate maintenance as required in 708.6(C) without jeopardizing continuity of power. When the bypass isolation transfer switch is in the bypass mode, either it shall automatically initiate transfer between power sources upon loss of the connected power source or it shall remain actively supervised by a qualified person who can manually initiate a transfer between power sources.	New requirement covering the use of transfer switches equipped with a bypass isolation switch. Impact: No negative impact.	2
Article 760	**Fire Alarm Systems**				
760.121(B)	**760.121 Power Sources for PLFA Circuits.** **(B) Branch Circuit.** The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch-circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters.	FR-8885	**760.121 Power Sources for PLFA Circuits.** **(B) Branch Circuit.** The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch-circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters. The fire alarm branch-circuit disconnecting means shall be permitted to be secured in the "on" position.	Revision to permit the disconnect to be secured in the "on" position. Impact: No negative impact.	2

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Article 770	**Optical Fiber Cables**				
770.110(D)	N/A	FR-7586	**770.110 Raceways, Cable Routing Assemblies, and Cable Trays for Optical Fiber Cables.** **(D) Cable Trays.** Optical fiber cables shall be permitted to be installed in metal or listed nonmetallic cable tray systems.	New subdivision addressing requirements for cable trays. Impact: No negative impact.	2
770.133	**770.133 Installation of Optical Fibers and Electrical Conductors.** **(A) With Conductors for Electric Light, Power, Class 1, Non– Power-Limited Fire Alarm, or Medium Power Network- Powered Broadband Communications Circuits.** When optical fibers are within the same composite cable for electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits operating at 1000 volts or less, they shall be permitted to be installed only where the functions of the optical fibers and the electrical conductors are associated. Nonconductive optical fiber cables shall be permitted to occupy the same cable tray or raceway with conductors for electric light, power, Class 1, non–power-limited fire alarm, Type ITC, or medium-power network-powered broadband communications circuits operating at 1000 volts or less. Conductive optical fiber cables shall not be permitted to occupy the same cable tray or raceway with conductors for electric light, power, Class 1, non–power-limited fire alarm, Type ITC, or medium-power network-powered broadband communications circuits. Optical fibers in composite optical fiber cables containing only current-carrying conductors for electric light, power, or	FR-7615, SR-7725	**770.133 Installation of Optical Fibers and Electrical Conductors.** **(A) In Cable Trays and Raceways.** Conductive optical fiber cables contained in an armored or metal-clad-type sheath and nonconductive optical fiber cables shall be permitted to occupy the same cable tray or raceway with conductors for electric light, power, Class 1, non-power-limited fire alarm, Type ITC, or medium-power network-powered broadband communications circuits operating at 1000 volts or less. Conductive optical fiber cables without an armored or metal-clad-type sheath shall not be permitted to occupy the same cable tray or raceway with conductors for electric light, power, Class 1, non-power-limited fire alarm, Type ITC, or medium-power network-powered broadband communications circuits, unless all of the conductors of electric light, power, Class 1, non-power-limited fire alarm, and medium-power network-powered broadband communications circuits are separated from all of the optical fiber cables by a permanent barrier or listed divider. **(B) In Cabinets, Outlet Boxes, and Similar Enclosures.** Nonconductive optical fiber cables shall not be permitted to occupy the same cabinet, outlet box, panel, or similar enclosure housing the electrical terminations of an electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuit	Revision to permit armored or metal clad sheath cables, create two first level subdivisions, and move exceptions to positive code language. Impact: No negative impact.	2

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	Class 1 circuits rated 1000 volts or less shall be permitted to occupy the same cabinet, cable tray, outlet box, panel, raceway, or other termination enclosure with conductors for electric light, power, or Class 1 circuits operating at 1000 volts or less. Nonconductive optical fiber cables shall not be permitted to occupy the same cabinet, outlet box, panel, or similar enclosure housing the electrical terminations of an electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuit. *Exception No. 1: Occupancy of the same cabinet, outlet box, panel, or similar enclosure shall be permitted where nonconductive optical fiber cable is functionally associated with the electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuit.* *Exception No. 2: Occupancy of the same cabinet, outlet box, panel, or similar enclosure shall be permitted where nonconductive optical fiber cables are installed in factory- or field-assembled control centers.* *Exception No. 3: In industrial establishments only, where conditions of maintenance and supervision ensure that only qualified persons service the installation, nonconductive optical fiber cables shall be permitted with circuits exceeding 1000 volts.* *Exception No. 4: In industrial establishments only, where conditions of maintenance and supervision ensure that only qualified persons service the installation, optical fibers in composite optical fiber cables contain-ing current-*		unless one or more of the following conditions exist: (1) The nonconductive optical fiber cables are functionally associated with the electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuit. (2) The conductors for electric light, power, Class 1, non-power-limited fire alarm, Type ITC, or medium-power network-powered broadband communications circuits operate at 1000 volts or less. (3) The nonconductive optical fiber cables and the electrical terminations of electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuit are installed in factory- or field-assembled control centers. (4) The nonconductive optical fiber cables are installed in an industrial establishment where conditions of maintenance and supervision ensure that only qualified persons service the installation. When optical fibers are within the same composite cable for electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuits operating at 1000 volts or less, they shall be permitted to be installed only where the functions of the optical fibers and the electrical conductors are associated.		

