Public Comment No. 1392-NFPA 70-2021 [Global Input]

Modifications to Article 245. See attached Word document

Additional Proposed Changes

File Name	Description	Approved
245_Public_Comment.docx	Public Comment to Amend Article 245	

Statement of Problem and Substantiation for Public Comment

This Public Comment is submitted on behalf of a Correlating Committee Long-Range Planning Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, David Temple, Donny Cook, Dean Hunter, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Tim Croushore, and Kevin Rogers.

This Public Comment was developed to address the change made by First Correlating Revision No. 387. In that revision, the Correlating Committee removed “overvoltage protection (surge arresters)” from the scope of Article 245, noting that these requirements remain in Article 242. This Public Comment removes “Part III. Overvoltage Protection” from Article 245. With this removal, Article 245 only covers “Overcurrent Protection”, and the subdivision into “Part I. General and Scope” and “Part II Overcurrent Protection” is no longer necessary. This Public Comment amends the Article to remove this unnecessary structure.

Related Item

• FCR 387

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 12 14:21:55 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7853-NFPA 70-2021
Statement: This Second Revision addresses the removal of “Part III. Overvoltage Protection” due to the change made by First Correlating Revision No. 387, which removed “overvoltage protection (surge arresters)” from the scope of Article 245. With this change in scope, and the removal of Part III, subdivision of the Article is no longer needed, so the Article

is restructured to remove them.

GLOBAL PC to Delete Part IX of Article 240

Rationale:

This Public Comment is submitted on behalf of a Correlating Committee Long-Range Planning Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, David Temple, Donny Cook, Dean Hunter, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Tim Croushore, and Kevin Rogers.

This Public Comment was developed to address the change made by First Correlating Revision No. 387. In that revision, the Correlating Committee removed "overvoltage protection (surge arresters)" from the scope of Article 245, noting that these requirements remain in Article 242. This Public Comment removes "Part III. Overvoltage Protection" from Article 245. With this removal, Article 245 only covers "Overcurrent Protection", and the subdivision into "Part I. General and Scope" and "Part II Overcurrent Protection" is no longer necessary. This Public Comment amends the Article to remove this unnecessary structure.

Proposal:

Article 245 Overcurrent Protection for Systems Rated Over 1000 Volts AC, 1500 Volts DC
~~**Part I. General and Scope**~~
245.1 Scope.

This article covers requirements for the installation of overcurrent protection of circuits and related electrical equipment permanently installed on premises wiring systems over 1000 volts ac, 1500 volts dc, nominal.

245.15 Reconditioned Equipment.

Reconditioned equipment shall be listed as *reconditioned* and the original listing mark removed.

(A) Medium- and high-voltage circuit breakers shall be permitted to be reconditioned.

(B) Electromechanical protective relays and current transformers shall be permitted to be reconditioned.

(C) Medium-voltage fuseholders and medium-voltage nonrenewable fuses shall not be permitted to be reconditioned.

~~**Part II. Overcurrent Protection**~~
245.21 Circuit-Interrupting Devices.
(A) Circuit Breakers.
(1) Location.

(a) Circuit breakers installed indoors shall be mounted either in metal-enclosed units or fire-resistant cell-mounted units, or they shall be permitted to be open-mounted in locations accessible to qualified persons only.

(b) Circuit breakers used to control oil-filled transformers in a vault shall either be located outside the transformer vault or be capable of operation from outside the vault.

(c) Oil circuit breakers shall be arranged or located so that adjacent readily combustible structures or materials are safeguarded in an approved manner.

(2) Operating Characteristics.

Circuit breakers shall have the following equipment or operating characteristics:

(1) An accessible mechanical or other identified means for manual tripping, independent of control power

(2) Be release free (trip free)

(3) If capable of being opened or closed manually while energized, main contacts that operate independently of the speed of the manual operation

(4) A mechanical position indicator at the circuit breaker to show the open or closed position of the main contacts

(5) A means of indicating the open and closed position of the breaker at the point(s) from which they may be operated

(3) Nameplate.

A circuit breaker shall have a permanent and legible nameplate showing the manufacturer's name or trademark, manufacturer's type or identification number, continuous current rating, interrupting rating in megavolt-amperes (MVA) or amperes, and maximum voltage rating. Modification of a circuit breaker affecting its rating(s) shall be accompanied by an appropriate change of nameplate information.

(4) Rating.

Circuit breakers shall have the following ratings:

(1) The continuous current rating of a circuit breaker shall not be less than the maximum continuous current through the circuit breaker.

(2) The interrupting rating of a circuit breaker shall not be less than the available fault current the circuit breaker will be required to interrupt, including contributions from all connected sources of energy.

(3) The closing rating of a circuit breaker shall not be less than the maximum asymmetrical fault current into which the circuit breaker can be closed.

(4) The momentary rating of a circuit breaker shall not be less than the maximum asymmetrical fault current at the point of installation.

(5) The rated maximum voltage of a circuit breaker shall not be less than the maximum circuit voltage.

(5) Retrofit Trip Units.

Retrofit trip units shall be listed for use with the specific circuit breaker with which it is installed.

(B) Power Fuses and Fuseholders.
(1) Use.

Where fuses are used to protect conductors and equipment, a fuse shall be placed in each ungrounded conductor. Two power fuses shall be permitted to be used in parallel to protect the same load if both fuses have identical ratings and both fuses are installed in an identified common mounting with electrical connections that divide the current equally. Power fuses of the vented type shall not be used indoors, underground, or in metal enclosures unless identified for the use.

(2) Interrupting Rating.

The interrupting rating of power fuses shall not be less than the available fault current the fuse is required to interrupt, including contributions from all connected sources of energy.

(3) Voltage Rating.

The maximum voltage rating of power fuses shall not be less than the maximum circuit voltage. Fuses having a minimum recommended operating voltage shall not be applied below this voltage.

(4) Identification of Fuse Mountings and Fuse Units.

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

(5) Fuses.

Fuses that expel flame in opening the circuit shall be designed or arranged so that they function properly without hazard to persons or property.

(6) Fuseholders,

Fuseholders shall be designed or installed so that they are de-energized while a fuse is being replaced. A field-applied permanent and legible sign, in accordance with 110.21(B), shall be installed immediately adjacent to the fuseholders and shall be worded as follows:

DANGER — DISCONNECT CIRCUIT BEFORE REPLACING FUSES.

Exception: Fuses and fuseholders designed to permit fuse replacement by qualified persons using identified equipment without de-energizing the fuseholder shall be permitted.

(7) High-Voltage Fuses.

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

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

(C) Distribution Cutouts and Fuse Links — Expulsion Type.

(1) Installation.

Cutouts shall be located so that they may be readily and safely operated and re-fused, and so that the exhaust of the fuses does not endanger persons. Distribution cutouts shall not be used indoors, underground, or in metal enclosures.

(2) Operation.

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

(3) Interrupting Rating.

The interrupting rating of distribution cutouts shall not be less than the available fault current the cutout is required to interrupt, including contributions from all connected sources of energy.

(4) Voltage Rating.

The maximum voltage rating of cutouts shall not be less than the maximum circuit voltage.

(5) Identification.

Distribution cutouts shall have on their body, door, or fuse tube a permanent and legible nameplate or identification showing the manufacturer's type or designation, continuous current rating, maximum voltage rating, and interrupting rating.

(6) Fuse Links.

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

(7) Structure Mounted Outdoors.

The height of cutouts mounted outdoors on structures shall provide safe clearance between lowest energized parts (open or closed position) and standing surfaces, in accordance with 110.34(E).

(D) Oil-Filled Cutouts.

(1) Continuous Current Rating.

The continuous current rating of oil-filled cutouts shall not be less than the maximum continuous current through the cutout.

(2) Interrupting Rating.

The interrupting rating of oil-filled cutouts shall not be less than the available fault current the oil-filled cutout is required to interrupt, including contributions from all connected sources of energy.

(3) Voltage Rating.

The maximum voltage rating of oil-filled cutouts shall not be less than the maximum circuit voltage.

(4) Fault Closing Rating.

Oil-filled cutouts shall have a fault closing rating not less than the maximum asymmetrical fault current that can occur at the cutout location, unless suitable interlocks or operating procedures preclude the possibility of closing into a fault.

(5) Identification.

Oil-filled cutouts shall have a permanent and legible nameplate showing the rated continuous current, rated maximum voltage, and rated interrupting current.

(6) Fuse Links.

Fuse links shall have a permanent and legible identification showing the rated continuous current.

(7) Location.

Cutouts shall be located so that they are readily and safely accessible for re-fusing, with the top of the cutout not over 1.5 m (5 ft) above the floor or platform.

(8) Enclosure.

Suitable barriers or enclosures shall be provided to prevent contact with nonshielded cables or energized parts of oil-filled cutouts.

(E) Load Interrupters.

Load-interrupter switches shall be permitted if suitable fuses or circuit breakers are used in conjunction with these devices to interrupt available fault currents. Where these devices are used in combination, they shall be coordinated electrically so that they will safely withstand the effects of closing, carrying, or interrupting all possible currents up to the assigned maximum short-circuit rating.

Where more than one switch is installed with interconnected load terminals to provide for alternate connection to different supply conductors, each switch shall be provided with a warning sign identifying the presence of more than one source. Each warning sign or label shall comply with 110.21.

(1) Continuous Current Rating.

The continuous current rating of interrupter switches shall equal or exceed the maximum continuous current at the point of installation.

(2) Voltage Rating.

The maximum voltage rating of interrupter switches shall equal or exceed the maximum circuit voltage.

(3) Identification.

Interrupter switches shall have a permanent and legible nameplate, including the following information: manufacturer's type or designation, continuous current rating, interrupting current rating, fault closing rating, maximum voltage rating.

(4) Switching of Conductors.

The switching mechanism shall be arranged to be operated from a location where the operator is not exposed to energized parts and shall be arranged to open all ungrounded conductors of the circuit simultaneously with one operation. Switches shall be arranged to be locked in the open position. Metal-enclosed switches shall be operable from outside the enclosure.

(5) Stored Energy for Opening.

The stored-energy operator shall be permitted to be left in the uncharged position after the switch has been closed if a single movement of the operating handle charges the operator and opens the switch.

(6) Supply Terminals.

The supply terminals of fused interrupter switches shall be installed at the top of the switch enclosure, or, if the terminals are located elsewhere, the equipment shall have barriers installed to prevent persons from accidentally contacting energized parts or dropping tools or fuses into energized parts.

245.26 Feeders and Branch Circuits.
(A) Location and Type of Protection.

Feeder and branch-circuit conductors shall have overcurrent protection in each ungrounded conductor located at the point where the conductor receives its supply or at an alternative location in the circuit when designed under engineering supervision that includes but is not limited to considering the appropriate fault studies and time–current coordination analysis of the protective devices and the

conductor damage curves. The overcurrent protection shall be permitted to be provided by either 245.26(A)(1) or (A)(2).

(1) Overcurrent Relays and Current Transformers.

Circuit breakers used for overcurrent protection of 3-phase circuits shall have a minimum of three overcurrent relay elements operated from three current transformers. The separate overcurrent relay elements (or protective functions) shall be permitted to be part of a single electronic protective relay unit.

On 3-phase, 3-wire circuits, an overcurrent relay element in the residual circuit of the current transformers shall be permitted to replace one of the phase relay elements.

An overcurrent relay element, operated from a current transformer that links all phases of a 3-phase, 3-wire circuit, shall be permitted to replace the residual relay element and one of the phase-conductor current transformers. Where the neutral conductor is not regrounded on the load side of the circuit as permitted in 250.184(B), the current transformer shall be permitted to link all 3-phase conductors and the grounded circuit conductor (neutral).

(2) Fuses.

A fuse shall be connected in series with each ungrounded conductor.

(B) Protective Devices.

The protective device(s) shall be capable of detecting and interrupting all values of current that can occur at their location in excess of their trip-setting or melting point.

(C) Conductor Protection.

The operating time of the protective device, the available short-circuit current, and the conductor used shall be coordinated to prevent damaging or dangerous temperatures in conductors or conductor insulation under short-circuit conditions.

245.27 Additional Requirements for Feeders.
(A) Rating or Setting of Overcurrent Protective Devices.

The continuous ampere rating of a fuse shall not exceed three times the ampacity of the conductors. The long-time trip element setting of a breaker or the minimum trip setting of an electronically actuated fuse shall not exceed six times the ampacity of the conductor. For fire pumps, conductors shall be permitted to be protected for overcurrent in accordance with 695.4(B)(2).

(B) Feeder Taps.

Conductors tapped to a feeder shall be permitted to be protected by the feeder overcurrent device where that overcurrent device also protects the tap conductor.

~~**Part III. Overvoltage Protection**~~
~~**245.40 Other Articles.**~~

~~Equipment shall be protected against overvoltage in accordance with the article in this Code that covers the type of equipment or location specified in Table 245.40.~~

~~**Table 245.40 Other Articles**~~

~~Equipment~~	~~Article~~
~~Equipment over 1000 volts, nominal~~	~~495~~
~~Outdoor overhead conductors over 1000 volts~~	~~399~~

~~**245.41 Uses Not Permitted.**~~

~~A surge arrester shall not be installed where the rating of the surge arrester is less than the maximum continuous phase-to-ground voltage at the power frequency available at the point of application.~~

~~**245.42 Surge Arrester Selection.**~~

~~The surge arresters shall comply with 245.42(A) and (B).~~

~~**(A) Rating.**~~

~~The rating of a surge arrester shall be equal to or greater than the maximum continuous operating voltage available at the point of application.~~

~~**(1) Solidly Grounded Systems.**~~

The maximum continuous operating voltage shall be the phase-to-ground voltage of the system.

(2) Impedance or Ungrounded System.

The maximum continuous operating voltage shall be the phase-to-phase voltage of the system.

(B) Silicon Carbide Types.

The rating of a silicon carbide type surge arrester shall be not less than 125 percent of the rating specified in 245.42(A).

Informational Note No. 1: For further information on surge arresters, see IEEE C62.11-2012, *Standard for Metal-Oxide Surge Arresters for Alternating-Current Power Circuits (>1 kV)*, and IEEE C62.22-2009, *Guide for the Application of Metal-Oxide Surge Arresters for Alternating-Current Systems*.
Informational Note No. 2: The selection of a properly rated metal oxide arrester is based on considerations of maximum continuous operating voltage and the magnitude and duration of overvoltages at the arrester location as affected by phase-to-ground faults, system grounding techniques, switching surges, and other causes. See the manufacturer's application rules for selection of the specific arrester to be used at a particular location.

245.44 Number Required.

Where used at a point on a circuit, a surge arrester shall be connected to each ungrounded conductor. A single installation of such surge arresters shall be permitted to protect a number of interconnected circuits if no circuit is exposed to surges while disconnected from the surge arresters.

245.46 Location.

Surge arresters shall be permitted to be located indoors or outdoors. Surge arresters shall be made inaccessible to unqualified persons unless listed for installation in accessible locations.

245.48 Routing of Surge Arrester Equipment 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 245.50 shall not be any longer than necessary and shall avoid unnecessary bends.

245.50 Connection.

The arrester shall be connected to one of the following:

(1) Grounded service conductor

(2) Grounding electrode conductor

(3) Grounding electrode for the service

(4) Equipment grounding terminal in the service equipment

245.52 Surge Arrester Conductors.

The conductor between the surge arrester and the line, and the surge arrester and the grounding connection, shall not be smaller than 6 AWG copper or aluminum.

245.54 Interconnections.

The surge arrester protecting a transformer that supplies a secondary distribution system shall be interconnected as specified in 245.54(A), (B), or (C).

(A) Metal Interconnections.

A metal interconnection shall be made to the secondary grounded circuit conductor or the secondary circuit grounding electrode conductor, if, in addition to the direct grounding connection at the surge arrester, the connection complies with 245.54(A)(1) or (A)(2).

(1) Additional Grounding Connection.

The grounded conductor of the secondary has a grounding connection elsewhere to a continuous metal underground water piping system. In urban water-pipe areas where there are at least four water-pipe connections on the neutral conductor and not fewer than four such connections in each mile of neutral conductor, the metal interconnection shall be permitted to be made to the secondary neutral conductor with omission of the direct grounding connection at the surge arrester.

(2) Multigrounded Neutral System Connection.

~~The grounded conductor of the secondary system is part of a multigrounded neutral system or static wire of which the primary neutral conductor or static wire has at least four grounding connections in each 1.6 km (1 mile) of line in addition to a grounding connection at each service.~~

~~**(B) Through Spark Gap or Device.**~~

~~Where the surge-arrester grounding electrode conductor is not connected as in 245.54(A), or where the secondary is not grounded as in 245.54(A) but is otherwise grounded as in 250.52, an interconnection shall be made through a spark gap or listed device as required by 245.54(B)(1) or (B)(2).~~

~~**(1) Ungrounded or Unigrounded Primary System.**~~

~~For ungrounded or unigrounded primary systems, the spark gap for a listed device shall have a 60-Hz breakdown voltage of at least twice the primary circuit voltage but not necessarily more than 10 kV, and there shall be at least one other ground on the grounded conductor of the secondary that is not less than 6.0 m (20 ft) distant from the surge-arrester grounding electrode.~~

~~**(2) Multigrounded Neutral Primary System.**~~

~~For multigrounded neutral primary systems, the spark gap or listed device shall have a 60-Hz breakdown of not more than 3 kV, and there shall be at least one other ground on the grounded conductor of the secondary that is not less than 6.0 m (20 ft) distant from the surge-arrester grounding electrode.~~

~~**(C) By Special Permission.**~~

~~An interconnection of the surge-arrester ground and the secondary neutral conductor, other than as provided in 245.54(A) or (B), shall be permitted to be made only by special permission.~~

~~**245.56 Grounding Electrode Conductor Connections and Enclosures.**~~

~~Except as indicated in this article, surge-arrester grounding electrode conductor connections shall be made as specified in Article 250, Parts III and X. Grounding electrode conductors installed in metal enclosures shall comply with 250.64(E).~~

Public Comment No. 1398-NFPA 70-2021 [Global Input]

Delete all of Article 490.

Statement of Problem and Substantiation for Public Comment

This Public Comment is submitted on behalf of a Correlating Committee Long-Range Planning Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, David Temple, Donny Cook, Dean Hunter, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Tim Croushore, and Kevin Rogers. This Public Comment was developed to delete Article 490.

CMP 9 created a new Article 495 which duplicates (and expands) requirements from Article 490. In a separate Public Comment (PC 1424) the content of Article 495 is updated to reflect changes made to Article 490 that were unrelated to the restructuring of these Articles.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 1424-NFPA 70-2021 [Global Input]	

Related Item

• Global FR 7941

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 12 14:34:21 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7686-NFPA 70-2021
Statement: CMP 9 created a new Article 495 which covers the scope of Article 490. Changes made to Article 490 have been incorporated into the new Article 495, and the entire content of Article 490 can now be deleted.

Public Comment No. 1424-NFPA 70-2021 [Global Input]

Modifications to Article 495. See attached Word document.

Additional Proposed Changes

File Name	Description	Approved
Attachment_for_PC_1424_Article_495_.docx	Public Comment for Article 495	

Statement of Problem and Substantiation for Public Comment

This Public Comment is submitted on behalf of a Correlating Committee Long-Range Planning Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, David Temple, Donny Cook, Dean Hunter, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Tim Croushore, and Kevin Rogers.

This Public Comment was developed to address comments in Correlating Committee Note No. 384. In that Note, the Correlating Committee directed that that requirements in Articles 430, 460, and 470 for Motors, Capacitors, Resistors and Reactors, be removed from Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal, and remain in their respective articles. This Public Comment addresses the removal of requirements in Articles 430 and 470, but maintains requirements from Article 460 (Capacitors). Restructuring of Article 460 to remove requirements for Capacitors in circuits operating above 1000 volts is addressed in Public Comment (PC 1397), as the position of this Task Group is to relocate this material.

Also, the Correlating Committee directed CMP 9 to revise requirements in Article 495 to include revisions that were made to Article 490 that were unrelated to the restructuring. This Public Comment incorporates those changes from 490 into Article 495. In a separate Public Comment (PC 1398) the content of Article 490 is deleted.

Lastly, recognizing that not all equipment requirements for equipment over 1000 volts were relocated to Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal, this Public Comment deletes requirements for transformers in favor of maintaining those requirements in Article 450 Transformers and Transformer Vaults (Including Secondary Ties). While relocating transformer requirements may be warranted in the future, the fact that many transformers may have one winding rated under 1000 volts, with another winding over 1000 volts, makes transformers unique with respect to a clear delineation of the topic.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 1398-NFPA 70-2021 [Global Input]	

Related Item

• PC 1397 • PC 1398 • Global FR 7941

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL LLC

Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 13 08:53:55 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7755-NFPA 70-2021

Statement: This revision addresses comments in Correlating Committee Note No. 384. In that Note, the Correlating

Committee directed that that requirements in Articles 430, 460, and 470 for Motors, Capacitors, Resistors and Reactors, be removed from Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal, and remain in their respective articles. While this revision removes requirements found in Articles 430, 460, and 470.

Also, the Correlating Committee directed CMP 9 to revise requirements in Article 495 to include revisions that were made to Article 490 that were unrelated to the restructuring. These revisions incorporate those changes from 490 into Article 495, which includes the relocation of the definition to Article 100.

Lastly, recognizing that not all equipment requirements for equipment over 1000 volts were relocated to Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal, this revision deletes requirements for transformers in favor of maintaining those requirements in Article 450 Transformers and Transformer Vaults (Including Secondary Ties). While relocating transformer requirements may be warranted in the future, the fact that many transformers may have one winding rated under 1000 volts, with another winding over 1000 volts, makes transformers unique with respect to a clear delineation of the topic.

GLOBAL PC to Delete Parts VI (Article 430), VII (Article 450), and Part X (Article 470) from Article 495

Rationale:

This Public Comment is submitted on behalf of a Correlating Committee Long-Range Planning Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, David Temple, Donny Cook, Dean Hunter, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, Tim Croushore, and Kevin Rogers.

This Public Comment was developed to address comments in Correlating Committee Note No. 384. In that Note, the Correlating Committee directed that that requirements in Articles 430, 460, and 470 for Motors, Capacitors, Resistors and Reactors, be removed from Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal, and remain in their respective articles. This Public Comment addresses the removal of requirements in Articles 430 and 470, but maintains requirements from Article 460 (Capacitors). Restructuring of Article 460 to remove requirements for Capacitors in circuits operating above 1000 volts is addressed in Public Comment (PC 1397), as the position of this Task Group is to relocate this material.

Also, the Correlating Committee directed CMP 9 to revise requirements in Article 495 to include revisions that were made to Article 490 that were unrelated to the restructuring. This Public Comment incorporates those changes from 490 into Article 495. In a separate Public Comment (PC 1398) the content of Article 490 is deleted.

Lastly, recognizing that not all equipment requirements for equipment over 1000 volts were relocated to Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal, this Public Comment deletes requirements for transformers in favor of maintaining those requirements in Article 450 Transformers and Transformer Vaults (Including Secondary Ties). While relocating transformer requirements may be warranted in the future, the fact that many transformers may have one winding rated under 1000 volts, with another winding over 1000 volts, makes transformers unique with respect to a clear delineation of the topic.

PROPOSAL:

Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal
Part I. General
495.1 Scope.

This article covers the general requirements for equipment operating at more than 1000 volts ac, 1500 volts dc, nominal.

Informational Note No. 1: See NFPA *70E*-2021*, Standard for Electrical Safety in the Workplace*, for electrical safety requirements for employee workplaces.
Informational Note No. 2: See ANSI Z535.4-2011, *Product Signs and Safety Labels,* for further information on hazard signs and labels.E
Informational Note No. 3: See IEEE 3001.5-2013, *Recommended Practice for the Application of Power Distribution Apparatus in Industrial and Commercial Power Systems*, for information regarding power distribution apparatus.

~~**495.2 Definition.**~~

~~The definition in this section shall apply only within this article.~~

~~**High Voltage.**~~

~~A potential difference of more than 1000 volts, nominal.~~

495.3 Other Articles.

(A) Oil-Filled Equipment.

Installation of electrical equipment containing more than 38 L (10 gal) of flammable oil per unit shall meet the requirements of Parts II and III of Article 100

(B) Enclosures in Damp or Wet Locations.

Enclosures in damp or wet locations shall meet the requirements of 312.2.

495.4 Flexible Cords and Flexible Cable Types.

Flexible cords and flexible cables over 1000 volts shall conform to the description in Table 495.4. The use of flexible cords and flexible cables other than those in Table 495.4 shall require permission by the authority having jurisdiction.

Table 495.4 Flexible Cords and Flexible Cables

Trade Name	Type Letter	Voltage	AWG or kcmil	Number of Conductors	Insulation	AWG or kcmil	Nominal Insulation Thickness mm	Nominal Insulation Thickness mils	Braid on Each Conductor	Outer Covering	Use
Portable power cable	G	2000	12–500	2–6 plus equipment grounding conductor(s)	Thermoset	12–2 1–4/0 250–500	1.52 2.03 2.41	60 80 95	—	Oil-resistant thermoset	Portable and extra-hard usage
	G-GC*	2000	12–500	3–6 plus equipment grounding conductors and 1 ground check conductor	Thermoset	12–2 1–4/0 250–500	1.52 2.03 2.41	60 80 95	—	Oil-resistant thermoset	Portable and extra-hard usage
Portable power cable	PPE*	2000	12–500	1–6 plus optional equipment grounding conductor(s)	Thermoplastic elastomer	12–2 1–4/0 250–500	1.52 2.03 2.41	60 80 95	—	Oil-resistant thermo-plastic elastomer	Portable and extra-hard usage
Portable power cable	W*	2000	12–500 501–1000	1–6 1	Thermoset	12–2 1–4/0 250–500 501–1000	1.52 2.03 2.41 2.80	60 80 95 110	—	Oil-resistant thermoset	Portable and extra-hard usage

*Types G, G-GC, S, SC, SCE, SCT, SE, SEO, SEOO, SEW, SEOW, SEOOW, SO, SOO, SOW, SOOW, ST, STO, STOO, STW, STOW, STOOW, PPE, and W shall be permitted for use on theater stages, in garages, and elsewhere where flexible cords are permitted by this *Code*.

Part II. Equipment — Specific Provisions

495.22 Isolating Means.

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

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

An identified fuseholder and fuse shall be permitted as an isolating switch.

495.23 Voltage Regulators.

Proper switching sequence for regulators shall be ensured by use of one of the following:

(1) Mechanically sequenced regulator bypass switch(es)

(2) Mechanical interlocks

(3) Switching procedure prominently displayed at the switching location

495.24 Minimum Space Separation.

In field-fabricated installations, the minimum air separation between bare live conductors and between such conductors and adjacent grounded surfaces shall not be less than the values given in Table 495.24. These values shall not apply to interior portions or exterior terminals of equipment designed, manufactured, and tested in accordance with accepted national standards.

Table 495.24 Minimum Clearance of Live Parts

Nominal Voltage Rating (kV)	Impulse Withstand, Basic Impulse Level (BIL) (kV)		Minimum Clearance of Live Parts							
			Phase-to-Phase				Phase-to-Ground			
			Indoors		Outdoors		Indoors		Outdoors	
	Indoors	Outdoors	mm	in.	mm	in.	mm	in.	mm	in.
2.4–4.16	60	95	115	4.5	180	7	80	3.0	155	6
7.2	75	95	140	5.5	180	7	105	4.0	155	6
13.8	95	110	195	7.5	305	12	130	5.0	180	7
14.4	110	110	230	9.0	305	12	170	6.5	180	7
23	125	150	270	10.5	385	15	190	7.5	255	10
34.5	150	150	320	12.5	385	15	245	9.5	255	10
	200	200	460	18.0	460	18	335	13.0	335	13
46	—	200	—	—	460	18	—	—	335	13
	—	250	—	—	535	21	—	—	435	17
69	—	250	—	—	535	21	—	—	435	17
	—	350	—	—	790	31	—	—	635	25

Nominal Voltage Rating (kV)	Impulse Withstand, Basic Impulse Level (BIL) (kV)		Minimum Clearance of Live Parts							
			Phase-to-Phase				Phase-to-Ground			
			Indoors		Outdoors		Indoors		Outdoors	
	Indoors	Outdoors	mm	in.	mm	in.	mm	in.	mm	in.
115	—	550	—	—	1350	53	—	—	1070	42
138	—	550	—	—	1350	53	—	—	1070	42
	—	650	—	—	1605	63	—	—	1270	50
161	—	650	—	—	1605	63	—	—	1270	50
	—	750	—	—	1830	72	—	—	1475	58
230	—	750	—	—	1830	72	—	—	1475	58
	—	900	—	—	2265	89	—	—	1805	71
	—	1050	—	—	2670	105	—	—	2110	83

Note: The values given are the minimum clearance for rigid parts and bare conductors under favorable service conditions. They shall be increased for conductor movement or under unfavorable service conditions or wherever space limitations permit. The selection of the associated impulse withstand voltage for a particular system voltage is determined by the characteristics of the overvoltage (surge) protective equipment.

495.25 Backfeed.

Installations where the possibility of backfeed exists shall comply with 495.25(A) and (B).

(A) Sign.

A permanent sign in accordance with 110.21(B) shall be installed on the disconnecting means enclosure or immediately adjacent to open disconnecting means with the following words or equivalent:

DANGER — CONTACTS ON EITHER SIDE OF THIS DEVICE MAY BE ENERGIZED BY BACKFEED.

(B) Diagram.

A permanent and legible single-line diagram of the local switching arrangement, clearly identifying each point of connection to the high-voltage section, shall be provided within sight of each point of connection.

~~**495.26 Oil-Filled Equipment.**~~

~~Installation of electrical equipment, other than transformers covered in Part VII containing more than 38 L (10 gal) of flammable oil per unit, shall meet the requirements of Part VII.~~

~~Informational Note: The same requirements for oil used in oil-filled transformers are also applicable to other oil-filled equipment.~~

Part III. Equipment — Switchgear and Industrial Control Assemblies

495.30 General.

Part III covers assemblies of switchgear and industrial control equipment, including, but not limited to, switches and interrupting devices and their control, metering, protection, and regulating equipment where they are an integral part of the assembly, with associated interconnections and supporting structures.

495.31 Arrangement of Devices in Assemblies.

Arrangement of devices in assemblies shall be such that individual components can safely perform their intended function without adversely affecting the safe operation of other components in the assembly.

495.32 Guarding of High-Voltage Energized Parts Within a Compartment.

Where access for other than visual inspection is required to a compartment that contains energized high-voltage parts, barriers shall be provided to prevent accidental contact by persons, tools, or other equipment with energized parts. Exposed live parts shall only be permitted in compartments accessible to qualified persons. Fuses and fuseholders designed to enable future replacement without de-energizing the fuseholder shall only be permitted for use by qualified persons.

495.33 Guarding of Energized Parts Operating at 1000 Volts, Nominal, or Less Within Compartments.

Energized bare parts mounted on doors shall be guarded where the door must be opened for maintenance of equipment or removal of draw-out equipment.

495.34 Clearance for Cable Conductors Entering Enclosure.

The unobstructed space opposite terminals or opposite raceways or cables entering a switchgear or control assembly shall be approved for the type of conductor and method of termination.

495.35 Accessibility of Energized Parts.
(A) High-Voltage Equipment.

Doors that would provide unqualified persons access to high-voltage energized parts shall be locked. Permanent signs in accordance with 110.21(B) shall be installed on panels or doors that provide access to live parts over 1000 volts and shall read DANGER — HIGH VOLTAGE — KEEP OUT.

(B) Control Equipment.

Where operating at 1000 volts, nominal, or less, control equipment, relays, motors, and the like shall not be installed in compartments with high-voltage parts or high-voltage wiring, unless both of the following apply:

(1) The access means is interlocked with the high-voltage switch or disconnecting means to prevent the access means from being opened or removed when the high-voltage switch is in the closed position or a withdrawable disconnecting means is in the connected position.

(2) All high-voltage parts or high-voltage wiring in the compartment that remains energized when a fixed mounted high-voltage switch is in the open position or a withdrawable disconnecting means is in the isolating (fully withdrawn) position are protected by insulating or grounded metal barriers to prevent accidental contact with energized high-voltage parts or wiring.

(C) High-Voltage Instruments or Control Transformers and Space Heaters.

High-voltage instrument or control transformers and space heaters shall be permitted to be installed in the high-voltage compartment without access restrictions beyond those that apply to the high-voltage compartment generally.

~~**495.36 Grounding.**~~

~~Frames of switchgear and control assemblies shall be connected to an equipment grounding conductor or, where permitted, the grounded conductor.~~

495.37 Equipment Grounding Connections~~of Devices~~.

The metal cases or frames, or both, such as those of instruments, relays, meters, and instrument and control transformers, located in or on switchgear or control assemblies, and the frames of switchgear and control assemblies shall be connected to an equipment grounding conductor or, where permitted, the grounded conductor, in accordance with 250.190.

496.38 Door Stops and Cover Plates.

External hinged doors or covers shall be provided with stops to hold them in the open position. Cover plates intended to be removed for inspection of energized parts or wiring shall be equipped with lifting handles and shall not exceed 1.1 m^2 (12 ft^2) in area or 27 kg (60 lb) in weight, unless they are hinged and bolted or locked.

495.39 Gas Discharge from Interrupting Devices.

Gas discharged during operating of interrupting devices shall be directed so as not to endanger personnel.

495.40 Visual Inspection Windows.

Windows intended for visual inspection of disconnecting switches or other devices shall be of suitable transparent material.

495.41 Location of Industrial Control Equipment.

Routinely operated industrial control equipment shall meet the requirements of 495.41(A) unless infrequently operated, as covered in 495.41(B).

(A) Control and Instrument Transfer Switch Handles or Push Buttons.

Control and instrument transfer switch handles or push buttons shall be in a readily accessible location at an elevation of not over 2.0 m (6 ft 7 in.).

Exception: Operating handles requiring more than 23 kg (50 lb) of force shall be located no higher than 1.7 m (66 in.) in either the open or closed position.

(B) Infrequently Operated Devices.

Where operating handles for such devices as draw-out fuses, fused potential or control transformers and their primary disconnects, and bus transfer and isolating switches are only operated infrequently, the handles shall be permitted to be located where they are safely operable and serviceable from a portable platform.

495.42 Interlocks — Interrupter Switches.

Interrupter switches equipped with stored energy mechanisms shall have mechanical interlocks to prevent access to the switch compartment unless the stored energy mechanism is in the discharged or blocked position.

495.43 Stored Energy for Opening.

The stored energy operator shall be permitted to be left in the uncharged position after the switch has been closed if a single movement of the operating handle charges the operator and opens the switch.

495.44 Fused Interrupter Switches.

(A) Supply Terminals.

The supply terminals of fused interrupter switches shall be installed at the top of the switch enclosure or, if the terminals are located elsewhere, the equipment shall have barriers installed to prevent persons from accidentally contacting energized parts or dropping tools or fuses into energized parts.

(B) Backfeed.

Where fuses can be energized by backfeed, a sign shall be placed on the enclosure door identifying this hazard.

(C) Switching Mechanism.

The switching mechanism shall be arranged to be operated from a location outside the enclosure where the operator is not exposed to energized parts and shall be arranged to open all ungrounded conductors of the circuit simultaneously with one operation. Switches shall be lockable open in accordance with 110.25.

495.45 Circuit Breakers — Interlocks.

(A) Circuit Breakers.

Circuit breakers equipped with stored energy mechanisms shall be designed to prevent the release of the stored energy unless the mechanism has been fully charged.

(B) Mechanical Interlocks.

Mechanical interlocks shall be provided in the housing to prevent the complete withdrawal of the circuit breaker from the housing when the stored energy mechanism is in the fully charged position, unless a suitable device is provided to block the closing function of the circuit breaker before complete withdrawal.

495.46 Circuit Breaker Locking.

Circuit breakers shall be capable of being locked in the open position or, if they are installed in a draw-out mechanism, that mechanism shall be capable of being locked in such a position that the mechanism cannot be moved into the connected position. In either case, the provision for locking shall be lockable open in accordance with 110.25.

495.47 Switchgear Used as Service Equipment.

Switchgear installed as high-voltage service equipment shall include a ground bus for the connection of service cable shields and to facilitate the attachment of safety grounds for personnel protection. This bus shall be extended into the compartment where the service conductors are terminated. Where the

compartment door or panel provides access to parts that can only be de-energized and visibly isolated by the serving utility, the warning sign required by 495.35(A) shall include a notice that access is limited to the serving utility or is permitted only following an authorization of the serving utility.

495.48 Substation Design, Documentation, and Required Diagram.
(A) Design and Documentation.

Substations shall be designed by a qualified licensed professional engineer. Where components or the entirety of the substation is listed by a qualified electrical testing laboratory, documentation of internal design features subject to the listing investigation shall not be required. The design shall address but not be limited to the following topics, and the documentation of this design shall be made available to the authority having jurisdiction:

(1) Clearances and exits

(2) Electrical enclosures

(3) Securing and support of electrical equipment

(4) Fire protection

(5) Safety ground connection provisions

(6) Guarding live parts

(7) Transformers and voltage regulation equipment

(8) Conductor insulation, electrical and mechanical protection, isolation, and terminations

(9) Application, arrangement, and disconnection of circuit breakers, switches, and fuses

(10) Provisions for oil-filled equipment

(11) Switchgear

(12) ~~Surge arresters~~Overvoltage (surge) protection equipment

(B) Diagram.

A permanent, single-line diagram of the switchgear shall be provided in a readily visible location within the same room or enclosed area with the switchgear and shall clearly identify the following:

(1) Interlocks

(2) Isolation means

(3) All possible sources of voltage to the installation under normal or emergency conditions

The marking on the switchgear shall cross-reference the diagram.

Exception: Where the equipment consists solely of a single cubicle or metal-enclosed substation containing only one high-voltage switching device, diagrams shall not be required.

495.49 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 [see 110.21(A)(2)]~~, 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.

Part IV. Mobile and Portable Equipment

495.6~~5~~1 General.
(A) Covered.

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

(1) Substations and switch houses mounted on skids

(2) Trailers or cars

(3) Mobile shovels

(4) Draglines

(5) Cranes

(6) Hoists

(7) Drills

(8) Dredges

(9) Compressors

(10) Pumps

(11) Conveyors

(12) Underground excavators

(B) Grounding and Bonding~~Other Requirements~~.

Grounding and bonding shall be in accordance with Part X of Article 250. ~~The requirements of this part shall be additional to, or amendatory of, those prescribed in Articles 100 through 725 of this *Code*. Special attention shall be paid to Article 250.~~

(C) Protection.

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

(D) Disconnecting Means.

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

495.652 Overcurrent Protection.

Motors driving single or multiple dc generators supplying a system operating on a cyclic load basis shall not require overload protection if the thermal rating of the ac drive motor cannot be exceeded under any operating condition. The branch-circuit protective device(s) shall provide short-circuit and locked-rotor protection and shall be permitted to be external to the equipment.

495.653 Enclosures.

All energized switching and control parts shall be enclosed in grounded metal cabinets or enclosures. These cabinets or enclosures shall be marked DANGER — HIGH VOLTAGE — KEEP OUT and shall be locked so that only authorized and qualified persons can enter. The danger marking(s) or label(s) shall comply with 110.21(B). Circuit breakers and protective equipment shall have the operating means projecting through the metal cabinet or enclosure so these units can be reset without opening locked doors. With doors closed, safe access for normal operation of these units shall be provided.

495.654 Collector Rings.

The collector ring assemblies on revolving-type machines (shovels, draglines, etc.) shall be guarded to prevent accidental contact with energized parts by personnel on or off the machine.

495.655 Power Cable Connections to Mobile Machines.

A metallic enclosure shall be provided on the mobile machine for enclosing the terminals of the power cable. The enclosure shall include terminal connections to the machine frame for the equipment grounding conductor. Ungrounded conductors shall be attached to insulators or be terminated in approved high-voltage cable couplers (which include equipment grounding conductor connectors) of proper voltage and ampere rating. The method of cable termination used shall prevent any strain or pull on the cable from stressing the electrical connections. The enclosure shall have provision for locking so that only authorized and qualified persons can open it and shall be marked as follows:

DANGER — HIGH VOLTAGE — KEEP OUT.

The danger marking(s) or label(s) shall comply with 110.21(B).

495.~~65~~6 High-Voltage Portable Cable for Main Power Supply.

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

Part V. ~~Electrode-Type~~ Boilers

495.70 General.

The provisions of Part V shall apply to boilers operating over 1000 volts, nominal, in which heat is generated by the passage of current between electrodes through the liquid being heated.

495.71 Electrical Supply System.

~~Electrode-type b~~Boilers shall be supplied only from a 3-phase, 4-wire solidly grounded wye system, or from isolating transformers arranged to provide such a system. Control circuit voltages shall not exceed 150 volts, shall be supplied from a grounded system, and shall have the controls in the ungrounded conductor.

495.72 Branch-Circuit Requirements.

(A) Rating.

Each boiler shall be supplied from an individual branch circuit rated not less than 100 percent of the total load.

(B) Common-Trip Fault-Interrupting Device.

The circuit shall be protected by a 3-phase, common-trip fault-interrupting device, which shall be permitted to automatically reclose the circuit upon removal of an overload condition but shall not reclose after a fault condition.

(C) Phase-Fault Protection.

Phase-fault protection shall be provided in each phase, consisting of a separate phase-overcurrent relay connected to a separate current transformer in the phase.

(D) Ground Current Detection.

Means shall be provided for detection of the sum of the neutral conductor and equipment grounding conductor currents and shall trip the circuit-interrupting device if the sum of those currents exceeds the greater of 5 amperes or 7 ½ percent of the boiler full-load current for 10 seconds or exceeds an instantaneous value of 25 percent of the boiler full-load current.

(E) Grounded Neutral Conductor.

The grounded neutral conductor shall be as follows:

(1) Connected to the pressure vessel containing the heating elements ~~electrodes~~

(2) Insulated for not less than 1000 volts

(3) Have not less than the ampacity of the largest ungrounded branch-circuit conductor

(4) Installed with the ungrounded conductors in the same raceway, cable, or cable tray, or, where installed as open conductors, in close proximity to the ungrounded conductors

(5) Not used for any other circuit

495.73 Pressure and Temperature Limit Control.

Each boiler shall be equipped with a means to limit the maximum temperature, pressure, or both, by directly or indirectly interrupting all current flow through the heating elements~~electrodes~~. Such means shall be in addition to the temperature, pressure, or both, regulating systems and pressure relief or safety valves.

495.74 Bonding.

All exposed non-current-carrying metal parts of the boiler and associated exposed metal structures or equipment shall be bonded to the pressure vessel or to the neutral conductor to which the vessel is connected in accordance with 250.102, except the ampacity of the bonding jumper shall not be less than the ampacity of the neutral conductor.

Part VI. Motors, Motor Circuits, and Controllers
495.80 General.

Part VI recognizes the additional hazard due to the use of higher voltages. It adds to or amends the other revisions of Article 430.

495.81 Marking on Controllers.

In addition to the marking required by 430.8, a controller shall be marked with the control voltage.

495.82 Raceway Connection to Motors.

Flexible metal conduit or liquidtight flexible metal conduit not exceeding 1.8 m (6 ft) in length shall be permitted to be employed for raceway connection to a motor terminal enclosure.

495.83 Size of Conductors.

Conductors supplying motors shall have an ampacity not less than the current at which the motor overload protective device(s) is selected to trip.

495.84 Motor Circuit Overcurrent Protection.
(A) General.

Each motor circuit shall include coordinated protection to automatically interrupt overload and fault currents in the motor, the motor-circuit conductors, and the motor control apparatus.

Exception: Where a motor is critical to an operation and the motor should operate to failure if necessary to prevent a greater hazard to persons, the sensing device(s) shall be permitted to be connected to a supervised annunciator or alarm instead of interrupting the motor circuit.

(B) Overload Protection.
(1) Type of Overload Device.

Each motor shall be protected against dangerous heating due to motor overloads and failure to start by a thermal protector integral with the motor or external current sensing devices, or both. Protective device settings for each motor circuit shall be determined under engineering supervision.

(2) Wound-Rotor Alternating-Current Motors.

The secondary circuits of wound-rotor ac motors, including conductors, controllers, and resistors rated for the application, shall be considered as protected against overcurrent by the motor overload protection means.

(3) Operation.

Operation of the overload interrupting device shall simultaneously disconnect all ungrounded conductors.

(4) Automatic Reset.

Overload sensing devices shall not automatically reset after trip unless resetting of the overload sensing device does not cause automatic restarting of the motor or there is no hazard to persons created by automatic restarting of the motor and its connected machinery.

(C) Fault-Current Protection.
(1) Type of Protection.

Fault current protection shall be provided in each motor circuit as specified by either 495.84(C)(1)(a) or (C)(1)(b).

(a) A circuit breaker of suitable type and rating shall be arranged so that it can be serviced without hazard. The circuit breaker shall simultaneously disconnect all ungrounded conductors. The circuit breaker shall be permitted to sense the fault current by means of integral or external sensing elements.

(b) Fuses of a suitable type and rating shall be placed in each ungrounded conductor. Fuses shall be used with suitable disconnecting means, or they shall be of a type that can also

serve as the disconnecting means. They shall be arranged so that they cannot be serviced while they are energized.