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	carrying conductors operating over 1000 volts shall be permitted to be installed. *Exception No. 5: Where all of the conductors of electric light, power, Class 1, nonpower-limited fire alarm, and medium-power network powered broadband communications circuits are separated from all of the optical fiber cables by a permanent barrier or listed divider.* **(B) With Other Circuits.** Optical fibers shall be permitted in the same cable, and conductive and nonconductive optical fiber cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly, with conductors of any of the following: (1) Class 2 and Class 3 remote-control, signaling, and power limited circuits in compliance with Article 645 or Parts I and III of Article 725 (2) Power-limited fire alarm systems in compliance with Parts I and III of Article 760 (3) Communications circuits in compliance with Parts I and V of Article 800 (4) Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820 (5) Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830 **(C) Support of Optical Fiber Cables.** Raceways shall be used for their intended purpose. Optical fiber cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support. *Exception: Overhead (aerial) spans of optical fiber cables shall be*		Optical fibers in composite optical fiber cables containing only current-carrying conductors for electric light, power, or Class 1 circuits rated 1000 volts or less shall be permitted to occupy the same cabinet, cable tray, outlet box, panel, raceway, or other termination enclosure with conductors for electric light, power, or Class 1 circuits operating at 1000 volts or less. Optical fibers in composite optical fiber cables containing current-carrying conductors for electric light, power, or Class 1 circuits rated over 1000 volts shall be permitted to occupy the same cabinet, cable tray, outlet box, panel, raceway, or other termination enclosure with conductors for electric light, power, or Class 1 circuits in industrial establishments, where conditions of maintenance and supervision ensure that only qualified persons service the installation. **(C) With Other Circuits.** Optical fibers shall be permitted in the same cable, and conductive and nonconductive optical fiber cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly, with conductors of any of the following: (1) Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Article 645 or Parts I and III of Article 725 (2) Power-limited fire alarm systems in compliance with Parts I and III of Article 760 (3) Communications circuits in compliance with Parts I and V of Article 805 (4) Community antenna television and radio distribution systems in		

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	permitted to be attached to the exterior of a raceway-type mast intended for the attachment and support of such cables.		compliance with Parts I and V of Article 820 (5) Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830 **(D) Support of Optical Fiber Cables.** Raceways shall be used for their intended purpose. Optical fiber cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support. *Exception: Overhead (aerial) spans of optical fiber cables shall be permitted to be attached to the exterior of a raceway-type mast intended for the attachment and support of such cables.*		
Chapter 8	**Communications Systems**				
Article 800	**General Requirements for Communications Systems**				
800.44(C)	**800.44 Overhead (Aerial) Communications Wires and Cables.** Overhead (aerial) communications wires and cables entering buildings shall comply with 800.44(A) and (B).	FR-7691, Global SR-7734	**800.44 Overhead (Aerial) Wires and Cables.** Overhead (aerial) wires and cables entering buildings shall comply with 800.44(A) through (D). **(C) On Masts.** Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.	New section covering permitted attachment of overhead communication conductors to masts. Impact: No negative impact.	2

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800.44(D)	**800.44 Overhead (Aerial) Communications Wires and Cables.** Overhead (aerial) communications wires and cables entering buildings shall comply with 800.44(A) and (B).	FR-7961, Global SR-7734	**(D) Between Buildings.** Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected. *Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*	New section addressing requirements for communications cables run between buildings. Impact: No negative impact.	2
800.53	**800.53 Lightning Conductors.** Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between communications wires and cables on buildings and lightning conductors. Informational Note: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2014, *Standard for the Installation of Lightning Protection Systems*, 4.16.2.	Global SR-7667	**800.53 Separation from Lightning Conductors.** Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables on buildings. Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*. Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*	New section contains requirements for separation from lightning conductors. Impact: No negative impact.	2

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Article 840	**Premises-Powered Broadband Communications Systems**				
840.94	N/A	FR-7889	**840.94 Premises Circuits Leaving the Building.** Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, 805.90 and 805.93 shall apply.	New section includes lightning protection requirements for circuits that leave a building. Impact: No negative impact.	2
840.102	N/A	FR7891, SR7750	**840.102 Premises Circuits Leaving the Building.** Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, the installation of communications wires and cables shall comply with 800.100 and 800.106, and the installation of coaxial cables shall comply with 820.100 and 800.106.	New section includes lightning protection requirements for circuits that leave a building. Impact: No negative impact.	2