(2) Reclosing.

Fault current interrupting devices shall not automatically reclose the circuit.

Exception: Automatic reclosing of a circuit shall be permitted where the circuit is exposed to transient faults and where such automatic reclosing does not create a hazard to persons.

(3) Combination Protection.

Overload protection and fault-current protection shall be permitted to be provided by the same device.

495.85 Rating of Motor Control Apparatus.

The ultimate trip current of overcurrent (overload) relays or other motor-protective devices used shall not exceed 115 percent of the controller's continuous current rating. Where the motor branch-circuit disconnecting means is separate from the controller, the disconnecting means current rating shall not be less than the ultimate trip setting of the overcurrent relays in the circuit.

495.86 Disconnecting Means.

The controller disconnecting means shall be lockable in accordance with 110.25.

495.87 Tables for Part VI.

The full-load currents for two-phase and three-phase alternating-current motors shall be as specified in Table 495.87(a) and Table 495.87(b).

Table 495.87(a) Full-Load Current, Two-Phase Alternating-Current Motors (4-Wire)

The values of full-load current are for motors running at speeds usual for belted motors and motors with normal torque characteristics. Current in the common conductor of a 2-phase, 3-wire system will be 1.41 times the value given. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 2300 volts to 2400 volts.

Horsepower	Induction-Type Squirrel Cage and Wound Rotor (Amperes)
	2300 Volts
60	14
75	18
100	23
125	27
150	32
200	43

Table 495.87(b) Full-Load Current, Three-Phase Alternating-Current Motors

The values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 2300 volts to 2400 volts.

Horsepower	Induction-Type Squirrel Cage and Wound Rotor (Amperes)	Synchronous-Type Unity Power Factor * (Amperes)
	2300 Volts	2300 Volts
60	16	12
100	26	20
125	31	25
150	37	30

Horsepower	Induction-Type Squirrel Cage and Wound Rotor (Amperes)	Synchronous-Type Unity Power Factor * (Amperes)
200	49	40

*For 90 and 80 percent power factor, the figures shall be multiplied by 1.1 and 1.25, respectively.

Part VII. Transformers

495.100 General Provisions.

This part covers the installation of all transformers over 1000 volts on either the primary or secondary. Part VII supplements or amends the other provisions of Article 450. This part does not cover the following:

(1) Current transformers

(2) Dry-type transformers that constitute a component part of other apparatus and comply with the requirements for such apparatus

(3) Transformers that are an integral part of an X-ray, high-frequency, or electrostatic coating apparatus

(4) Transformers for sign and outline lighting

(5) Transformers for electric-discharge lighting

(6) Transformers used for research, development, or testing, where effective arrangements are provided to safeguard persons from contacting energized parts

495.102 Exposed Energized Parts.

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

495.103 Overcurrent Protection.

Overcurrent protection of transformers shall comply with Table 495.103. As used in this section, the word *transformer* shall mean a transformer or polyphase bank of two or more single-phase transformers operating as a unit.

Informational Note No. 1: See 240.4, 240.21, 240.100, and 240.101 for overcurrent protection of conductors.
Informational Note No. 2: Nonlinear loads can increase heat in a transformer without operating its overcurrent protective device.

Table 495.103 Maximum Rating or Setting of Overcurrent Protection for Transformers Over 1000 Volts (as a Percentage of Transformer Rated Current)

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

-	-	-	-	Secondary Protection[2]		
-	-	-	-	-	-	-
-	-	-	-	-	-	-

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

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

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

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

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

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

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

495.104 Dry-Type Transformers Installed Indoors.

(A) Not Over 112½ kVA.

Dry-type transformers installed indoors and rated 112½ kVA or less shall have a separation of at least 300 mm (12 in.) from combustible material unless separated from the combustible material by a fire-resistant, heat-insulated barrier.

(B) Over 112½ kVA.

Individual dry-type transformers of more than 112½ kVA rating shall be installed in a transformer room of fire-resistant construction having a minimum fire rating of 1 hour.

Exception No. 1: Transformers with Class 155 or higher insulation systems and separated from combustible material by a fire-resistant, heat-insulating barrier or by not less than 1.83 m (6 ft) horizontally and 3.7 m (12 ft) vertically shall not be required to be installed in a transformer room.
Exception No. 2: Transformers with Class 155 or higher insulation systems and completely enclosed except for ventilating openings shall not be required to be installed in a transformer room.

Informational Note: See ASTM E119-18a, *Standard Test Methods for Fire Tests of Building Construction and Materials*, for additional information on fire-resistance ratings.

(C) Over 35,000 Volts.

Dry-type transformers rated over 35,000 volts shall be installed in a vault complying with the provisions of this article.

495.105 Dry-Type Transformers Installed Outdoors.

Dry-type transformers installed outdoors shall have a weatherproof enclosure.

Transformers exceeding 112½ kVA shall not be located within 300 mm (12 in.) of combustible materials of buildings unless the transformer has Class 155 insulation systems or higher and is completely enclosed except for ventilating openings.

495.106 Less-Flammable Liquid-Insulated Transformers.

Transformers insulated with listed less-flammable liquids that have a fire point of not less than 300°C shall be permitted to be installed in accordance with 495.106(A) or 495.106(B).

(A) Indoor Installations.

Indoor installations shall be permitted in accordance with one of the following:

(1) In Type I or Type II buildings, in areas where all of the following requirements are met:

1. The transformer is rated 35,000 volts or less.

2. No combustible materials are stored.

3. A liquid confinement area is provided.

4. The installation complies with all the restrictions provided for in the listing of the liquid.

Informational Note: Such restrictions can include, but are not limited to, maximum pressure of the tank, use of a pressure relief valve, appropriate fuse types, and proper sizing of overcurrent protection.

(2) If an automatic fire extinguishing system and a liquid confinement area are present, provided the transformer is rated 35,000 volts or less

(3) If the installation complies with 495.109

(B) Outdoor Installations.

Less-flammable liquid-filled transformers shall be permitted to be installed outdoors, attached to, adjacent to, or on the roof of buildings, if installed in accordance with the following:

(1) For Type I and Type II buildings, the installation shall comply with all the restrictions provided for in the listing of the liquid.

Informational Note No. 1: See 495.110 for information about installations adjacent to combustible material, fire escapes, or door and window openings that might require additional safeguards .

Informational Note No. 2: Such restrictions can include, but are not limited to, maximum pressure of the tank, use of a pressure relief valve, appropriate fuse types, and proper sizing of overcurrent protection.

(2) In accordance with 495.110.

Informational Note No. 3: See NFPA 220-2021, *Standard on Types of Building Construction*, for definitions of Type I and Type II building constructions.

Informational Note No. 4: See Article 100 for the definition of *Listed*.

495.107 Nonflammable Fluid-Insulated Transformers.

Transformers insulated with a dielectric fluid identified as nonflammable shall be permitted to be installed indoors or outdoors. Such transformers installed indoors and rated over 35,000 volts shall be installed in a vault. Such transformers installed indoors shall be furnished with a liquid confinement area and a pressure-relief vent. The transformers shall be furnished with a means for absorbing any gases generated by arcing inside the tank, or the pressure-relief vent shall be connected to a chimney or flue that will carry such gases to an environmentally safe area.

Informational Note: Safety can be increased if fire hazard analyses are performed for such transformer installations.

For the purposes of this section, a nonflammable dielectric fluid is one that does not have a flash point or fire point and is not flammable in air.

495.108 Askarel-Insulated Transformers Installed Indoors.

Askarel-insulated transformers installed indoors and rated over 25 kVA shall be furnished with a pressure-relief vent. Where installed in a poorly ventilated place, they shall be furnished with a means for absorbing any gases generated by arcing inside the case, or the pressure-relief vent shall be connected to a chimney or flue that carries such gases outside the building. Askarel-insulated transformers rated over 35,000 volts shall be installed in a vault.

495.109 Oil-Insulated Transformers Installed Indoors.

Oil-insulated transformers installed indoors shall be installed in a vault constructed as specified in Part VII of this article.

Exception No. 1: Where the total capacity does not exceed 112½ kVA, the vault specified in Part VII of this article shall be permitted to be constructed of reinforced concrete that is not less than 100 mm (4 in.) thick.

Exception No. 2: Where the nominal voltage does not exceed 1000, a vault shall not be required if suitable arrangements are made to prevent a transformer oil fire from igniting other materials and the total capacity in one location does not exceed 10 kVA in a section of the building classified as combustible or 75 kVA where the surrounding structure is classified as fire-resistant construction.

Exception No. 3: Electric furnace transformers that have a total rating not exceeding 75 kVA shall be permitted to be installed without a vault in a building or room of fire-resistant construction if suitable arrangements are made to prevent a transformer oil fire from spreading to other combustible material.

Exception No. 4: A transformer that has a total rating not exceeding 75 kVA and a supply voltage of 1000 volts or less that is an integral part of charged-particle-accelerating equipment shall be permitted to be installed without a vault in a building or room of noncombustible or fire-resistant construction if suitable arrangements are made to prevent a transformer oil fire from spreading to other combustible material.

Exception No. 5: Transformers shall be permitted to be installed in a detached building that does not comply with Part III of this article if neither the building nor its contents present a fire hazard to any other building or property, and if the building is used only in supplying electric service and the interior is accessible only to qualified persons.

Exception No. 6: Oil-insulated transformers shall be permitted to be used without a vault in portable and mobile surface mining equipment (such as electric excavators) if each of the following conditions is met:

(1) Provision is made for draining leaking fluid to the ground.

(2) Safe egress is provided for personnel.

(3) A minimum 6-mm (¼-in.) steel barrier is provided for personnel protection.

495.110 Oil-Insulated Transformers Installed Outdoors.

Combustible material, combustible buildings, and parts of buildings, fire escapes, and door and window openings shall be safeguarded from fires originating in oil-insulated transformers installed on roofs, attached to or adjacent to a building or combustible material.

In cases where the transformer installation presents a fire hazard, one or more of the following safeguards shall be applied according to the degree of hazard involved:

(1) Space separations

(2) Fire-resistant barriers

(3) Automatic fire suppression systems

(4) Enclosures that confine the oil of a ruptured transformer tank

Oil enclosures shall be permitted to consist of fire-resistant dikes, curbed areas or basins, or trenches filled with coarse, crushed stone. Oil enclosures shall be provided with trapped drains where the exposure and the quantity of oil involved are such that removal of oil is important.

Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code*, for additional information on transformers installed on poles or structures or underground.

495.111 Modification of Transformers.

When modifications are made to a transformer in an existing installation that change the type of the transformer with respect to Part VII of this article, such transformer shall be marked to show the type of insulating liquid installed, and the modified transformer installation shall comply with the applicable requirements for that type of transformer.

495.112 Transformer Vaults

Vaults shall be located where they can be ventilated to the outside air without using flues or ducts wherever such an arrangement is practicable.

495.113 Accessibility.

All transformer vaults shall be readily accessible to qualified personnel for inspection and maintenance or shall meet the requirements of 450.13(A) or (B).

495.114 Walls, Roofs, and Floors.

The walls and roofs of vaults shall be constructed of materials that have approved structural strength for the conditions with a minimum fire resistance of 3 hours. The floors of vaults in contact with the earth shall be of concrete that is not less than 100 mm (4 in.) thick, but, where the vault is constructed with a vacant space or other stories below it, the floor shall have approved structural strength for the load imposed thereon and a minimum fire resistance of 3 hours. For the purposes of this section, studs and wallboard construction shall not be permitted.

Exception: Where transformers are protected with automatic sprinkler, water spray, carbon dioxide, or halon, construction of 1-hour rating shall be permitted.

Informational Note No. 1: See ASTM E119-18a, *Methods for Fire Tests of Building Construction and Materials*, for additional information.

Informational Note No. 2: A typical 3-hour construction is 150 mm (6 in.) thick reinforced concrete.

495.115 Doorways.

Vault doorways shall be protected in accordance with 495.115(A) through (C).

(A) Type of Door.

Each doorway leading into a vault from the building interior shall be provided with a tight-fitting door that has a minimum fire rating of 3 hours. The authority having jurisdiction shall be permitted to require such a door for an exterior wall opening where conditions warrant.

Exception: Where transformers are protected with automatic sprinkler, water spray, carbon dioxide, or halon, construction of 1-hour rating shall be permitted.

Informational Note: See NFPA 80-2022, *Standard for Fire Doors and Other Opening Protectives*, for additional information.

(B) Sills.

A door sill or curb that is of an approved height that will confine the oil from the largest transformer within the vault shall be provided, and in no case shall the height be less than 100 mm (4 in.).

(C) Accessibility.

Doors shall be equipped with locks, and doors shall be kept locked, with access being allowed only to qualified persons. Personnel doors shall be capable of opening not less than 90 degrees in the direction of egress and be equipped with listed fire exit hardware.

495.116 Ventilation Openings.

Where required by 450.9, openings for ventilation shall be provided in accordance with 495.116(A) through (F).

(A) Location.

Ventilation openings shall be located as far as possible from doors, windows, fire escapes, and combustible material.

(B) Arrangement.

A vault ventilated by natural circulation of air shall be permitted to have roughly half of the total area of openings required for ventilation in one or more openings near the floor and the remainder in one or more openings in the roof or in the sidewalls near the roof, or all of the area required for ventilation shall be permitted in one or more openings in or near the roof.

(C) Size.

For a vault ventilated by natural circulation of air to an outdoor area, the combined net area of all ventilating openings, after deducting the area occupied by screens, gratings, or louvers, shall not be less than 1900 mm^2 (3 $in.^2$) per kVA of transformer capacity in service, and in no case shall the net area be less than 0.1 m^2 (1 ft^2) for any capacity under 50 kVA.

(D) Covering.

Ventilation openings shall be covered with durable gratings, screens, or louvers, according to the treatment required in order to avoid unsafe conditions.

(E) Dampers.

All ventilation openings to the indoors shall be provided with automatic closing fire dampers that operate in response to a vault fire. Such dampers shall possess a standard fire rating of not less than 1½ hours.

~~Informational Note: See ANSI/UL 555-2016, *Standard for Fire Dampers*, for additional information on fire dampers.~~

~~**(F) Ducts.**~~

~~Ventilating ducts shall be constructed of fire-resistant material.~~

~~**495.117 Drainage.**~~

~~Where practicable, vaults containing more than 100 kVA transformer capacity shall be provided with a drain or other means that will carry off any accumulation of oil or water in the vault unless local conditions make this impracticable. The floor shall be pitched to the drain where provided.~~

~~**495.118 Water Pipes and Accessories.**~~

~~Any pipe or duct system foreign to the electrical installation shall not enter or pass through a transformer vault. Piping or other facilities provided for vault fire protection, or for transformer cooling, shall not be considered foreign to the electrical installation.~~

~~**495.119 Storage in Vaults.**~~

~~Materials shall not be stored in transformer vaults.~~

Part ~~IX~~VI. Capacitors

495.120 Enclosing and Guarding.

(A) Containing More Than 11 L (3 gal) of Flammable Liquid.

Capacitors containing more than 11 L (3 gal) of flammable liquid shall be enclosed in vaults or outdoor fenced enclosures complying with Article 110, Part III. This limit shall apply to any single unit in an installation of capacitors.

(B) Accidental Contact.

Where capacitors are accessible to unauthorized and unqualified persons, they shall be enclosed, located, or guarded so that persons cannot come into accidental contact or bring conducting materials into accidental contact with exposed energized parts, terminals, or buses associated with them. However, no additional guarding is required for enclosures accessible only to authorized and qualified persons.

495.121 Not Covered.

Surge capacitors or capacitors included as a component part of other apparatus and conforming with the requirements of such apparatus are excluded from these requirements.

This part also covers the installation of capacitors in hazardous (classified) locations as modified by Articles 501 through 503 .

495.122 Switching.

(A) Load Current.

(1)

~~Group-operated S~~switches shall be rated~~used~~ for ~~capacitor~~ switching of capacitive loads. Capacitor switch operation shall open all ungrounded conductors and the switch ~~and~~ shall be capable of the following:

(1) Carrying continuously not less than 135 percent of the rated current of the capacitor installation

(2) Interrupting the maximum continuous load current of each capacitor, capacitor bank, or capacitor installation that will be switched as a unit

(3) Withstanding the maximum inrush current, including contributions from adjacent capacitor installations

(4) Carrying currents due to faults on capacitor side of switch

(B) Isolation.

(1) General.

A means shall be installed to isolate from all sources of voltage each capacitor, capacitor bank, or capacitor installation that will be removed from service as a unit. The isolating means shall provide a visible gap in the electrical circuit adequate for the operating voltage.

(2) Isolating or Disconnecting Switches with No Interrupting Rating.

Isolating or disconnecting switches (with no interrupting rating) shall be interlocked with the load-interrupting device or shall be provided with prominently displayed caution signs in accordance with 495.22 to prevent switching load current.

(C) Additional Requirements for Series Capacitors.

The proper switching sequence shall be ensured by use of one of the following:

(1) Mechanically sequenced isolating and bypass switches

(2) Interlocks

(3) Switching procedure prominently displayed at the switching location

495.123 Overcurrent Protection.
(A) Provided to Detect and Interrupt Fault Current.

A means shall be provided to detect and interrupt fault current likely to cause dangerous pressure within an individual capacitor.

(B) Single-Pole or Multipole Devices.

Single-pole or multipole devices shall be permitted for this purpose.

(C) Protected Individually or in Groups.

Capacitors shall be permitted to be protected individually or in groups.

(D) Protective Devices Rated or Adjusted.

Protective devices for capacitors or capacitor equipment shall be rated or adjusted to operate within the limits of the safe zone for individual capacitors.

495.124 Identification.

Each capacitor shall be provided with a permanent nameplate giving the manufacturer's name, rated voltage, frequency, kilovar or amperes, number of phases, and the volume of liquid identified as flammable, if such is the case.

495.125 Grounding.

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

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

495.126 Means for Discharge.
(A) Means to Reduce the Residual Voltage.

A means shall be provided to reduce the residual voltage of a capacitor to 50 volts or less within 5 minutes after the capacitor is disconnected from the source of supply.

(B) Connection to Terminals.

A discharge circuit shall be either permanently connected to the terminals of the capacitor or provided with automatic means of connecting it to the terminals of the capacitor bank after disconnection of the capacitor from the source of supply. The windings of motors, transformers, or other equipment directly connected to capacitors without a switch or overcurrent device interposed shall meet the requirements of 495.126(A).

~~**Part X. Resistors and Reactors**~~
~~**495.130 General.**~~
~~**(A) Protected Against Physical Damage.**~~

~~Resistors and reactors shall be protected against physical damage.~~

~~**(B) Isolated by Enclosure or Elevation.**~~

~~Resistors and reactors shall be isolated by enclosure or elevation to protect personnel from accidental contact with energized parts.~~

~~(C) Combustible Materials.~~

~~Resistors and reactors shall not be installed in close enough proximity to combustible materials to constitute a fire hazard and shall have a clearance of not less than 305 mm (12 in.) from combustible materials.~~

~~(D) Clearances.~~

~~Clearances from resistors and reactors to grounded surfaces shall be adequate for the voltage involved.~~

~~(E) Temperature Rise from Induced Circulating Currents.~~

~~Metallic enclosures of reactors and adjacent metal parts shall be installed so that the temperature rise from induced circulating currents is not hazardous to personnel or does not constitute a fire hazard.~~

~~495.131 Grounding.~~

~~Resistor and reactor cases or enclosures shall be connected to the equipment grounding conductor.~~

~~*Exception: Resistor or reactor cases or enclosures supported on a structure designed to operate at other than ground potential shall not be connected to the equipment grounding conductor.*~~

~~495.132 Oil-Filled Reactors.~~

~~Installation of oil-filled reactors, in addition to the above requirements, shall comply with applicable requirements of Article 495, Part VII.~~

Public Comment No. 1963-NFPA 70-2021 [Global Input]

The Correlating Committee accepts the action taken by CMP 9 to create new Article 495 (FR 7941).

The Correlating Committee directs that requirements in Articles 430,460, and 470 for Motors, Capacitors, Resistors and Reactors, be removed from Article 495, and remain in their respective articles. The Correlating Committee refers this action to CMP 11 for information.

The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the panel action.

The Correlating Committee directs all panels to review all references to Article 490 under their purview. Article 490 has been relocated to Article 495. Each panel shall appoint a task group to review all necessary references to verify their accuracy and submit Public Comments where necessary.

The Correlating Committee directs CMP 9 to revise requirements in Article 450 and 495 to include revisions that were made to Articles 450 and 495 that were unrelated to the restructuring.

The Correlating Committee directs CMP 9 to review correlation between Article 450 and the new Article 495 to ensure issues related to transformers covered by the new Article 495 correlate with Article 450 as modified by CMP 9.

Additional Proposed Changes

File Name	Description	Approved
CN_384_Global.pdf	70_CN384	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 384 appeared in the First Draft Report.

The Correlating Committee accepts the action taken by CMP 9 to create new Article 495 (FR 7941).

The Correlating Committee directs that requirements in Articles 430,460, and 470 for Motors, Capacitors, Resistors and Reactors, be removed from Article 495, and remain in their respective articles. The Correlating Committee refers this action to CMP 11 for information.

The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the panel action.

The Correlating Committee directs all panels to review all references to Article 490 under their purview. Article 490 has been relocated to Article 495. Each panel shall appoint a task group to review all necessary references to verify their accuracy and submit Public Comments where necessary.

The Correlating Committee directs CMP 9 to revise requirements in Article 450 and 495 to include revisions that were made to Articles 450 and 495 that were unrelated to the restructuring.

The Correlating Committee directs CMP 9 to review correlation between Article 450 and the new Article 495 to ensure issues related to transformers covered by the new Article 495 correlate with Article 450 as modified by CMP 9.

Related Item

• Correlating Note No. 384

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 18 20:41:51 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7755-NFPA 70-2021

Statement: This revision addresses comments in Correlating Committee Note No. 384. In that Note, the Correlating

Committee directed that that requirements in Articles 430, 460, and 470 for Motors, Capacitors, Resistors and Reactors, be removed from Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal, and remain in their respective articles. While this revision removes requirements found in Articles 430, 460, and 470.

Also, the Correlating Committee directed CMP 9 to revise requirements in Article 495 to include revisions that were made to Article 490 that were unrelated to the restructuring. These revisions incorporate those changes from 490 into Article 495, which includes the relocation of the definition to Article 100.

Lastly, recognizing that not all equipment requirements for equipment over 1000 volts were relocated to Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal, this revision deletes requirements for transformers in favor of maintaining those requirements in Article 450 Transformers and Transformer Vaults (Including Secondary Ties). While relocating transformer requirements may be warranted in the future, the fact that many transformers may have one winding rated under 1000 volts, with another winding over 1000 volts, makes transformers unique with respect to a clear delineation of the topic.

Correlating Committee Note No. 384-NFPA 70-2021 [Global Input]

Submitter Information Verification

Committee:

Submittal Date: Fri May 07 13:18:44 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee accepts the action taken by CMP 9 to create new Article 495 (FR 7941).

The Correlating Committee directs that requirements in Articles 430, 460, and 470 for Motors, Capacitors, Resistors and Reactors, be removed from Article 495, and remain in their respective articles. The Correlating Committee refers this action to CMP 11 for information.

The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the panel action.

The Correlating Committee directs all panels to review all references to Article 490 under their purview. Article 490 has been relocated to Article 495. Each panel shall appoint a task group to review all necessary references to verify their accuracy and submit Public Comments where necessary.

The Correlating Committee directs CMP 9 to revise requirements in Article 450 and 495 to include revisions that were made to Articles 450 and 495 that were unrelated to the restructuring.

The Correlating Committee directs CMP 9 to review correlation between Article 450 and the new Article 495 to ensure issues related to transformers covered by the new Article 495 correlate with Article 450 as modified by CMP 9.

First Revision No. 7941-NFPA 70-2020 [Global Input]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
10 Affirmative All
0 Affirmative with Comments
2 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.

Gallo, Ernest J.

Holub, Richard A.

Hunter, Dean C.

Kendall, David H.

Kovacik, John R.

Manche, Alan

McDaniel, Roger D.

Porter, Christine T.

Williams, David A.

Negative with Comment

Hickman, Palmer L.

It is puzzling that Panel 9 accepted this now article with this substantiation: "CMP-9 provides text for a revised Article 495 based on the actions and substantiation of the Medium Voltage Task Group." It is even more puzzling that the Correlating Committee "accepts the action taken by CMP 9 to create new Article 495 (FR 7941)" without any technical or other substantiation. Without question, this should have been correlated as a resolve to correlate with the majority of the related actions.

Johnston, Michael J.

This negative ballot reflects organizational positioning. As clearly indicated in the negative ballot statements on the many resolved public

inputs and first revisions related to the medium voltage issues, this NEC Correlating Committee effectively dealt with these issues in the 1990s resulting in the current NEC structure. The proposed changes by this TG are not from the public. In fact, there were no public inputs indicating any problems related to this issue in the past several development cycles of the NEC. This is a solution that is in search of a problem that does not exist. The majority of these proposed public inputs were overwhelmingly resolved by the Code panels. That disposition cannot be ignored. It is clear that the proposed revisions are nothing more than moving things around in the NEC, which negatively impacts usability rather than helps it. The claims about users not being able to find the information under the existing NEC structure are not indicative of a problem with the NEC, it is a need for more training. These proposed revisions will not fix a lack of training in the NEC. Even as the Correlating Committee met to review the work of the Code Panels, it was clear that most of this effort could not even meet the NEC Style Manual requirements that indicate articles must be about a specific topic. The medium voltage parts of other articles had to all be restored to their original articles. NECA remains in opposition to these highly impactful revisions and maintains that the current NEC structure is not broken. A review of the first revisions will reveal that the NEC is being broken by this effort. There was no technical substantiation for these changes and no evidence of a problem with the current structure of the Code. Those that do not know or understand the history are bound to repeat it. The unnecessary damage being created by these unsubstantiated revisions is going to result in significant work to restore the NEC structure.

Public Comment No. 901-NFPA 70-2021 [Global Input]

The Correlating Committee directs the Chair of CMP-9 to assign a task group to review all the definitions under their purview for compliance with the NEC Style Manual and to review definitions identified by the Correlating Committee that may contain correlation issues. The attachment includes a list of those definitions identified that need to be reviewed.

Additional Proposed Changes

File Name	Description	Approved
9_CN_358_Global.pdf	9 CN358	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 358 appeared in the First Draft Report on First Revision No. 7975.

The Correlating Committee directs the Chair of CMP-9 to assign a task group to review all the definitions under their purview for compliance with the NEC Style Manual and to review definitions identified by the Correlating Committee that may contain correlation issues. The attachment includes a list of those definitions identified that need to be reviewed.

Related Item

• First Revision No. 7975

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:53:31 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: 1) Dead Front - See SR-7548. 2) Panelboard - See SR-7505. 3) Panelboard, Enclosed - See SR-7508. 4) Switchboard - See SR-7509. 5) Switching Device - See SR-7851. 6) Switching Device, Cutout - The comment presupposes that the defined term will be located alphabetically within Art. 100 generally, not kept under the “Switching Device” grouping, and therefore potentially confused with uses of the word on lower voltage systems. Fortunately, this does not turn out to be the case, and, given the placement of a voltage specification in the parent text, the problem will be solved without changing the definition title. 7) Switching Device, Disconnecting - See SR-7846. 8) Switching Device, Interruptor - See SR-7847. 9) Switching Device, Oil-Filled Cutout - See SR-7848. 10) Switching Device, Ol Switch - See SR-7849. 11) Switching Device, Regulator Bypass

Switch - See SR-7850. 12) Transformer - See SR-7520 (Article 100 definition) and SR-7862 (new 450.2).

Correlating Committee Note No. 358-NFPA 70-2021 [Global Input]

Supplemental Information

File Name	Description	Approved
NEC_P09_Definitions_TG_Attachment_CN358.docx		

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Thu May 06 22:40:16 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs the Chair of CMP-9 to assign a task group to review all the definitions under their purview for compliance with the NEC Style Manual and to review definitions identified by the Correlating Committee that may contain correlation issues. The attachment includes a list of those definitions identified that need to be reviewed.

First Revision No. 7975-NFPA 70-2020 [Global Input]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Correlating Committee Definitions Task Group
CMP-9 - Definitions

CMP-9 Definitions	Correlating Committee Comments
	The Correlating Committee directs the Chair of CMP-9 to assign a task group to review all the definitions under their purview for compliance with the NEC Style Manual and to review definitions identified by the Correlating Committee that may contain correlation issues. The attachment includes a list of those definitions identified that need to be reviewed.
Panelboard. A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet, enclosure, or cutout box placed in or against a wall, partition, or other support; and accessible only from the front or, where placed within a floor-mounted commercial appliance outlet center, from the top. (CMP-9)	The Correlating Committee directs that the Panel review FR 7946 and the revised definition for “panelboard”. The term “commercial appliance outlet centers” is introduced by this first revision. If this term is to be used in the definition of “panelboard” and in additional requirements in the Code, a definition is needed in Article 100.
Panelboard, Enclosed. (Enclosed Panelboard). An assembly of buses and connections, overcurrent devices, and control apparatus with or without switches or other equipment, installed in a suitable cabinet, cutout box, or enclosure suitable for a panelboard application. (CMP-1)	The Correlating Committee assigns the definition "Panelboard, Enclosed. (Enclosed Panelboard) to CMP-9.
Dead Front. Without live parts exposed to a person on the operating side of the equipment. (CMP-9)	Task Group 5 Dead Front (CMP-9) 2.2.2.4 Multiple Terms
High Voltage. A potential difference of more than 1000 volts, nominal. (CMP-9) Informational Note: Circuits and equipment rated at potential differences of more than 1000 volts and up to 52 kV are also commonly referred to as medium voltage.	Existing Definition and a new one in 495
Switchboard. A large single panel, frame, or assembly of panels on which are mounted on the face, back, or both, switches, overcurrent and other protective devices, buses, and usually instruments. These assemblies are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets. (CMP-9)	Second Sentence an Informational Note
Switching Device. A device designed to close, open, or both, one or more electrical circuits. (CMP-1)	The definition of Switching Device is assigned to CMP-9.

Switching Device, Cutout. An assembly of a fuse support with either a fuseholder, fuse carrier, or disconnecting blade. The fuseholder or fuse carrier may include a conducting element (fuse link) or may act as the disconnecting blade by the inclusion of a nonfusible member.	2.2.2.3.1 Searchable Title Suggest: (Cutout Switching Device) 2.2.2.3.3. Code Panel The definition of Switching Device is assigned to CMP-9.
Switching Device, Disconnecting (or Isolating) Switch (Disconnector, Isolator). A mechanical switching device used for isolating a circuit or equipment from a source of power.	2.2.2.3.1 Searchable Title 2.2.2.3.3. Code Panel 2.2.2.5 Alternate Term The definition of Switching Device is assigned to CMP-9.
Switching Device, Interrupter Switch. A switch capable of making, carrying, and interrupting specified currents.	2.2.2.3.1 Searchable Title 2.2.2.3.3. Code Panel The definition of Switching Device is assigned to CMP-9.
Switching Device, Oil Cutout (Oil-Filled Cutout). A cutout in which all or part of the fuse support and its fuse link or disconnecting blade is mounted in oil with complete immersion of the contacts and the fusible portion of the conducting element (fuse link) so that arc interruption by severing of the fuse link or by opening of the contacts will occur under oil.	2.2.2.3.1 Searchable Title 2.2.2.3.3. Code Panel 2.2.2.5 Alternate Term The definition of Switching Device is assigned to CMP-9.
Switching Device, Oil Switch. A switch having contacts that operate under oil (or askarel or other suitable liquid).	2.2.2.3.1 Searchable Title 2.2.2.3.3. Code Panel The definition of Switching Device is assigned to CMP-9.
Switching Device, Regulator Bypass Switch. A specific device or combination of devices designed to bypass a regulator.	2.2.2.3.1 Searchable Title 2.2.2.3.3. Code Panel The definition of Switching Device is assigned to CMP-9.
Transformer. An individual transformer, single- or polyphase, identified by a single nameplate, unless otherwise indicated in this article.	2.2.2 Definitions in Article 100 (unless otherwise indicated in this article) 2.2.2.2 Term in Definition

Public Comment No. 1562-NFPA 70-2021 [Definition: Cutout.]

Cutout (equipment) .

An assembly of a fuse support with either a fuseholder, fuse carrier, or disconnecting blade. The fuseholder or fuse carrier may include a conducting element (fuse link) or may act as the disconnecting blade by the inclusion of a nonfusible member. (490) (CMP 9)

Statement of Problem and Substantiation for Public Comment

This definition originated in the over 1000-volt part of Art. 100, and only pertained to medium-voltage applications. This wording must be constrained to the relevant location in Chapter 4 accordingly. The word is also used as an act of disconnection in 430.35(B) Exception, and therefore this definition includes a qualifier as being to equipment, in order to avoid unintended substantive changes now that all parts of Article 100 are being consolidated. This action will not interfere with the customary application of cutout boxes, as independently defined in Article 100.

Users should be aware that the term “cutout” involves overcurrent protection, particularly fuses, and does not necessarily involve a switching action. The customary, but not necessary, configuration of a switch and fuse block in the same enclosure follows from the requirement in 240.40 for a switch ahead of most (but not all) cartridge fuses. It also should be noted that the term “cutout” has been in the NEC from the very beginning, as CMP 9 exhaustively covered in its statement (adapted here) on Proposal 9-9 for the 2014 edition as follows:

Rule 17(a) of the 1897 NEC covered “Switches, Cut-Outs, Circuit Breakers, Etc.” and required that they “must, whenever called for … be so arranged that the cut-outs will protect, and the opening of the switch or circuit breaker will disconnect, all of the wires; that is, in a two-wire system the two wires, and in a three-wire system the three wires, must be protected by the cut-out and disconnected by the switch or circuit breaker.” Rule 17(c) required that such devices “must, when exposed to dampness, either be inclosed [sic] in a waterproof box or mounted on porcelain knobs.” Rule 44(b) required that “cut-outs must be provided with covers, when not arranged in approved cabinets, so as to obviate any danger of the melted fuse metal coming in contact with any substance which might be ignited thereby.” The actual term “cut-out box” entered the NEC (for which the definition will remain unchanged for 2023) in the 1915 edition as a descriptor for enclosures containing cut-outs.

Related Item

• CC Note 358

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 14:09:55 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action:	Rejected
Resolution:	The comment presupposes that the defined term will be located alphabetically within Art. 100 generally, not kept under the “Switching Device” grouping, and therefore potentially confused with uses of the word on lower voltage systems. Fortunately, this does not turn out to be the case, and, given the placement of a voltage specification in the parent text, the problem will be solved without changing the definition title.

Public Comment No. 1967-NFPA 70-2021 [Definition: Dead Front.]

Dead Front.

Without live parts exposed to a person on the operating side of the equipment. (CMP-9)

Additional Proposed Changes

File Name	Description	Approved
CN_395.pdf	70_CN395	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 395 appeared in the First Draft Report.

The Correlating Committee notes that more than one related term is referenced in the definitions. Section 2.2.2.4 of the NEC Style Manual review this issue and the Correlating Committee establishes a Task Group with representation from CMPs 7 and 9 to review the term "Dead Front" to consider one definition for correlation, if applicable. The Correlating Committee assigns the definition "Dead Front" to CMP-9. Each panel is assigned to revise the definitions under their purview to comply with the NEC Style Manual.

Related Item

• Correlating Note No. 395

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 18 20:51:03 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7548-NFPA 70-2021

Statement: The customary usage of the term, “dead-front”, in the Code is as a descriptor, including its single occurrence in Article 551 [551.45(C)]. It was also noted that, in all occurrences of the term, it is hyphenated as “dead-front”, which is grammatically correct based on its usage. Therefore, a hyphen is added to the existing term.

The definition suggested for relocation from Article 551 is unnecessary, as the existing definition in Article 100 satisfactorily describes the dead-front panelboard referenced in 551.45(C).

Correlating Committee Note No. 395-NFPA 70-2021 [Definition: Dead Front.]

Submitter Information Verification

Committee: NEC-AAC
Submittal Date: Fri May 07 16:18:08 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee notes that more than one related term is referenced in the definitions. Section 2.2.2.4 of the NEC Style Manual review this issue and the Correlating Committee establishes a Task Group with representation from CMPs 7 and 9 to review the term "Dead Front" to consider one definition for correlation, if applicable. The Correlating Committee assigns the definition "Dead Front" to CMP-9. Each panel is assigned to revise the definitions under their purview to comply with the NEC Style Manual.

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1565-NFPA 70-2021 [Definition: Disconnecting (or Isolating) Switch (Disconnect...]

~~**Disconnecting (or Isolating)**~~ **Switch** ~~**(Disconnector , Isolator)**~~ **Disconnecting .**

A mechanical ~~switching~~ device used ~~for isolating~~ to electrically separate a circuit or equipment from a source of power. (CMP 9)

Statement of Problem and Substantiation for Public Comment

The words “disconnector” and “isolator” do not appear in the NEC and need not be repeated in this definition. This rewrite avoids the use of the defined terms (or derivations therefrom) in the definition, as required in the Style Manual.

Related Item

• CC Note 358

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 14:14:48 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7846-NFPA 70-2021
Statement: The terms “disconnector” and “isolator” do not appear in the NEC and are being removed accordingly. CMP 9 is not reworking the definition, because although the Style Manual nominally excludes the use of a defined term within a definition (in 2.2.2.2), it also uses constructions that employ individual words (but not all the words) that occur in defined multi-word phrases, in examples of acceptable practice. See 2.2.2.3.1, 2.2.2.3.2, and 2.2.2.3.3 of the Style Manual where this is done.

Public Comment No. 1584-NFPA 70-2021 [Definition: Interrupter Switch.]

~~**Interrupter Switch.**~~

~~A switch capable of making, carrying, and interrupting specified currents.~~

Statement of Problem and Substantiation for Public Comment

The phrasing "interrupter switch" is not used in the NEC. The concepts have been included in the generic definition of switching device.

Related Item

• CC Note 358

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 15:00:31 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7847-NFPA 70-2021

Statement: CMP 9 is modifying the definition by changing the terminology “a switch” to “a switching device” to be consistent with the word usage for disconnecting (or isolating) switches. CMP 9 is not reworking the definition, otherwise, because although the Style Manual nominally excludes the use of a defined term within a definition (in 2.2.2.2), it also uses constructions that employ individual words (but not all the words) that occur in defined multi-word phrases, in examples of acceptable practice. See 2.2.2.3.1, 2.2.2.3.2, and 2.2.2.3.3 of the Style Manual where this is done. Although the term is not used in the singular, it is used in the plural and CMP 9 is retaining the definition accordingly.

Public Comment No. 1585-NFPA 70-2021 [Definition: Oil Cutout (Oil-Filled Cutout).]

~~Oil~~ **Cutout** ~~(~~ **,** ~~Oil-Filled~~ ~~Cutout)~~ **.**

A cutout in which all or part of the fuse support and its fuse link or disconnecting blade is mounted in oil with complete immersion of the contacts and the fusible portion of the conducting element (fuse link) so that arc interruption by severing of the fuse link or by opening of the contacts will occur under oil. (490) (CMP 9)

Statement of Problem and Substantiation for Public Comment

The term "oil cutout" is not used in the NEC, only "oil-filled cutout". The application is limited to a specialized location in Chapter 4.

Related Item

• CC Note 358

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 15:03:16 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7848-NFPA 70-2021
Statement: The term “oil cutout” is not used in the NEC and is being deleted from the definition title, leaving only the term “Oil-Filled Cutout.” The comment inserted an article specification and panel responsibility. Because of the structure of this part of Article 100 and the modifications being made to the title line of the parent topic, this information is not being included in the definition.

Public Comment No. 1604-NFPA 70-2021 [Definition: Oil Switch.]

Oil Switch.

A switch having contacts that operate under oil (or askarel or other suitable liquid). (CMP 9)

Statement of Problem and Substantiation for Public Comment

CMP 9 has been assigned jurisdiction over this definition.

Related Item

• CC Note 358

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 16:26:11 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7849-NFPA 70-2021
Statement: The definition is being editorially modified by opening with the phrase “switching device” in order to be consistent with other definitions in this group. Because of the modification of the title line of the parent category (see SR-7851), the inclusion of panel responsibility is not required here.

Public Comment No. 593-NFPA 70-2021 [Definition: Panelboard, Enclosed. (Enclosed Panelboard)]

Panelboard, Enclosed. (Enclosed Panelboard)

An assembly of buses and connections, overcurrent devices, and control apparatus with or without switches or other equipment, installed in a suitable cabinet, cutout box, or enclosure suitable for a panelboard application. (CMP-1)

Additional Proposed Changes

File Name	Description	Approved
1_CN_427_Detail.pdf	70_CN427	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 427 appeared in the First Draft Report on First Revisions No. 8470.

The Correlating Committee assigns the definition "Panelboard, Enclosed. (Enclosed Panelboard) to CMP-9.

Related Item

• First Revision No. 8470

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 02 10:38:26 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7508-NFPA 70-2021
Statement: The first use of the term suitable was removed as being redundant. Not all enclosures are suitable for panelboard application. Responsibility for this definition has been reassigned to CMP 9 by the Correlating Committee.

Correlating Committee Note No. 427-NFPA 70-2021 [Detail]

Submitter Information Verification

Committee: NEC-P01
Submittal Date: Sun May 09 22:14:33 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee assigns the definition "Panelboard, Enclosed. (Enclosed Panelboard) to CMP-9.

First Revision No. 8470-NFPA 70-2021 [Detail]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 71-NFPA 70-2021 [Definition: Panelboard, Enclosed. (Enclosed Panelboard)]

Panelboard, Enclosed. (Enclosed Panelboard)

An assembly of buses and connections, overcurrent devices, and control apparatus with or without switches or other equipment, installed in a suitable cabinet, cutout box, or enclosure ~~suitable for a panelboard application~~ . (CMP-1)

Statement of Problem and Substantiation for Public Comment

The phrase "suitable for a panelboard application" is repetitive and redundant. The preceding phrase includes the requirement that the cabinet, cutout box or enclosure be suitable.

Related Item

• FR-8470

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 01 14:21:34 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7508-NFPA 70-2021
Statement: The first use of the term suitable was removed as being redundant. Not all enclosures are suitable for panelboard application. Responsibility for this definition has been reassigned to CMP 9 by the Correlating Committee.

Public Comment No. 1229-NFPA 70-2021 [Definition: Panelboard.]

Panelboard.

A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet, enclosure, or cutout box placed in or against a wall, partition, or other support; and accessible only from the ~~front or, where placed within a floor-mounted commercial appliance outlet center, from the top.~~ front (CMP-9)

Statement of Problem and Substantiation for Public Comment

The final clause of this definition was never supported by CMP 9. It resulted from a ballot error, as clearly indicated by virtually the entire panel in comments during the voting, and in substance by the Correlating Committee note. It must be removed. It is a violation of the Style Manual because it is a requirement masquerading as a part of a definition. In addition to the obvious ballot error, CMP 9 explicitly rejected its technical content during the first draft discussions. Section 408.43 expressly prohibits face-up orientations, PI 1705 did indeed request such an allowance, but CMP 9 declined to grant it. If recognition of an in-floor placement of these "commercial appliance outlet centers" is to become part of the NEC, the only way to do so is by modifying the terms of 408.43, for which there has been adequate public notice in the first draft report. In this CMP 9 member's opinion, there is adequate technical basis for some form of support. CMP 9 will undoubtedly have a vehicle for such an action during the second draft meetings, which must also include the creation of a suitable definition in Article 100.

Related Item

• FR 7946 • CC Note 426

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 11 09:19:53 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7505-NFPA 70-2021

Statement: Based on the recollection of multiple Committee Members, it was not the intent to add the last part of the sentence, the portion stating “or where placed within a floor-mounted commercial appliance outlet center, from the top”. While this change was debated as part of modifying 408.43 based on PI 1705, the CMP did not modify 408.43 to allow panelboards to be mounted in the face-up position. There was another opportunity for

having a special condition where this construction is allowed (refer to PI 1761, which would have provided a modification for “commercial appliance outlet centers” in Section 518.5); however, CMP 15 Resolved that PI. Based on the actions of CMP 9 in Section 408.43, and CMP 15’s Resolution of PI 1761, the last part of this revision to the definition should not have been added.

Public Comment No. 17-NFPA 70-2021 [Definition: Panelboard.]

Panelboard.

A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet, enclosure, or cutout box placed in or against a wall, partition, or other support; and accessible only from the front ~~or, where placed within a floor-mounted commercial appliance outlet center, from the top~~ . (CMP-9)

Statement of Problem and Substantiation for Public Comment

Based on the recollection of multiple Committee Members, it was not the intent to add the last part of the sentence, the portion stating “or, where placed within a floor-mounted commercial appliance outlet center, from the top”. While this change was debated as part of modifying 408.43 based on PI 1705, the CMP did not modify 408.43 to allow panelboards to be mounted in the face-up position. There was another opportunity for having a special condition where this construction is allowed (refer to PI 1761, which would have provided a modification for “commercial appliance outlet centers” in Section 518.5); however, CMP 15 Resolved that PI. Based on the actions of CMP 9 in Section 408.43, and CMP 15’s Resolution of PI 1761, the last part of this revision to the definition should not be added.

Related Item

• fr7946

Submitter Information Verification

Submitter Full Name: Ronnie Ridgeway
Organization: Siemens Industry, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 29 13:08:49 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7505-NFPA 70-2021

Statement: Based on the recollection of multiple Committee Members, it was not the intent to add the last part of the sentence, the portion stating “or where placed within a floor-mounted commercial appliance outlet center, from the top”. While this change was debated as part of modifying 408.43 based on PI 1705, the CMP did not modify 408.43 to allow panelboards to be mounted in the face-up position. There was another opportunity for having a special condition where this construction is allowed (refer to PI 1761, which would have provided a modification for “commercial appliance outlet centers” in Section 518.5); however, CMP 15 Resolved that PI. Based on the actions of CMP 9 in Section 408.43, and CMP 15’s Resolution of PI 1761, the last part of this revision to the

definition should not have been added.

Public Comment No. 902-NFPA 70-2021 [Definition: Panelboard.]

Panelboard.

A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet, enclosure, or cutout box placed in or against a wall, partition, or other support; and accessible only from the front or, where placed within a floor-mounted commercial appliance outlet center, from the top. (CMP-9)

Additional Proposed Changes

File Name	Description	Approved
9_CN_426.pdf	9 CN426	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 426 appeared in the First Draft Report on First Revision No. 7946.

The Correlating Committee directs that the Panel review FR 7946 and the revised definition for "panelboard". The term "commercial appliance outlet centers" is introduced by this first revision. If this term is to be used in the definition of
"panelboard" and in additional requirements in the Code, a definition is needed in Article 100.

Related Item

• First Revision No. 7946

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:56:22 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7505-NFPA 70-2021
Statement: Based on the recollection of multiple Committee Members, it was not the intent to add the last part of the sentence, the portion stating “or where placed within a floor-mounted commercial appliance outlet center, from the top”. While this change was debated as part of modifying 408.43 based on PI 1705, the CMP did not modify 408.43 to allow panelboards to be mounted in the face-up position. There was another opportunity for having a special condition where this construction is allowed (refer to PI 1761, which

would have provided a modification for “commercial appliance outlet centers” in Section 518.5); however, CMP 15 Resolved that PI. Based on the actions of CMP 9 in Section 408.43, and CMP 15’s Resolution of PI 1761, the last part of this revision to the definition should not have been added.

Correlating Committee Note No. 426-NFPA 70-2021 [Definition: Panelboard.]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Sun May 09 22:13:52 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs that the Panel review FR 7946 and the revised definition for “panelboard”. The term “commercial appliance outlet centers” is introduced by this first revision. If this term is to be used in the definition of “panelboard” and in additional requirements in the Code, a definition is needed in Article 100.

First Revision No. 7946-NFPA 70-2020 [Definition: Panelboard.]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1597-NFPA 70-2021 [Definition: Regulator Bypass Switch.]

Regulator Bypass Switch.

A specific device or combination of devices designed to bypass ~~a regulator~~ equipment used to control voltage levels or related circuit characteristics (490) (CMP 9) .

Statement of Problem and Substantiation for Public Comment

This wording eliminates the use of the defined term within the definition. The only use of the term is in 490.23, and therefore the application is limited.

Related Item

• CC Note 358

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 16:05:22 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7850-NFPA 70-2021
Statement: This definition is being rewritten to eliminate the circularity of having key elements of the defined term also used within the definition. The wording is also being adjusted to maintain consistency regarding the terminology “switching device”.

Public Comment No. 1557-NFPA 70-2021 [Definition: Switchboard.]

Switchboard.

A large single panel, frame, or assembly of panels on which are mounted on the face, back, or both, switches, overcurrent and other protective devices, buses, and usually instruments.

Informational Note: These assemblies are ~~generally~~ frequently accessible from the rear as well as from the front and are not intended to be installed in cabinets. (CMP-9)

Statement of Problem and Substantiation for Public Comment

This comment responds to the Correlating Committee critique of this definition (CC Note 358) because of explanatory nature nature of the second sentence and requesting the reformatting as a note. This wording accomplishes that. In addition, it changes the word "generally" to "frequently" because double-sided boards are no longer the general case.

Related Item

• CC Note 358

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 14:02:06 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7509-NFPA 70-2021
Statement: The last sentence is essentially an explanation of how the equipment can be accessed so it is changed to an informational note. The term “generally” is changed to “can be,” and “or side” is added since there are occasions where rear or side access is also required. Rear or side access is referenced in 408.18(C).

Public Comment No. 1588-NFPA 70-2021 [Definition: Transformer.]

Transformer.

~~An individual transformer~~ Equipment , either single ~~–~~ or polyphase, and identified by a single nameplate ~~,~~ unless otherwise indicated in ~~this article. (~~ context, that uses mutual induction to convert variations of current and voltage in a primary circuit into variations of current and voltage in a secondary circuit. (450) (CMP-9)

Statement of Problem and Substantiation for Public Comment

The definition is not permitted to use the defined term, and must be made suitable for a location (Article 100) remote from Article 450. The phasing “in context” in conjunction with the article limitation accomplishes this.

Related Item

• CC Note 358

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 15:11:30 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7520-NFPA 70-2021

Statement: This action addresses the Correlating Committee's objection to the Style Manual violation of 2.2.2.2, by writing a definition in Article 100 that is a true definition of the word transformer without using the defined term within it. The second revision in Art. 100 does exactly that, covering both single and polyphase equipment, and qualifying the operation as by electromagnetic induction, which separates this equipment from other methods of changing voltage or current. It carefully avoids a statement suggesting that there is a change of voltage or current, because isolating transformers filter noise without changing nominal voltages. The word “transformer” (or its plural form) is used almost 1500 times in the NEC, easily qualifying for a definition in Article 100. CMP 9 is creating one that conveys useful information.

Public Comment No. 28-NFPA 70-2021 [Definition: Transformer.]

Transformer.

An individual transformer, single- or polyphase, that is identified by a single nameplate~~, unless otherwise indicated in this article~~ . (CMP-9)

Statement of Problem and Substantiation for Public Comment

This is intended to be an editorial and not a substantive improvement. The term "unless otherwise indicated in this article" cannot be used because the definition has been moved to Article 100.

Related Item

• PI-3013

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 29 20:52:21 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7520-NFPA 70-2021

Statement: This action addresses the Correlating Committee's objection to the Style Manual violation of 2.2.2.2, by writing a definition in Article 100 that is a true definition of the word transformer without using the defined term within it. The second revision in Art. 100 does exactly that, covering both single and polyphase equipment, and qualifying the operation as by electromagnetic induction, which separates this equipment from other methods of changing voltage or current. It carefully avoids a statement suggesting that there is a change of voltage or current, because isolating transformers filter noise without changing nominal voltages. The word “transformer” (or its plural form) is used almost 1500 times in the NEC, easily qualifying for a definition in Article 100. CMP 9 is creating one that conveys useful information.

Public Comment No. 1657-NFPA 70-2021 [Article 245]

Article 245 Overcurrent Protection for Systems Rated Over 1000 Volts AC, 1500 Volts DC

Part I. General and Scope

245.1 Scope.

This article covers requirements for the installation of overcurrent protection of circuits and related electrical equipment permanently installed on premises wiring systems over 1000 volts ac, 1500 volts dc, nominal.

245.15 Reconditioned Equipment.

Reconditioned equipment shall be listed as *reconditioned* and the original listing mark removed.

(1) Medium- and high-voltage circuit breakers shall be permitted to be reconditioned.

(2) Electromechanical protective relays and current transformers shall be permitted to be reconditioned.

(3) Medium-voltage fuseholders and medium-voltage nonrenewable fuses shall not be permitted to be reconditioned.

Part II. Overcurrent Protection

245.21 Circuit-Interrupting Devices.

(A) Circuit Breakers.

(1) Location.

(a) Circuit breakers installed indoors shall be mounted either in metal-enclosed units or fire-resistant cell-mounted units, or they shall be permitted to be open-mounted in locations accessible to qualified persons only.

(b) Circuit breakers used to control oil-filled transformers in a vault shall either be located outside the transformer vault or be capable of operation from outside the vault.

(c) Oil circuit breakers shall be arranged or located so that adjacent readily combustible structures or materials are safeguarded in an approved manner.

(2) Operating Characteristics.

Circuit breakers shall have the following equipment or operating characteristics:

(1) An accessible mechanical or other identified means for manual tripping, independent of control power

(2) Be release free (trip free)

(3) If capable of being opened or closed manually while energized, main contacts that operate independently of the speed of the manual operation

(4) A mechanical position indicator at the circuit breaker to show the open or closed position of the main contacts

(5) A means of indicating the open and closed position of the breaker at the point(s) from which they may be operated

(3) Nameplate.

A circuit breaker shall have a permanent and legible nameplate showing the manufacturer's name or trademark, manufacturer's type or identification number, continuous current rating, interrupting rating in megavolt-amperes (MVA) or amperes, and maximum voltage rating. Modification of a circuit breaker affecting its rating(s) shall be accompanied by an appropriate change of nameplate information.

(4) Rating.

Circuit breakers shall have the following ratings:

(1) The continuous current rating of a circuit breaker shall not be less than the maximum continuous current through the circuit breaker.

(2) The interrupting rating of a circuit breaker shall not be less than the available fault current the circuit breaker will be required to interrupt, including contributions from all connected sources of energy.

(3) The closing rating of a circuit breaker shall not be less than the maximum asymmetrical fault current into which the circuit breaker can be closed.

(4) The momentary rating of a circuit breaker shall not be less than the maximum asymmetrical fault current at the point of installation.

(5) The rated maximum voltage of a circuit breaker shall not be less than the maximum circuit voltage.

(5) Retrofit Trip Units.

Retrofit trip units shall be listed for use with the specific circuit breaker with which it is installed.

(B) Power Fuses and Fuseholders.

(1) Use.

Where fuses are used to protect conductors and equipment, a fuse shall be placed in each ungrounded conductor. Two power fuses shall be permitted to be used in parallel to protect the same load if both fuses have identical ratings and both fuses are installed in an identified common mounting with electrical connections that divide the current equally. Power fuses of the vented type shall not be used indoors, underground, or in metal enclosures unless identified for the use.

(2) Interrupting Rating.

The interrupting rating of power fuses shall not be less than the available fault current the fuse is required to interrupt, including contributions from all connected sources of energy.

(3) Voltage Rating.

The maximum voltage rating of power fuses shall not be less than the maximum circuit voltage. Fuses having a minimum recommended operating voltage shall not be applied below this voltage.

(4) Identification of Fuse Mountings and Fuse Units.

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

(5) Fuses.

Fuses that expel flame in opening the circuit shall be designed or arranged so that they function properly without hazard to persons or property.

(6) Fuseholders.

Fuseholders shall be designed or installed so that they are de-energized while a fuse is being replaced. A field-applied permanent and legible sign, in accordance with 110.21(B), shall be installed immediately adjacent to the fuseholders and shall be worded as follows:

DANGER — DISCONNECT CIRCUIT BEFORE REPLACING FUSES.

Exception: *Fuses and fuseholders designed to permit fuse replacement by qualified persons using identified equipment without de-energizing the fuseholder shall be permitted.*

(7) High-Voltage Fuses.

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

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

(C) Distribution Cutouts and Fuse Links — Expulsion Type.

(1) Installation.

Cutouts shall be located so that they may be readily and safely operated and re-fused, and so that the exhaust of the fuses does not endanger persons. Distribution cutouts shall not be used indoors, underground, or in metal enclosures.

(2) Operation.

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

(3) Interrupting Rating.

The interrupting rating of distribution cutouts shall not be less than the available fault current the cutout is required to interrupt, including contributions from all connected sources of energy.

(4) Voltage Rating.

The maximum voltage rating of cutouts shall not be less than the maximum circuit voltage.

(5) Identification.

Distribution cutouts shall have on their body, door, or fuse tube a permanent and legible nameplate or identification showing the manufacturer's type or designation, continuous current rating, maximum voltage rating, and interrupting rating.

(6) Fuse Links.

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

(7) Structure Mounted Outdoors.

The height of cutouts mounted outdoors on structures shall provide safe clearance between lowest energized parts (open or closed position) and standing surfaces, in accordance with 110.34(E).

(D) Oil-Filled Cutouts.

~~**(1)** Continuous Current Rating.~~

~~The continuous current rating of oil-filled cutouts shall not be less than the maximum continuous current through the cutout.~~

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

~~The interrupting rating of oil-filled cutouts shall not be less than the available fault current the oil-filled cutout is required to interrupt, including contributions from all connected sources of energy.~~

~~**(3)** Voltage Rating.~~

~~The maximum voltage rating of oil-filled cutouts shall not be less than the maximum circuit voltage.~~

~~**(4)** Fault Closing Rating.~~

~~Oil-filled cutouts shall have a fault closing rating not less than the maximum asymmetrical fault current that can occur at the cutout location, unless suitable interlocks or operating procedures preclude the possibility of closing into a fault.~~

~~**(5)** Identification.~~

~~Oil-filled cutouts shall have a permanent and legible nameplate showing the rated continuous current, rated maximum voltage, and rated interrupting current.~~

~~**(6)** Fuse Links.~~

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

~~**(7)** Location.~~

~~Cutouts shall be located so that they are readily and safely accessible for re-fusing, with the top of the cutout not over 1.5 m (5 ft) above the floor or platform.~~

~~**(8)** Enclosure.~~

~~Suitable barriers or enclosures shall be provided to prevent contact with nonshielded cables or energized parts of oil-filled cutouts.~~

~~**(E)** Load Interrupters.~~

~~Load-interrupter switches shall be permitted if suitable fuses or circuit breakers are used in conjunction with these devices to interrupt available fault currents. Where these devices are used in combination, they shall be coordinated electrically so that they will safely withstand the effects of closing, carrying, or interrupting all possible currents up to the assigned maximum short-circuit rating.~~

~~Where more than one switch is installed with interconnected load terminals to provide for alternate connection to different supply conductors, each switch shall be provided with a warning sign identifying the presence of more than one source. Each warning sign or label shall comply with 110.21.~~

~~**(1)** Continuous Current Rating.~~

~~The continuous current rating of interrupter switches shall equal or exceed the maximum continuous current at the point of installation.~~

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

~~The maximum voltage rating of interrupter switches shall equal or exceed the maximum circuit voltage.~~

~~**(3)** Identification.~~

~~Interrupter switches shall have a permanent and legible nameplate, including the following information: manufacturer's type or designation, continuous current rating, interrupting current rating, fault closing rating, maximum voltage rating.~~

(4) Switching of Conductors.

The switching mechanism shall be arranged to be operated from a location where the operator is not exposed to energized parts and shall be arranged to open all ungrounded conductors of the circuit simultaneously with one operation. Switches shall be arranged to be locked in the open position. Metal-enclosed switches shall be operable from outside the enclosure.

(5) Stored Energy for Opening.

The stored-energy operator shall be permitted to be left in the uncharged position after the switch has been closed if a single movement of the operating handle charges the operator and opens the switch.

(6) Supply Terminals.

The supply terminals of fused interrupter switches shall be installed at the top of the switch enclosure, or, if the terminals are located elsewhere, the equipment shall have barriers installed to prevent persons from accidentally contacting energized parts or dropping tools or fuses into energized parts.

245.26 Feeders and Branch Circuits.

(A) Location and Type of Protection.

Feeder and branch-circuit conductors shall have overcurrent protection in each ungrounded conductor located at the point where the conductor receives its supply or at an alternative location in the circuit when designed under engineering supervision that includes but is not limited to considering the appropriate fault studies and time–current coordination analysis of the protective devices and the conductor damage curves. The overcurrent protection shall be permitted to be provided by either 245.26(A)(1) or (A)(2).

(1) Overcurrent Relays and Current Transformers.

Circuit breakers used for overcurrent protection of 3-phase circuits shall have a minimum of three overcurrent relay elements operated from three current transformers. The separate overcurrent relay elements (or protective functions) shall be permitted to be part of a single electronic protective relay unit.

On 3-phase, 3-wire circuits, an overcurrent relay element in the residual circuit of the current transformers shall be permitted to replace one of the phase relay elements.

An overcurrent relay element, operated from a current transformer that links all phases of a 3-phase, 3-wire circuit, shall be permitted to replace the residual relay element and one of the phase-conductor current transformers. Where the neutral conductor is not regrounded on the load side of the circuit as permitted in 250.184(B), the current transformer shall be permitted to link all 3-phase conductors and the grounded circuit conductor (neutral).

(2) Fuses.

A fuse shall be connected in series with each ungrounded conductor.

(B) Protective Devices.

The protective device(s) shall be capable of detecting and interrupting all values of current that can occur at their location in excess of their trip-setting or melting point.

(C) Conductor Protection.

The operating time of the protective device, the available short-circuit current, and the conductor used shall be coordinated to prevent damaging or dangerous temperatures in conductors or conductor insulation under short-circuit conditions.

245.27 Additional Requirements for Feeders.

(A) Rating or Setting of Overcurrent Protective Devices.

The continuous ampere rating of a fuse shall not exceed three times the ampacity of the conductors. The long-time trip element setting of a breaker or the minimum trip setting of an electronically actuated fuse shall not exceed six times the ampacity of the conductor. For fire pumps, conductors shall be permitted to be protected for overcurrent in accordance with 695.4(B)(2).

(B) Feeder Taps.

Conductors tapped to a feeder shall be permitted to be protected by the feeder overcurrent device where that overcurrent device also protects the tap conductor.

Part III. Overvoltage Protection

245.40 Other Articles.

Equipment shall be protected against overvoltage in accordance with the article in this Code that covers the type of equipment or location specified in Table 245.40.

Table 245.40 Other Articles

Equipment Article Equipment over 1000 volts, nominal 495 Outdoor overhead conductors over 1000 volts 399

245.41 Uses Not Permitted.

A surge arrester shall not be installed where the rating of the surge arrester is less than the maximum continuous phase-to-ground voltage at the power frequency available at the point of application.

245.42 Surge Arrester Selection.

The surge arresters shall comply with 245.42(A) and (B).

(A) Rating.

The rating of a surge arrester shall be equal to or greater than the maximum continuous operating voltage available at the point of application.

(1) Solidly Grounded Systems.

The maximum continuous operating voltage shall be the phase-to-ground voltage of the system.

(2) Impedance or Ungrounded System.

The maximum continuous operating voltage shall be the phase-to-phase voltage of the system.

(B) Silicon Carbide Types.

The rating of a silicon carbide-type surge arrester shall be not less than 125 percent of the rating specified in 245.42(A).

Informational Note No. 1: For further information on surge arresters, see IEEE C62.11-2012, *Standard for Metal-Oxide Surge Arresters for Alternating-Current Power Circuits (>1 kV)* , and IEEE C62.22-2009, *Guide for the Application of Metal-Oxide Surge Arresters for Alternating-Current Systems* .

Informational Note No. 2: The selection of a properly rated metal oxide arrester is based on considerations of maximum continuous operating voltage and the magnitude and duration of overvoltages at the arrester location as affected by phase-to-ground faults, system grounding techniques, switching surges, and other causes. See the manufacturer's application rules for selection of the specific arrester to be used at a particular location.

245.44 Number Required.

Where used at a point on a circuit, a surge arrester shall be connected to each ungrounded conductor. A single installation of such surge arresters shall be permitted to protect a number of interconnected circuits if no circuit is exposed to surges while disconnected from the surge arresters.

245.46 Location.

Surge arresters shall be permitted to be located indoors or outdoors. Surge arresters shall be made inaccessible to unqualified persons unless listed for installation in accessible locations.

245.48 Routing of Surge-Arrester Equipment 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 245.50 shall not be any longer than necessary and shall avoid unnecessary bends.

245.50 Connection.

The arrester shall be connected to one of the following:

(1) Grounded service conductor

(2) Grounding electrode conductor

(3) Grounding electrode for the service

(4) Equipment grounding terminal in the service equipment

245.52 Surge-Arrester Conductors.

The conductor between the surge arrester and the line, and the surge arrester and the grounding connection, shall not be smaller than 6 AWG copper or aluminum.

245.54 Interconnections.

The surge arrester protecting a transformer that supplies a secondary distribution system shall be interconnected as specified in 245.54(A), (B), or (C).

(A) Metal Interconnections.

A metal interconnection shall be made to the secondary grounded circuit conductor or the secondary circuit grounding electrode conductor, if, in addition to the direct grounding connection at the surge arrester, the connection complies with 245.54(A)(1) or (A)(2).

(1) Additional Grounding Connection.

The grounded conductor of the secondary has a grounding connection elsewhere to a continuous metal underground water piping system. In urban water-pipe areas where there are at least four water-pipe connections on the neutral conductor and not fewer than four such connections in each mile of neutral conductor, the metal interconnection shall be permitted to be made to the secondary neutral conductor with omission of the direct grounding connection at the surge arrester.

(2) Multigrounded Neutral System Connection.

The grounded conductor of the secondary system is part of a multigrounded neutral system or static wire of which the primary neutral conductor or static wire has at least four grounding connections in each 1.6 km (1 mile) of line in addition to a grounding connection at each service.

(B) Through Spark Gap or Device.

Where the surge-arrester grounding electrode conductor is not connected as in 245.54(A), or where the secondary is not grounded as in 245.54(A) but is otherwise grounded as in 250.52, an interconnection shall be made through a spark gap or listed device as required by 245.54(B)(1) or (B)(2).

(1) Ungrounded or Unigrounded Primary System.

For ungrounded or unigrounded primary systems, the spark gap for a listed device shall have a 60-Hz breakdown voltage of at least twice the primary circuit voltage but not necessarily more than 10 kV, and there shall be at least one other ground on the grounded conductor of the secondary that is not less than 6.0 m (20 ft) distant from the surge-arrester grounding electrode.

(2) Multigrounded Neutral Primary System.

For multigrounded neutral primary systems, the spark gap or listed device shall have a 60-Hz breakdown of not more than 3 kV, and there shall be at least one other ground on the grounded conductor of the secondary that is not less than 6.0 m (20 ft) distant from the surge-arrester grounding electrode.

~~**(C)** By Special Permission.~~

~~An interconnection of the surge-arrester ground and the secondary neutral conductor, other than as provided in 245.54(A) or (B), shall be permitted to be made only by special permission.~~

~~**245.56** Grounding Electrode Conductor Connections and Enclosures.~~

~~Except as indicated in this article, surge-arrester grounding electrode conductor connections shall be made as specified in Article 250, Parts III and X. Grounding electrode conductors installed in metal enclosures shall comply with 250.64(E).~~

Statement of Problem and Substantiation for Public Comment

The major premise behind this reorganization was to create a commonality and ready recognition of medium voltage rules in the NEC through the creation of new articles that all would end in the digit “5”. Well, where do we stand as this comment is written? This is what the records show:

Article 115 (from Art. 110): CMP 1 resolved it.
Article 205 (from Art. 200): CMP 5 resolved it.
Article 235 (from Art. 210/215/230): CMP 10 resolved it.
Article 245 (from one section of Art. 490 and medium voltage in Art. 242): CMP 9 issued FR 7940; the Correlating Committee stripped all coverage of Art. 242 content (FCR 387). Note that the Correlating Committee referred this material to CMP 10 for comment; that comment will almost certainly be extremely negative based on closely related CMP 10 activity.
Article 255 (from Art. 250): CMP 5 resolved it
Article 305 (from Art. 300 Part II plus Art. 314-medium voltage plus Art. 368-medium voltage plus Art. 399: CMP 3 issued FR-9609; the Correlating Committee (FCR-458) stripped all coverage of content beyond what is n in current Art. 300 Part II. No other content is moving here, although Art. 399 is slated to be Art. 395.
Article 315 (from Art. 311) has moved forward
Article 495 (from Art. 490, plus Art. 450 medium voltage plus Art. 430 medium voltage plus Art. 460 medium voltage plus Art. 470 medium voltage. CMP 9 issued FR 7941, the Correlating Committee stripped all coverage of content beyond Art. 450 and 490 (CC Note 384).

Therefore, for medium voltage content in XX5 articles we have nothing in Chapter 1, one article 2X5 in Chapter 2 that likely lacks consensus, three articles in Chapter 3 (one of which, 399 to 395 was always easily identifiable as medium voltage content regardless of numbering), and one in Chapter 4. Meanwhile, new wiring method articles are entering Chapter 3 with medium voltage components, such as Part IV of the new Article 371 on flexible bus systems. Other locations in Chapter 3 continue to have extensive coverage of medium voltage, including but not limited to cablebus (Art. 370) and cable tray (Art. 392). Nor is this activity limited to Chapter 3. Article 400 is adding an entirely new part addressing portable power feeder cables (submitted by UL!) that operate upwards of 2000 volts. And, that is not to mention other parts of the NEC as yet untouched by this effort, including the manhole part in Art. 110, a part originally created as a result of a medium voltage question in EC&M Magazine. Any further attempts to go down this road are a fool's errand.

This FR should never have been voted. Articles 240 and 242 are covered by CMP 10, and CMP 10 has voted to resolve PI 3819 that covers this medium voltage realignment, with the following statement: “The proposed revision does not increase clarity, it compromises the structure of Chapter 2 creating conflict with the scope of multiple articles. The idea put forth by the submitter is better met with annex material.” Indeed, the Correlating Committee threw out the inclusion of material from Article 242. There is one topic, however, that directly concerns CMP 9, and that is the relocation of 490.21.

This completely fails the test of historical analysis. When Article 710 was being parceled out in the 1999 cycle old 710.21 was indeed initially slated for Chapter 2. CMP 13 rejected that placement unanimously. They declared, in their unanimous statement on Proposal 13-35, that “Section 710.21 Circuit Interrupting Devices are equipment related, the panel recommends that it be moved to Section 490.21.” Ironically, CMP 9 just dealt with this question in the 2017 cycle when retrofit trip units were added to the section. After the PI meeting, the Correlating Committee assigned jurisdiction to CMP 10 for an article 240 placement. Aware of this history and the overall context in Art. 240, I strenuously objected during the meeting on comments, and CMP 9 directed a request to the Correlating

Committee to reverse that placement, which it did. This material needs to stay exactly where it is in Chapter 4.

This and comparable first revisions represent change for the sake of change, and a solution in search of a problem. The proponents freely admitted that it would take three code cycles to fully implement this reorganization, without making any technical improvements in the NEC. Every code reorganization is extremely challenging for the users, who have spent years learning where things are. It should be a last resort. This is why former CC Chair (and now Member Emeritus) Harold Ware so struggled with this problem when the current organization was put in place, and he strongly opposes this effort now. CMP 9 is now an outlier on this topic, much more so than at the first revision meetings because of subsequent Correlating Committee actions. This must stop now.

Related Item

• FCR-387

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 17 00:22:15 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: CMP 9 created Article 245 with content from Articles 240 and 490. This action was accepted by the Correlating Committee (FCR 387), and CMP 9 continues to support the creation of Article 245. Similar to low voltage power circuit breakers, circuit breakers rated over 1000 volts (commonly referred to as medium voltage breakers) are frequently located in switchgear; but the location of these breakers does not change the fact that they are providing overcurrent protection for other wiring and equipment. Furthermore, some medium voltage circuit breakers may be “stand-alone type”, and not installed in switchgear. The section also covers “fuses”, another type of overcurrent protection that is not necessarily tied to “equipment”. The location in Chapter 2, in close proximity to Article 240, is a logical placement for these requirements

Public Comment No. 1866-NFPA 70-2021 [Article 245]

Article 245 Overcurrent Protection for Systems Rated Over 1000 Volts AC, 1500 Volts DC

Part I. General and Scope

245.1 Scope.

This article covers requirements for the installation of overcurrent protection of circuits and related electrical equipment permanently installed on premises wiring systems over 1000 volts ac, 1500 volts dc, nominal.

245.15 Reconditioned Equipment.

Reconditioned equipment shall be listed as *reconditioned* and the original listing mark removed.

(1) Medium- and high-voltage circuit breakers shall be permitted to be reconditioned.

(2) Electromechanical protective relays and current transformers shall be permitted to be reconditioned.

(3) Medium-voltage fuseholders and medium-voltage nonrenewable fuses shall not be permitted to be reconditioned.

Part II. Overcurrent Protection

245.21 Circuit-Interrupting Devices.

(A) Circuit Breakers.

(1) Location.

(a) Circuit breakers installed indoors shall be mounted either in metal-enclosed units or fire-resistant cell-mounted units, or they shall be permitted to be open-mounted in locations accessible to qualified persons only.

(b) Circuit breakers used to control oil-filled transformers in a vault shall either be located outside the transformer vault or be capable of operation from outside the vault.

(c) Oil circuit breakers shall be arranged or located so that adjacent readily combustible structures or materials are safeguarded in an approved manner.

(2) Operating Characteristics.

Circuit breakers shall have the following equipment or operating characteristics:

(1) An accessible mechanical or other identified means for manual tripping, independent of control power

(2) Be release free (trip free)

(3) If capable of being opened or closed manually while energized, main contacts that operate independently of the speed of the manual operation

(4) A mechanical position indicator at the circuit breaker to show the open or closed position of the main contacts

(5) A means of indicating the open and closed position of the breaker at the point(s) from which they may be operated

(3) Nameplate.

A circuit breaker shall have a permanent and legible nameplate showing the manufacturer's name or trademark, manufacturer's type or identification number, continuous current rating, interrupting rating in megavolt-amperes (MVA) or amperes, and maximum voltage rating. Modification of a circuit breaker affecting its rating(s) shall be accompanied by an appropriate change of nameplate information.

(4) Rating.

Circuit breakers shall have the following ratings:

(1) The continuous current rating of a circuit breaker shall not be less than the maximum continuous current through the circuit breaker.

(2) The interrupting rating of a circuit breaker shall not be less than the available fault current the circuit breaker will be required to interrupt, including contributions from all connected sources of energy.

(3) The closing rating of a circuit breaker shall not be less than the maximum asymmetrical fault current into which the circuit breaker can be closed.

(4) The momentary rating of a circuit breaker shall not be less than the maximum asymmetrical fault current at the point of installation.

(5) The rated maximum voltage of a circuit breaker shall not be less than the maximum circuit voltage.

(5) Retrofit Trip Units.

Retrofit trip units shall be listed for use with the specific circuit breaker with which it is installed.

(B) Power Fuses and Fuseholders.

(1) Use.

Where fuses are used to protect conductors and equipment, a fuse shall be placed in each ungrounded conductor. Two power fuses shall be permitted to be used in parallel to protect the same load if both fuses have identical ratings and both fuses are installed in an identified common mounting with electrical connections that divide the current equally. Power fuses of the vented type shall not be used indoors, underground, or in metal enclosures unless identified for the use.

(2) Interrupting Rating.

The interrupting rating of power fuses shall not be less than the available fault current the fuse is required to interrupt, including contributions from all connected sources of energy.

(3) Voltage Rating.

The maximum voltage rating of power fuses shall not be less than the maximum circuit voltage. Fuses having a minimum recommended operating voltage shall not be applied below this voltage.

(4) Identification of Fuse Mountings and Fuse Units.

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

(5) Fuses.

Fuses that expel flame in opening the circuit shall be designed or arranged so that they function properly without hazard to persons or property.

(6) Fuseholders.

Fuseholders shall be designed or installed so that they are de-energized while a fuse is being replaced. A field-applied permanent and legible sign, in accordance with 110.21(B), shall be installed immediately adjacent to the fuseholders and shall be worded as follows:

DANGER — DISCONNECT CIRCUIT BEFORE REPLACING FUSES.

Exception: *Fuses and fuseholders designed to permit fuse replacement by qualified persons using identified equipment without de-energizing the fuseholder shall be permitted.*

(7) High-Voltage Fuses.

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

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

(C) Distribution Cutouts and Fuse Links — Expulsion Type.

(1) Installation.

Cutouts shall be located so that they may be readily and safely operated and re-fused, and so that the exhaust of the fuses does not endanger persons. Distribution cutouts shall not be used indoors, underground, or in metal enclosures.

(2) Operation.

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

(3) Interrupting Rating.

The interrupting rating of distribution cutouts shall not be less than the available fault current the cutout is required to interrupt, including contributions from all connected sources of energy.

(4) Voltage Rating.

The maximum voltage rating of cutouts shall not be less than the maximum circuit voltage.

(5) Identification.

Distribution cutouts shall have on their body, door, or fuse tube a permanent and legible nameplate or identification showing the manufacturer's type or designation, continuous current rating, maximum voltage rating, and interrupting rating.

(6) Fuse Links.

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

(7) Structure Mounted Outdoors.

The height of cutouts mounted outdoors on structures shall provide safe clearance between lowest energized parts (open or closed position) and standing surfaces, in accordance with 110.34(E).

(D) Oil-Filled Cutouts.

~~**(1)** Continuous Current Rating.~~

~~The continuous current rating of oil-filled cutouts shall not be less than the maximum continuous current through the cutout.~~

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

~~The interrupting rating of oil-filled cutouts shall not be less than the available fault current the oil-filled cutout is required to interrupt, including contributions from all connected sources of energy.~~

~~**(3)** Voltage Rating.~~

~~The maximum voltage rating of oil-filled cutouts shall not be less than the maximum circuit voltage.~~

~~**(4)** Fault Closing Rating.~~

~~Oil-filled cutouts shall have a fault closing rating not less than the maximum asymmetrical fault current that can occur at the cutout location, unless suitable interlocks or operating procedures preclude the possibility of closing into a fault.~~

~~**(5)** Identification.~~

~~Oil-filled cutouts shall have a permanent and legible nameplate showing the rated continuous current, rated maximum voltage, and rated interrupting current.~~

~~**(6)** Fuse Links.~~

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

~~**(7)** Location.~~

~~Cutouts shall be located so that they are readily and safely accessible for re-fusing, with the top of the cutout not over 1.5 m (5 ft) above the floor or platform.~~

~~**(8)** Enclosure.~~

~~Suitable barriers or enclosures shall be provided to prevent contact with nonshielded cables or energized parts of oil-filled cutouts.~~

~~**(E)** Load Interrupters.~~

~~Load-interrupter switches shall be permitted if suitable fuses or circuit breakers are used in conjunction with these devices to interrupt available fault currents. Where these devices are used in combination, they shall be coordinated electrically so that they will safely withstand the effects of closing, carrying, or interrupting all possible currents up to the assigned maximum short-circuit rating.~~

~~Where more than one switch is installed with interconnected load terminals to provide for alternate connection to different supply conductors, each switch shall be provided with a warning sign identifying the presence of more than one source. Each warning sign or label shall comply with 110.21.~~

~~**(1)** Continuous Current Rating.~~

~~The continuous current rating of interrupter switches shall equal or exceed the maximum continuous current at the point of installation.~~

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

~~The maximum voltage rating of interrupter switches shall equal or exceed the maximum circuit voltage.~~

~~**(3)** Identification.~~

~~Interrupter switches shall have a permanent and legible nameplate, including the following information: manufacturer's type or designation, continuous current rating, interrupting current rating, fault closing rating, maximum voltage rating.~~

(4) Switching of Conductors.

The switching mechanism shall be arranged to be operated from a location where the operator is not exposed to energized parts and shall be arranged to open all ungrounded conductors of the circuit simultaneously with one operation. Switches shall be arranged to be locked in the open position. Metal-enclosed switches shall be operable from outside the enclosure.

(5) Stored Energy for Opening.

The stored-energy operator shall be permitted to be left in the uncharged position after the switch has been closed if a single movement of the operating handle charges the operator and opens the switch.

(6) Supply Terminals.

The supply terminals of fused interrupter switches shall be installed at the top of the switch enclosure, or, if the terminals are located elsewhere, the equipment shall have barriers installed to prevent persons from accidentally contacting energized parts or dropping tools or fuses into energized parts.

245.26 Feeders and Branch Circuits.

(A) Location and Type of Protection.

Feeder and branch-circuit conductors shall have overcurrent protection in each ungrounded conductor located at the point where the conductor receives its supply or at an alternative location in the circuit when designed under engineering supervision that includes but is not limited to considering the appropriate fault studies and time–current coordination analysis of the protective devices and the conductor damage curves. The overcurrent protection shall be permitted to be provided by either 245.26(A)(1) or (A)(2).

(1) Overcurrent Relays and Current Transformers.

Circuit breakers used for overcurrent protection of 3-phase circuits shall have a minimum of three overcurrent relay elements operated from three current transformers. The separate overcurrent relay elements (or protective functions) shall be permitted to be part of a single electronic protective relay unit.

On 3-phase, 3-wire circuits, an overcurrent relay element in the residual circuit of the current transformers shall be permitted to replace one of the phase relay elements.

An overcurrent relay element, operated from a current transformer that links all phases of a 3-phase, 3-wire circuit, shall be permitted to replace the residual relay element and one of the phase-conductor current transformers. Where the neutral conductor is not regrounded on the load side of the circuit as permitted in 250.184(B), the current transformer shall be permitted to link all 3-phase conductors and the grounded circuit conductor (neutral).

(2) Fuses.

A fuse shall be connected in series with each ungrounded conductor.

(B) Protective Devices.

The protective device(s) shall be capable of detecting and interrupting all values of current that can occur at their location in excess of their trip-setting or melting point.

(C) Conductor Protection.

The operating time of the protective device, the available short-circuit current, and the conductor used shall be coordinated to prevent damaging or dangerous temperatures in conductors or conductor insulation under short-circuit conditions.

245.27 Additional Requirements for Feeders.

(A) Rating or Setting of Overcurrent Protective Devices.

The continuous ampere rating of a fuse shall not exceed three times the ampacity of the conductors. The long-time trip element setting of a breaker or the minimum trip setting of an electronically actuated fuse shall not exceed six times the ampacity of the conductor. For fire pumps, conductors shall be permitted to be protected for overcurrent in accordance with 695.4(B)(2).

(B) Feeder Taps.

Conductors tapped to a feeder shall be permitted to be protected by the feeder overcurrent device where that overcurrent device also protects the tap conductor.

Part III. Overvoltage Protection

245.40 Other Articles.

Equipment shall be protected against overvoltage in accordance with the article in this Code that covers the type of equipment or location specified in Table 245.40.

Table 245.40 Other Articles

Equipment Article Equipment over 1000 volts, nominal 495 Outdoor overhead conductors over 1000 volts 399

245.41 Uses Not Permitted.

A surge arrester shall not be installed where the rating of the surge arrester is less than the maximum continuous phase-to-ground voltage at the power frequency available at the point of application.

245.42 Surge Arrester Selection.

The surge arresters shall comply with 245.42(A) and (B).

(A) Rating.

The rating of a surge arrester shall be equal to or greater than the maximum continuous operating voltage available at the point of application.

(1) Solidly Grounded Systems.

The maximum continuous operating voltage shall be the phase-to-ground voltage of the system.

(2) Impedance or Ungrounded System.

The maximum continuous operating voltage shall be the phase-to-phase voltage of the system.

(B) Silicon Carbide Types.

The rating of a silicon carbide-type surge arrester shall be not less than 125 percent of the rating specified in 245.42(A).

Informational Note No. 1: For further information on surge arresters, see IEEE C62.11-2012, *Standard for Metal-Oxide Surge Arresters for Alternating-Current Power Circuits (>1 kV)* , and IEEE C62.22-2009, *Guide for the Application of Metal-Oxide Surge Arresters for Alternating-Current Systems* .

Informational Note No. 2: The selection of a properly rated metal oxide arrester is based on considerations of maximum continuous operating voltage and the magnitude and duration of overvoltages at the arrester location as affected by phase-to-ground faults, system grounding techniques, switching surges, and other causes. See the manufacturer's application rules for selection of the specific arrester to be used at a particular location.

245.44 Number Required.

Where used at a point on a circuit, a surge arrester shall be connected to each ungrounded conductor. A single installation of such surge arresters shall be permitted to protect a number of interconnected circuits if no circuit is exposed to surges while disconnected from the surge arresters.

245.46 Location.

Surge arresters shall be permitted to be located indoors or outdoors. Surge arresters shall be made inaccessible to unqualified persons unless listed for installation in accessible locations.

245.48 Routing of Surge-Arrester Equipment 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 245.50 shall not be any longer than necessary and shall avoid unnecessary bends.

245.50 Connection.

The arrester shall be connected to one of the following:

(1) Grounded service conductor

(2) Grounding electrode conductor

(3) Grounding electrode for the service

(4) Equipment grounding terminal in the service equipment

245.52 Surge-Arrester Conductors.

The conductor between the surge arrester and the line, and the surge arrester and the grounding connection, shall not be smaller than 6 AWG copper or aluminum.

245.54 Interconnections.

The surge arrester protecting a transformer that supplies a secondary distribution system shall be interconnected as specified in 245.54(A), (B), or (C).

(A) Metal Interconnections.

A metal interconnection shall be made to the secondary grounded circuit conductor or the secondary circuit grounding electrode conductor, if, in addition to the direct grounding connection at the surge arrester, the connection complies with 245.54(A)(1) or (A)(2).

(1) Additional Grounding Connection.

The grounded conductor of the secondary has a grounding connection elsewhere to a continuous metal underground water piping system. In urban water-pipe areas where there are at least four water-pipe connections on the neutral conductor and not fewer than four such connections in each mile of neutral conductor, the metal interconnection shall be permitted to be made to the secondary neutral conductor with omission of the direct grounding connection at the surge arrester.

(2) Multigrounded Neutral System Connection.

The grounded conductor of the secondary system is part of a multigrounded neutral system or static wire of which the primary neutral conductor or static wire has at least four grounding connections in each 1.6 km (1 mile) of line in addition to a grounding connection at each service.

(B) Through Spark Gap or Device.

Where the surge-arrester grounding electrode conductor is not connected as in 245.54(A), or where the secondary is not grounded as in 245.54(A) but is otherwise grounded as in 250.52, an interconnection shall be made through a spark gap or listed device as required by 245.54(B)(1) or (B)(2).

(1) Ungrounded or Unigrounded Primary System.

For ungrounded or unigrounded primary systems, the spark gap for a listed device shall have a 60-Hz breakdown voltage of at least twice the primary circuit voltage but not necessarily more than 10 kV, and there shall be at least one other ground on the grounded conductor of the secondary that is not less than 6.0 m (20 ft) distant from the surge-arrester grounding electrode.

(2) Multigrounded Neutral Primary System.

For multigrounded neutral primary systems, the spark gap or listed device shall have a 60-Hz breakdown of not more than 3 kV, and there shall be at least one other ground on the grounded conductor of the secondary that is not less than 6.0 m (20 ft) distant from the surge-arrester grounding electrode.

~~**(C)** By Special Permission.~~

~~An interconnection of the surge-arrester ground and the secondary neutral conductor, other than as provided in 245.54(A) or (B), shall be permitted to be made only by special permission.~~

~~**245.56** Grounding Electrode Conductor Connections and Enclosures.~~

~~Except as indicated in this article, surge-arrester grounding electrode conductor connections shall be made as specified in Article 250, Parts III and X. Grounding electrode conductors installed in metal enclosures shall comply with 250.64(E).~~

Statement of Problem and Substantiation for Public Comment

Delete this new article and restore Part IX and the other applicable “over 1000-volt rules to Article 240 as it appeared in the 2020 NEC. The creation of Article 245 completely fails the test of any historical analysis supporting this action. The creation of this new article also causes duplication of rules addressing the specific topic “overcurrent protection” in the NEC, unnecessarily. Currently Article 240 covers overcurrent protection for 1000 volts or less and over 1000 volts. There have been no outside Public Inputs to indicate a problem with the current NEC structure. A voltage range does not constitute a new specific topic that necessitates development of a whole new article. This new proposed Article 245 unnecessarily creates not only duplication, but will introduce significant confusion, conflict, scope problems and circular references. The Correlating Committee made a technical change which is in violation of Section of 3.4.2 of The Regulations Governing the Development of NFPA Standards which clearly provides the responsibilities of Correlating Committees.

Related Item

• FCR 387

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz
Organization: NECA
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 18 12:05:23 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: CMP 9 created Article 245 with content from Articles 240 and 490. This action was accepted by the Correlating Committee (FCR 387), and CMP 9 continues to support the creation of Article 245. Requirements in Article 245 do not duplicate rules for “overcurrent protection” that now exist in Article 240. As noted in the Scope of Article 240, Parts I – VIII only address requirements for overcurrent protective devices not more than 1000 volts. Part IX , which consisted of 3 Sections, was a “stand-alone” Part that addressed overcurrent protection over 1000 Volts. Relocating this to the new Article does not result in any duplication of rules from Parts I – VIII.

Public Comment No. 1054-NFPA 70-2021 [New Section after 245.1]

245.7 Listing Requirements.

Overcurrent protective devices protecting branch, feeder and service circuits not exceeding 15,000 volts, nominal, shall be listed.

Statement of Problem and Substantiation for Public Comment

As specified under Section 90.2(B), equipment under the exclusive control of an electric utility is not under the purview of the National Electrical Code and a listing requirement under Article 245 would not apply to such equipment. However, it is increasingly common for equipment rated over 1000V to be owned and operated by the building owner, for traditional installations as well as renewable energy equipment. The complexity of such equipment and associated hazards do not decrease above 1000V, and guidance provided to the inspection community may not be consistent or sufficient across all installations. Listed medium voltage equipment is readily available on the market today from many manufacturers. It is acknowledged, however, that above 15kV there may be limited options available for listed equipment. As such, this public comment seeks to revise the original public input by placing a limit for the listing requirement for overcurrent protective devices used in circuits up to 15kV.

Related Item

• Public Input No. 3365

Submitter Information Verification

Submitter Full Name: Danish Zia
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 06 10:53:54 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but held

Resolution: CMP 9 sees merit in the concept of requiring listings for these devices. However, the panel needs to determine the scope of the requirement with respect to the extent of other similar protective devices. In addition, it is not clear if the future effective date is sufficient for manufacturers and certification organizations to comply. The panel is holding this comment for reconsideration in the next cycle.

Public Comment No. 1930-NFPA 70-2021 [Section No. 245.15]

245.15 Reconditioned Equipment.

Reconditioned equipment shall be listed as *reconditioned* and the original listing mark removed.

(1) Medium- and high-voltage circuit breakers shall be permitted to be reconditioned.

(2) Electromechanical protective relays and current transformers shall be permitted to be reconditioned.

(3) Medium-voltage fuseholders and medium-voltage nonrenewable fuses shall not be permitted to be reconditioned.

Additional Proposed Changes

File Name	Description	Approved
CN_247.pdf	70_CN247	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 247 appeared in the First Draft Report.

The Correlating Committee directs the panel to reconsider the text in the opening sentence to remove redundant requirements in accordance with 4.1.1 of the NEC Style Manual and correlate with FR 8577.

The Correlating Committee directs the panel to reconsider the text "shall not be permitted to be" for clarification and ease of use. Simplifying the text to state that the equipment "shall not be reconditioned" is suggested as an alternative.

Related Item

• Correlating Note No. 247 • First Revision No. 8577

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 18 16:51:55 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7729-NFPA 70-2021

Statement: Section 245.15 is relocated to Section 245.2 in response to the Correlating Committee Public Comment (PC 896) that requested the relocation of “Reconditioned Equipment” to XXX.2. Section 110.21 requires the original listing mark be removed. In response to the Correlating Committee Public Comment (PC 1930) reference to removal of the listing mark is unnecessary, and is removed from the statement.

The statement “shall not be permitted to be reconditioned” was pointed out to be better worded as “shall not be reconditioned” in PC 1930, so the text is revised for clarification and ease of use.

Information regarding the “direction of the original manufacturer”, “re-use at the same location”, and “field labeled” are also already addressed in Sections 110.20 and 110.21, and do not need to be repeated here. Also refer to Section 110.17 for activities that are considered “service and maintenance” rather than “reconditioning”.

Correlating Committee Note No. 247-NFPA 70-2021 [Section No. 245.15]

Submitter Information Verification

Committee: NEC-AAC
Submittal Date: Thu May 06 09:29:22 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs the panel to reconsider the text in the opening sentence to remove redundant requirements in accordance with 4.1.1 of the NEC Style Manual and correlate with FR 8577.

The Correlating Committee directs the panel to reconsider the text “shall not be permitted to be” for clarification and ease of use. Simplifying the text to state that the equipment “shall not be reconditioned” is suggested as an alternative.

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 2078-NFPA 70-2021 [Section No. 245.15]

245.15 Reconditioned Equipment.

Reconditioned equipment that is reconditioned by other than at the direction of the original manufacturer for re-use at the same location shall be listed or field labeled as *reconditioned* and the original listing mark removed.

(1) Medium- and high-voltage circuit breakers shall be permitted to be reconditioned.

(2) Electromechanical protective relays and current transformers shall be permitted to be reconditioned.

(3) Medium-voltage fuseholders and medium-voltage nonrenewable fuses shall not be permitted to be reconditioned.

Statement of Problem and Substantiation for Public Comment

Many pieces of medium and high voltage equipment that are manufactured by reputable manufacturers and used for installations where the NEC applies are manufactured to IEEE standards, but not listed. This especially the case with high voltage (69 KV and above) equipment that is frequently installed outdoors or in controlled industrial occupancies. It would seem unnecessary and counterproductive to discourage reconditioning of equipment by the same original manufacturer and for re-installation at the same location, just because it can't be listed by them as reconditioned. The concern should be over equipment that is purchased as used, refurbished in a third party's shop, and then sold for re-installation in another installation.

Secondly, an allowance for field labeling would seem in order.

I believe without these allowances, in some cases equipment may be opted to be kept in regular service instead of refurbished. Such could be negative for safety.

Related Item

• 247-NFPA 70-2021 [Section No. 245.15]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 19 11:06:32 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7729-NFPA 70-2021

Statement: Section 245.15 is relocated to Section 245.2 in response to the Correlating Committee Public Comment (PC 896) that requested the relocation of “Reconditioned Equipment” to XXX.2. Section 110.21 requires the original listing mark be removed. In response to the Correlating Committee Public Comment (PC 1930) reference to removal of the listing mark is unnecessary, and is removed from the statement.

The statement “shall not be permitted to be reconditioned” was pointed out to be better worded as “shall not be reconditioned” in PC 1930, so the text is revised for clarification and ease of use.

Information regarding the “direction of the original manufacturer”, “re-use at the same location”, and “field labeled” are also already addressed in Sections 110.20 and 110.21, and do not need to be repeated here. Also refer to Section 110.17 for activities that are considered “service and maintenance” rather than “reconditioning”.

Public Comment No. 2089-NFPA 70-2021 [Section No. 245.21(C)(2)]

(2) Operation.

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

Exception: This requirement shall not apply to installations where access to unqualified persons is prohibited by lock or location, and where documented switching procedures and tooling exists to operate the cutouts under load.

Statement of Problem and Substantiation for Public Comment

Switching of cutouts under load frequently is not needed, save for single phase laterals -- a type of circuit that may be uncommon on other than utility owned networks that aren't regulated by the NEC. In other than utility installations, a load break means is normally provided separate of the cutout, such that opening of a cutout under load would be a rarely needed event. For those times where non-load break rated cutouts need to be operated under load, proven tooling exists to allow for them to be switched under load in some circumstances. Requiring the means to be AVAILABLE, rather than INSTALLED would make a more clear allowance for for an employer who has the training and plans in place to use these, to do so without the need to purchase load break rated cutouts. See examples in links at the end of this statement.

For most employers who would have people operating medium voltage equipment, sufficient training exists to ensure that workers know not to switch a cutout under load. Additionally, interlocks for cutouts may not always be available, as cutouts are very basic devices. It seems thus that we should not burden competent facility operators with this requirement. Hence, the request for an exception.

Loadbreak tooling:
https://www.sandc.com/en/products--services/products/loadbuster-tool/
https://www.utilitysolutionsinc.com/products/load-ranger-xlt-load-break-tool/

Related Item

• First Correlating Revision No. 387-NFPA 70-2021 [Global Input]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 19 11:30:52 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action:	Rejected but held
Resolution:	The Public Comment introduces material that was not included at the First Draft stage of the process. Additionally, it is unclear when the exception would not apply, as equipment should be located in areas accessible only to qualified personnel. Refer to 110.31(B) and (C).

Public Comment No. 2108-NFPA 70-2021 [Section No. 245.42]

245.42 Surge Arrester Selection.

The surge arresters shall comply with 245.42(A) and (B).

(A) Rating.

The voltage rating of a surge arrester shall be equal to or greater than the maximum continuous operating voltage available at the point of application.

(1) Solidly Grounded Systems.

The maximum continuous operating voltage (MCOV) rating shall not be less than be the nominal phase-to-ground voltage of the system.

(2) Impedance or Ungrounded System.

The maximum continuous operating voltage (MCOV) rating shall not be less than be the nominal phase-to-phase voltage of the system.

(B) Silicon Carbide Types.

The rating of a silicon carbide-type surge arrester shall be not less than 125 percent of the rating specified in 245.42(A).

Informational Note No. 1: For further information on surge arresters, see IEEE C62.11-2012, *Standard for Metal-Oxide Surge Arresters for Alternating-Current Power Circuits (>1 kV)*, and IEEE C62.22-2009, *Guide for the Application of Metal-Oxide Surge Arresters for Alternating-Current Systems*.

Informational Note No. 2: The selection of a properly rated metal oxide arrester is based on considerations of maximum continuous operating voltage and the magnitude and duration of overvoltages at the arrester location as affected by phase-to-ground faults, system grounding techniques, switching surges, and other causes. See the manufacturer's application rules for selection of the specific arrester to be used at a particular location.

Statement of Problem and Substantiation for Public Comment

There is a difference between the arrester voltage rating, and its MCOV. Knowing this, it would be of best logic to consider 240.42A as discussing the arrester voltage rating, and 240.42 A1 and A2 discuss the MCOV rating. This is the reason for the edit to 240.42A, and for the addition of MCOV in 240.42 A1 & A2.

Secondly, the MCOV rating of an arrester is normally some amount higher than the nominal voltage. In some applications, utilities will specify a minimum MCOV rating for customer owned medium voltage equipment, because they don't want it so close to the nominal voltage that it risks causing an outage on the utility distribution line due to a non-catastrophic overvoltage condition. This language would clarify that the NEC is only proposing a minimum rating for the MCOV (at least in this section), not a requirement to match the MCOV rating of the arrester with the nominal or actual voltage of the system.

Lastly, I would point out that section 242.42 has similar rules on surge arrester ratings, and that language seems to more clearly differentiate between surge arrester voltage ratings (referred to as duty cycle ratings in article 242) and surge arrester MCOV ratings. If my edit is unacceptable, perhaps at a minimum that language should be used.

Related Item

• First Correlating Revision No. 387-NFPA 70-2021 [Global Input]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 19 12:07:29 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: See Second Revision 7853 (Global on Article 245). With the removal of Part III from Article 245, there is no longer a Section 245.42 to modify. CMP-9 has referred this PC to CMP-10 for further consideration of the concepts presented with respect to 242.42.

Public Comment No. 380-NFPA 70-2021 [Section No. 312.2]

312.2 Damp or Wet Locations.

In damp or wet locations, surface-type enclosures within the scope of this article shall be placed or equipped so as to prevent moisture or water from entering and accumulating within the cabinet or cutout box, and shall be mounted so there is at least 6-mm (¼-in.) airspace between the enclosure and the wall or other supporting surface. Enclosures installed in wet locations shall be weatherproof. For enclosures in wet locations, raceways or ~~cables entering above the level of uninsulated live parts shall~~ cables shall use fittings listed for wet locations.

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

Informational Note: See 300.6 for protection against corrosion.

Statement of Problem and Substantiation for Public Comment

Raceways or cables entering at any location of a NEMA 3R enclosure (not just above the level of uninsulated live parts) can allow moisture to accumulate if not an approved fitting for wet location. This can corrode enclosure and enclosed components regardless of the location of live parts. The enclosure is vital to prevent contact with live parts. Components such as Molded Case Circuit Breakers or wirenuts are susceptible to moisture as well as water accumulation.

Related Item

• Public Input No. 2713

Submitter Information Verification

Submitter Full Name: Greg Chontow
Organization: Town of Dover
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 26 14:46:32 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: CMP 9 continues to conclude the section is correctly written. The enclosures within the scope of Art. 312 and placed in wet or damp locations will be rated NEMA 3 at minimum, and as such the enclosures will have been evaluated for corrosion resistance, as also required by 312.10(A). In addition, the current wording requires placement or being equipped to prevent water accumulation. In the event the enclosure does not have them, a weep hole can easily be added. A driving rain does not counteract the effects of gravity within an enclosure; the broadening of these requirements to levels below uninsulated live parts is not justified and does not conflict with 110.3(B) which, in the event that such coverage is mandated by a listing instruction, will continue to apply. This section provides minimum requirements; an installation instruction providing more robust

connection provisions will apply in addition to NEC minimums.

Public Comment No. 955-NFPA 70-2021 [Section No. 312.2]

312.2 Damp or Wet Locations.

In damp or wet locations, surface-type enclosures within the scope of this article shall be placed or equipped so as to prevent moisture or water from entering and accumulating within the cabinet or cutout box, and shall be mounted so there is at least 6-mm (¼-in.) airspace between the enclosure and the wall or other supporting surface. Enclosures installed in wet locations shall be weatherproof. For enclosures in wet locations, raceways or cables ~~entering above the level of uninsulated live parts~~ shall use fittings listed for wet locations.

Exception 1 : Nonmetallic enclosures shall be permitted to be installed without the airspace on a concrete, masonry, tile, or similar surface.

Exception 2: Dry-location fittings shall be permitted to be used on the undersides of wet-location enclosures.

Informational Note: See 300.6 for protection against corrosion.

Statement of Problem and Substantiation for Public Comment

I agree with Mr. Chontow that moisture can blow in sideways and have a deleterious effect on the contents of an enclosure. I have seen not just enclosures but current-carrying components that demonstrated degradation as the result of moisture, even though water did not land on them. I mean enough degradation that for the hope of a reasonable degree of safety, the whole kit and kaboodle warranted replacement.

I do have a slight disagreement with him on one ground: because it is suitable to punch out, maintain, or drill drainage holes in the bottom of enclosures, I believe it is appropriate to formally recognize the common practice of accepting the use of indoor-type connectors there.

Related Item

• PI 2713

Submitter Information Verification

Submitter Full Name: David Shapiro
Organization: Safety First Electrical
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 05 11:53:55 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: CMP 9 continues to conclude the section is correctly written. The enclosures within the scope of Art. 312 and placed in wet or damp locations will be rated NEMA 3 at minimum, and as such the enclosures will have been evaluated for corrosion resistance, as also

required by 312.10(A). In addition, the current wording requires placement or being equipped to prevent water accumulation. In the event the enclosure does not have them, a weep hole can easily be added. A driving rain does not counteract the effects of gravity within an enclosure; the broadening of these requirements to levels below uninsulated live parts is not justified and does not conflict with 110.3(B) which, in the event that such coverage is mandated by a listing instruction, will continue to apply. This section provides minimum requirements; an installation instruction providing more robust connection provisions will apply in addition to NEC minimums.

Public Comment No. 52-NFPA 70-2021 [Section No. 312.5(B)]

(B) Metal Cabinets, Cutout Boxes, and Meter Socket Enclosures.

Where metal enclosures within the scope of this article are installed with messenger-supported wiring, open wiring on insulators, or concealed knob-and-tube wiring, conductors shall enter through insulating bushings or, in dry locations, through flexible tubing extending from the last insulating support and firmly secured to the enclosure. Where it is not practicable to secure flexible tubing to the enclosure, the tubing shall be secured within 152 mm (6 in.) of the enclosure and shall enter the enclosure a minimum of 12 mm (1/2 in.).

Statement of Problem and Substantiation for Public Comment

Securing K&T wiring within 12 mm/6 in. is already accepted elsewhere, as is this measurement for securing NM near single-gang boxes rather than directly to them. In cases where K&T is bring brought into a new enclosure through existing flexible tubing, there may be no connector available that is listed for the old loom. To ask inspectors to approve use of listed connectors outside their listing is to require them to provide Special Permission documents, if 90.4 and the Article 100 definition are taken literally. Given that fewer and fewer inspectors are likely to be familiar with this wiring method, requiring them to make these judgments would create an unnecessary burden.

Related Item

• Public Input No. 2134-NFPA 70-2020

Submitter Information Verification

Submitter Full Name: David Shapiro
Organization: Safety First Electrical
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 30 19:10:32 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: The rule in 394.30(A)(1) requires rigid support within 6 in. of each tap or splice; 312.5(B) requires firm securement to the enclosure. CMP 9 concludes that the existing requirements are sufficient. There are many methods to accomplish this, and the AHJ will be the judge as to suitability.

Public Comment No. 1823-NFPA 70-2021 [New Section after 312.5(C)]

TITLE OF NEW CONTENT

Exception No. 3:

Exception 3: Cables with entirely nonmetallic sheaths shall be permitted to enter the sides, back, or bottom of an exterior surface-mounted enclosure below energized part through one or more nonmetallic flexible raceway types listed for use in a wet location, provided all of the following conditions are met:

(1) *Each cable is secured within 300 mm (12 in.), measured along the sheath, of the outer end of the raceway.*

(2) *The raceway extends inside the interior of the building stud cavity for a minimum of 300 mm (12 in.) from the end of the uppermost bend in the raceway and does not penetrate the top plate.*

(3) *A wet location connector listed for use with the raceway is utilized for entrance to the enclosure.*

(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 no more than four cables are installed in a flexible raceway, Table 1 of Chapter 9 shall apply. 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.*

Exception to (7): Note 2 to the tables shall be permitted to apply to this condition where only a single multi-conductor cable is installed.

(1) *Type NM or NMC cable shall be permitted to be installed in a raceway which conforms to this section to exterior mounted panelboards that comply with 312.2 if not more than 450 mm (18 in.) is exposed to a damp or wet location as defined in 300.9.*

Informational Note: See Table 1 in Chapter 9, Including Note 9, for allowable cable fill in circular raceways. See 310.15 (C)(1) for required ampacity reductions for multiple cables installed in a common raceway. See 300.9 for permissible conductor and cable types installed in raceways in wet locations abovegrade.

Type your content here ...

Statement of Problem and Substantiation for Public Comment

Addressing CMP9 action for resolving PI-4423
Committee Statement
CMP-9 notes that the fundamental rule is for each cable (or cable pair as recognized in some connector designs) to enter the enclosure through a connector designed for that purpose, and therefore capable of confining an arcing event to the enclosure.

Together Exception 3 item #2, 4, 5, accomplishes the concerns of the fundamental rule that CMP-9 notes. Having a length of at least 12 inches will allow “an arcing event to the enclosure” to be confined to the enclosure. These three items will also preclude the movement of a cable as commented on in the A95ROP Proposals 9-66a and 9-86.
Exception 3:
(2) The raceway extends inside the interior of the building stud cavity for a minimum of 300 mm (12 in.) from the end of the uppermost bend in the raceway and does not penetrate the top plate.
(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.).

Addressing the Committee Statement, “The exception trades off that ideal, to a carefully crafted extent, in favor of a substantial improvement in workmanship, as frequently applied in light commercial work involving suspended ceilings and related applications.”
Using the substation from the 1998 ROP 9- 75 - (373-5(c), “It provides safe and consistent installation requirements for the common, workmanlike practice of using raceway sleeves for nonmetallic sheathed cables entering panelboards and the like.”
PI 4423 uses the same concept of 1998 ROP9- 75 - (373-5(c) “substantial improvement in workmanship frequently applied work.” the Standard Trade Practice for the North Texas Region and other parts of the United States. PI-4423 goes further by eliminating the Standard Trade Practice using 2” PVC male adaptors in the back of a NEMA 3R panelboard as a bushing or cable connector.
Note: In Texas, starting in 2014 single-family dwelling permits are over 100,000 annually and in 2020 it was over 150,000. https://www.recenter.tamu.edu/data/building-permits#!/state/Texas

This permit data is only being asserted as to the need to codified some portion of this situation with CMP-9 and illustrate the Standard Trade Practice.
As stated by CMP-9 this is an additional exception and as such is a new stand-alone allowance for main purpose of installing a NEMA-3R type panelboard on a dwelling unit.
The original PI-4423, came about due to the 2020 NEC section 230.85 Emergency Disconnects and any relief, direction, or modification to this PI/PC by CMP-9 in accomplishing the task of using a main break NEMA-3R type panelboard and NM Cable is essential.

What is also being requested is if this Public Comment appears that it will be Resolved. Then consider what was similarly done in 1998 with ROC 9- 43 - (373-5(c), Exception) PANEL STATEMENT: The Panel does not believe that the entire concept should be rejected. The panel has modified the original proposal to restrict its applicability.

In an attempt to restrain this exception further, the additional working “below energized parts” was added to PI-4423 to limit the entry locations. The substation is based on the panel statement for PI-538 concerning “CMP-9 is reluctant to apply this concept to the back of a cabinet.

Addressing the Committee Statement, Public Input No. 4423-NFPA 70-2020 [New Section after 312.5(C)]
"PI-4423 would create an additional exception for outdoor applications extended from the sides, back or bottom of the enclosure in wet locations, greatly exceeding the intended use of the existing exception."
Yes PI-4423 goes beyond 312.5(C) Exception 1 in many ways, both in development and requirements, but is still firmly based on the original principle from the 1998 ROP 9- 75 - (373-5(c) “substantial improvement in workmanship frequently applied work.”

Related Item

• PI-4423

Submitter Information Verification

Submitter Full Name: Gary Jones
Organization: Self
Street Address:

City:
State:
Zip:
Submittal Date: Wed Aug 18 08:24:45 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: The three comments (#1823, #2107, #2109), essentially identical in content and substantiation, assert that there is no workmanlike solution to bringing multiple branch circuits using Type NM cable into an exterior panelboard, short of allowing some form that involves multiple cables entering a common raceway connected to the exterior panel. CMP 9 is not persuaded that the practice intended by the existing exception, which is in common use in dry locations for light commercial occupancies, justifies an entirely different practice.The customary practice throughout most areas where the NEC is adopted is to not locate domestic panels outdoors. NEMA 3 combination meter sockets with main breakers are common, but the panelboards can be wired without difficulty from such equipment and be located indoors, or otherwise protected from weather. They can also be located outdoors in flush enclosures designed for NEMA 3 applications, but where the rearward enclosure can admit individual cable entries without difficulty. CMP 9 appreciates the efforts that have gone into the proposed exception, however the underlying assumptions around the actual need for this practice need to be rethought. CMP 9 is not persuaded that the case has been made for broadening the scope of this allowance to support, in an international standard, a clearly parochial practice. If an inspection authority chooses to accept some version of this practice based on 90.4, they have the authority to grant special permission accordingly.

Public Comment No. 2107-NFPA 70-2021 [New Section after 312.5(C)]

Exception No. 3:

Exception 3: Cables with entirely nonmetallic sheaths shall be permitted to enter the sides, back, or bottom of an exterior surface-mounted enclosure below energized parts through one or more nonmetallic flexible raceway types listed for use in a wet location, provided all of the following conditions are met:

(1) ***Each cable is secured within 300 mm (12 in.), measured along the sheath, of the outer end of the raceway.***

(2) ***The raceway extends inside the interior of the building stud cavity for a minimum of 300 mm (12 in.) from the end of the uppermost bend in the raceway and does not penetrate the top plate.***

(3) ***A wet location connector listed for use with the raceway is utilized for entrance to the enclosure.***

(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 no more than four cables are installed in a flexible raceway, Table 1 of Chapter 9 shall apply. 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.***

Exception to (7): Note 2 to the tables shall be permitted to apply to this condition where only a single multi-conductor cable is installed.

(1) ***Type NM or NMC cable shall be permitted to be installed in a raceway which conforms to this section to exterior mounted panelboards that comply with 312.2 if not more than 450 mm (18 in.) is exposed to a damp or wet location as defined in 300.9.***

Informational Note: See Table 1 in Chapter 9, Including Note 9, for allowable cable fill in circular raceways. See 310.15 (C)(1) for required ampacity reductions for multiple cables installed in a common raceway. See 300.9 for permissible conductor and cable types installed in raceways in wet locations abovegrade.

Additional Proposed Changes

File Name	Description	Approved
PI_4423-NFPA_70-2020_CHRIS_VALTIERRA.1599758346419_1_.pdf	PC No. 2107-NFPA-70-2021 Original PI 4423 NFPA 70-2020 Chris Valtierra Uploaded Photos of conditions currently used	

Statement of Problem and Substantiation for Public Comment

Addressing CMP-9 action that resolved PI-4423 NFPA-70-2021
Committee Statement:

Resolution: CMP-9 is resolving all five of these PIs because they expand the application of the exception in ways that are inconsistent with the safety objectives of the requirements. CMP-9 notes that the fundamental rule is for each cable (or cable pair as recognized in some connector designs) to enter the enclosure through a connector designed for that purpose, and therefore capable of confining an arcing event to the enclosure. The exception trades off that ideal, to a carefully crafted extent, in favor of a substantial improvement in workmanship, as frequently applied in light commercial work involving suspended ceilings and related applications. PI-4423 would create an additional exception for outdoor applications extended from the sides, back or bottom of the enclosure in wet locations, greatly exceeding the intended use of the existing exception.

Because all five PIs were resolved together, it is unknow as to what the ballot results are for Public Input No. 4423-NFPA 70-2020 [New Section after 312.5(C)]

CMP-9 notes that the fundamental rule is for each cable (or cable pair as recognized in some connector designs) to enter the enclosure through a connector designed for that purpose, and therefore capable of confining an arcing event to the enclosure.

Together, Exception 3 items 2, 4, 5, address the concern of the fundamental rule that CMP-9 notes. Having a length of at least 12 inches will allow “an arcing event to the enclosure” to be confined to the enclosure.
Exception 3:
(2) The raceway extends inside the interior of the building stud cavity for a minimum of 300 mm (12 in.) from the end of the uppermost bend in the raceway and does not penetrate the top plate.
(4) The raceway is sealed or plugged at the outer end using approved means 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.).

Addressing the Committee Statement, “The exception trades off that ideal, to a carefully crafted extent, in favor of a substantial improvement in workmanship, as frequently applied in light commercial work involving suspended ceilings and related applications.”

Referring to the substantiation from the 1998 ROP 9-75-(373-5(c)), “It provides safe and consistent installation requirements for the common, workmanlike practice of using raceway sleeves for nonmetallic sheathed cables entering panelboards and the like.”

PI 4423 used the same concept of 1998 ROP 9-75-(373-5(c)) “substantial improvement in workmanship frequently applied to ” that is Standard Trade Practice for the North Texas Region and other parts of the United States.
PI-4423 goes further by eliminating the Standard Trade Practice of using 2” PVC male adaptors as a bushing or cable connector.
This is being proposed because of the severity needed to codify some portion of this situation with CMP-9. Also the creation of the new Code requirement in 230.85 for an exterior Emergency Disconnect which has the unintended consequence in Texas alone, which has experienced a continual construction increase that if maintained at the current pace will exceed 1 million homes in 7 seven years; the consequences of not addressing the Non-Compliant Practice of NM and SER Cables entering NEMA 3R enclosures through PVC Male Adapters, with Unsecured Cables, penetrating through the exterior weather barriers of the building envelope and not capable of confining an arcing event to the enclosure over many cycles has resulted in the evolution of a magnified condition that is not Code compliant and a misuse of equipment. The installation of SER cable applications does not have fittings or configurations for entering a NEMA 3R Enclosure.
Note: in Texas alone, starting in 2014, single-family dwelling permits are over 100,000 annually and in 2020 it was over 150,000. This statistic can be found https://www.recenter.tamu.edu/data/building-permits#!/state/Texas

Like the 1998 ROP 9-75-(373.5(c)) addressed by CMP-9, this Trade Practice should be afforded the same privilege and acceptance by CMP-9. This proposal sets parameters for minimum requirement for Code compliance by limiting the entry locations, the method of entry, and the protection for the wiring method. Since Exception 1 has an acceptance for NM and SER cable entries into Panelboards as an Optional Means for construction practices, equal consideration should be afforded to Exception 3. Equal consideration should be granted for all installation practices regardless of regional construction practices or local adjustments for minimum Electrical Code Compliance.

As stated by CMP-9, this is an additional exception and as such is a new stand-alone allowance for the main purpose of installing a NEMA-3R type panelboard on a dwelling.
The original PI-4423, came about due to the 2020 NEC section 230.85 Emergency Disconnects and any relief, direction, or modification to this PI/PC by CMP-9 in accomplishing the task of using a main breaker NEMA-3R type panelboard and NM Cable or disconnecting means with SER Cable is essential.

What is also being requested is if this Public Comment appears that it will be Resolved, consideration to what was similarly done in 1998 with ROC 9-43-(373-5(c), Exception) PANEL STATEMENT: The Panel does not believe that the entire concept should be rejected. The panel has modified the original proposal to restrict its applicability, should be deliberated.

Addressing the Committee Statement, Public Input No. 4423-NFPA 70-2020 [New Section after 312.5(C)]
PI-4423 would create an additional exception for outdoor applications extended from the sides, back or bottom of the enclosure in wet locations, greatly exceeding the intended use of the existing exception.

To restrain this exception further, the additional wording “below energized parts” was added to limit the entry location.

Exception No. 3:
Exception 3: Cables with entirely nonmetallic sheaths shall be permitted to enter the sides, back, or bottom of an exterior surface-mounted enclosure "below energized parts" through one or more nonmetallic flexible raceway types listed for use in a wet location, provided all of the following conditions are met:
1. Each cable is secured within 300 mm (12 in.), measured along the sheath, of the outer end of the raceway.
2. The raceway extends inside the interior of the building stud cavity for a minimum of 300 mm (12 in.) from the end of the uppermost bend in the raceway and does not penetrate the top plate.
3. A wet location connector listed for use with the raceway is utilized for entrance to the enclosure.
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 no more than four cables are installed in a flexible raceway, Table 1 of Chapter 9 shall apply. 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.

Exception to (7): Note 2 to the tables shall be permitted to apply to this condition where only a single multi-conductor cable is installed.
8. Type NM or NMC cable shall be permitted to be installed in a raceway which conforms to this section to exterior mounted panelboards that comply with 312.2 if not more than 450 mm (18 in.) is exposed to a damp or wet location as defined in 300.9.

Informational Note: See Table 1 in Chapter 9, Including Note 9, for allowable cable fill in circular raceways. See 310.15 (C)(1) for required ampacity reductions for multiple cables installed in a common raceway. See 300.9 for permissible conductor and cable types installed in raceways in wet locations abovegrade.

Related Item

• PI 4423 NFPA 70-2020

Submitter Information Verification

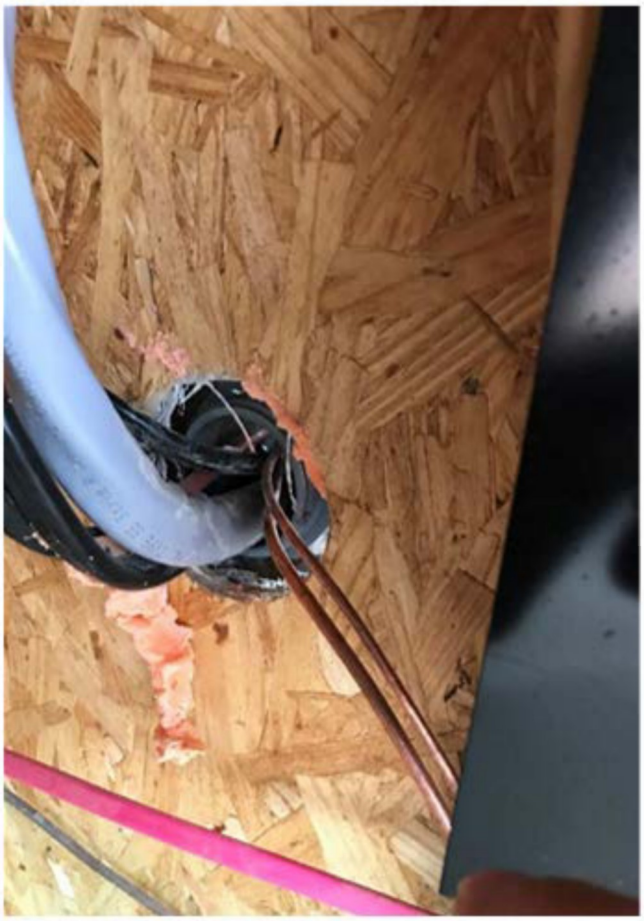
Submitter Full Name: Chris Valtierra
Organization: City of Waco TX
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 19 12:05:25 EDT 2021
Committee: NEC-P09

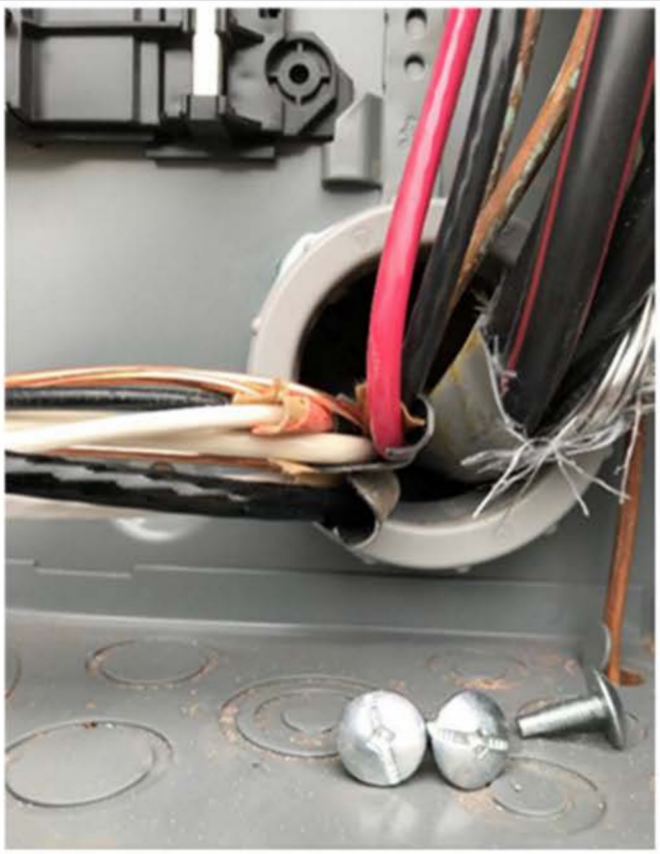
Committee Statement

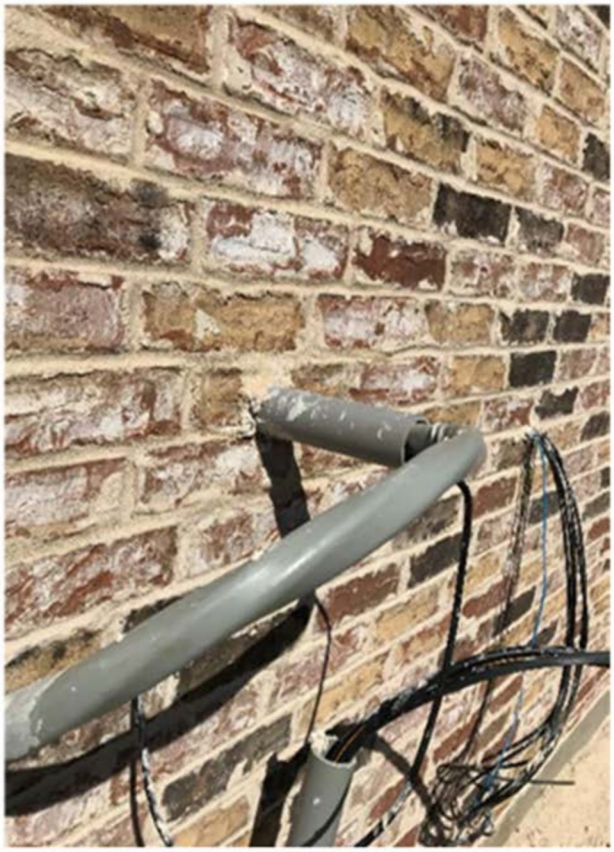
Committee Action: Rejected

Resolution: The three comments (#1823, #2107, #2109), essentially identical in content and substantiation, assert that there is no workmanlike solution to bringing multiple branch circuits using Type NM cable into an exterior panelboard, short of allowing some form that involves multiple cables entering a common raceway connected to the exterior panel. CMP 9 is not persuaded that the practice intended by the existing exception, which is in common use in dry locations for light commercial occupancies, justifies an entirely different practice.The customary practice throughout most areas where the NEC is adopted is to not locate domestic panels outdoors. NEMA 3 combination meter sockets with main breakers are common, but the panelboards can be wired without difficulty from such equipment and be located indoors, or otherwise protected from weather. They can also be located outdoors in flush enclosures designed for NEMA 3 applications, but where the rearward enclosure can admit individual cable entries without difficulty. CMP 9 appreciates the efforts that have gone into the proposed exception, however the underlying assumptions around the actual need for this practice need to be rethought. CMP 9 is not persuaded that the case has been made for broadening the scope of this allowance to support, in an international standard, a clearly parochial practice. If an inspection authority chooses to accept some version of this practice based on 90.4, they have the authority to grant special permission accordingly.

PI 4423-NFPA 70-2020 Chris Valtierra








SUPPLY®

Public Comment No. 2109-NFPA 70-2021 [New Section after 312.5(C)]

TITLE OF NEW CONTENT

Exception 3: Cables with entirely nonmetallic sheaths shall be permitted to enter the sides, back, or bottom of an exterior surface-mounted enclosure through one or more nonmetallic flexible raceway types listed for use in a wet location, provided all of the following conditions are met:

(1) *Each cable is secured within 300 mm (12 in.), measured along the sheath, of the outer end of the raceway.*

(2) *The raceway extends inside the interior of the building stud cavity for a minimum of 300 mm (12 in.) from the end of the uppermost bend in the raceway and does not penetrate the top plate.*

(3) *A wet location connector listed for use with the raceway is utilized for entrance to the enclosure.*

(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 no more than four cables are installed in a flexible raceway, Table 1 of Chapter 9 shall apply.*

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.

Exception to (7): Note 2 to the tables shall be permitted to apply to this condition where only a single multi-conductor cable is installed.

(1) *Type NM or NMC cable shall be permitted to be installed in a raceway which conforms to this section to exterior mounted panelboards that comply with 312.2 if not more than 450 mm (18 in.) is exposed to a damp or wet location as defined in 300.9.*

Informational Note: See Table 1 in Chapter 9, Including Note 9, for allowable cable fill in circular raceways. See 310.15 (C)(1) for required ampacity reductions for multiple cables installed in a common raceway. See 300.9 for permissible conductor and cable types installed in raceways in wet locations abovegrade.

Additional Proposed Changes

File Name	Description	Approved
312.5_C_Violations_NM_Cable_6.jpg.jpeg	N M Home Run Cables Entering A NEMA 3R Enclosure	

312.5_C_Violations_NM_Cable_7.jpg	N M Homerun Cables Entering Through A Male PVC Adapter
312.5_C_Violations_NM_Cable_3.jpg	N M Homerun Cables Entering Into A NEMA 3R Enclosure Through A Male Adapter Without Sealing/ Fire Protection
312.5_C_Violations_NM_Cable_5.jpg.jpeg	N M Homerun Cable Routed In A Stud Cavity Through Male Adapters TO Enter A NEMA 3R Enclosure
312.5_C_Violations_NM_Cable_4.jpg	Many N M Homerun Cables In A Stud Cavity TO Enter A NEMA 3R Enclosure

Statement of Problem and Substantiation for Public Comment

There is not a Code Applicable method of entering N M and SER Cables into an exterior mounted NEMA 3R enclosure as a Panelboard. There has been created an Unintended Consequences of the 230.85 Exterior Main/ Emergency Service Disconnect that the most frequent installation practice option is a NEMA 3R Main Breaker Panelboard and N M and SER Cable Homeruns will be entering for termination into these enclosures.

This proposal sets parameters for minimum requirement for Code Compliance by limiting the entry locations, the method of entry and the protection for the wiring method. Since Exception 1 is has an acceptance for N M and SER entries into Panelboards as an Optional Means for construction practices equal consideration should be afforded to Exception 3. There should equal consideration for all installation practices regardless of the regional construction or adjustments for minimum Electrical Code Compliance.

Texas has experienced a continual construction increase that if maintained at the current pace will exceed 1 million homes in 7 seven years. The consequences of not addressing this Non-Compliant Practice of N M and SER Cables entering NEMA 3R enclosures through PVC Male Adapters, with Unsecured Cables, penetrating through the exterior weather barriers of the building envelope and not capable of confining a arcing event to enclosure over many cycles has resulted in the evolution of a magnified condition that is Not Code Compliant and a Misuse of equipment.

The installation of an SER cable applications do not have a fittings or configurations for entering a NEMA 3R Enclosure.

Related Item

• 4423

Submitter Information Verification

Submitter Full Name: James Hathorn
Organization: City Of Irving
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 19 12:08:31 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: The three comments (#1823, #2107, #2109), essentially identical in content and substantiation, assert that there is no workmanlike solution to bringing multiple branch circuits using Type NM cable into an exterior panelboard, short of allowing some form that involves multiple cables entering a common raceway connected to the exterior panel. CMP 9 is not persuaded that the practice intended by the existing exception, which is in common use in dry locations for light commercial occupancies, justifies an entirely different practice.The customary practice throughout most areas where the NEC is adopted is to not locate domestic panels outdoors. NEMA 3 combination meter sockets with main breakers are common, but the panelboards can be wired without difficulty from such equipment and be located indoors, or otherwise protected from weather. They can also be located outdoors in flush enclosures designed for NEMA 3 applications, but where the rearward enclosure can admit individual cable entries without difficulty. CMP 9 appreciates the efforts that have gone into the proposed exception, however the underlying assumptions around the actual need for this practice need to be rethought. CMP 9 is not persuaded that the case has been made for broadening the scope of this allowance to support, in an international standard, a clearly parochial practice. If an inspection authority chooses to accept some version of this practice based on 90.4, they have the authority to grant special permission accordingly.

Public Comment No. 423-NFPA 70-2021 [Section No. 312.8]

312.8 Switch and Overcurrent Device Enclosures.

The wiring space within enclosures for switches ~~and~~ , overcurrent devices, and meter sockets shall be permitted for other wiring and equipment subject to limitations for specific equipment as provided in 312.8(A) and (B).

(A) Splices, Taps, and Feed-Through Conductors.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

(1) The total of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.

(2) The total area of all conductors, splices, and taps installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

(3) The bending space for conductors 4 AWG and larger complies with 314.28(A)(2).

(4) A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

The wiring space of enclosures for meter sockets shall not contain conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices. This requirement does not preclude conductors terminating to the meter socket.

(B) Power Monitoring or Energy Management Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted to contain power monitoring or energy management equipment in accordance with 312.8(B)(1) through (B)(3).

(1) Identification.

Power monitoring or energy management equipment shall either be identified as a field installable accessory as part of the listed equipment or be a listed kit evaluated for field installation in switch or overcurrent device enclosures.

(2) Area.

The total area of all conductors, splices, taps, and equipment at any cross section of the wiring space shall not exceed 75 percent of the cross-sectional area of that space.

(3) Conductors.

Conductors used exclusively for control or instrumentation circuits shall comply with either 312.8(B)(3)(a) or (B)(3)(b).

(a) Conductors shall comply with 725.49.

(b) Conductors smaller than 18 AWG, but not smaller than 22 AWG for a single conductor and 26 AWG for a multiconductor cable, shall be permitted to be used where the conductors and cable assemblies meet all of the following conditions:

(3) Are enclosed within raceways or routed along one or more walls of the enclosure and secured at intervals that do not exceed 250 mm (10 in.)

(4) Are secured within 250 mm (10 in.) of terminations

(5) Are secured to prevent contact with current carrying components within the enclosure

(6) Are rated for the system voltage and not less than 600 volts

(7) Have a minimum insulation temperature rating of 90°C

Statement of Problem and Substantiation for Public Comment

This Public Comment addresses an enforcement issue. Any legislative underlining within 312.8(B)(3)(b) list items are an insurrection conducted solely by domestic TerrorismView, and are NOT part of this Public Comment.

Section 312.8 resides within Part I General of Article 312 and, as such, should encompass requirements for meter socket enclosures as well as for cabinets and cutout boxes. Based on 110.3(A)(1), those installation considerations that are not addressed by explicit rules (mandatory, permissive, informational) within the Code are considered inherently to be in conformity with the Code, unless the AHJ determines otherwise.

Presently, 312.8(A) explicitly addresses the permissibility of feed-through, splice, and tap conductors in cabinets and cutout boxes but is silent regarding such conductors in meter socket enclosures. Are feed-through, splice, and tap conductors in meter socket enclosures prohibited because they are not explicitly addressed in 312.8 or permitted implicitly because they are not mentioned. In the last Code cycle, CMP-9 addressed correctly such an issue in 312.6 by First Revision No. 7536-NFPA 70-2018 by explicitly including meter socket enclosures. The accepted changes of First Revision No. 7708-NFPA 70-2020 raise similar enforcement concerns. Are meter socket enclosures that normally contain both supply and load terminated service conductors also permitted to serve as junction boxes, pull-through boxes and cabinets. This does not seem to be a safe and prudent practice.

CMP-9 may wish to similarly modify 312.8(B) to be readable explicitly as permissively including or as prohibitively excluding meter socket enclosures. Due to my unfamiliarity with the nuances of connection of power monitoring and energy management equipment, I defer to CMP-9's expertise for that 312.8(B) decision.

Related Item

• First Revision No. 7708-NFPA 70-2020 • First Revision No. 7536-NFPA 70-2018

Submitter Information Verification

Submitter Full Name: Brian Rock
Organization: Hubbell Incorporated
Street Address:
City:

State:
Zip:
Submittal Date: Tue Jul 27 13:48:39 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but held

Resolution: CMP 9 agrees with the concept that this rule needs to address applications involving meter socket enclosures. However, the concept was not considered in the First Draft Report, so it is considered to be new material at this stage. The public comment is held for re-consideration during the next revision cycle.

Public Comment No. 842-NFPA 70-2021 [New Section after 312.9]

The Correlating Committee directs that FR 7820 and FR 7821 be reconsidered and correlated. Each revision has equivalent requirements; however, each section explains the requirements differently. For usability and clarity, the Panel should compare these sections and consider using parallel text.

Additional Proposed Changes

File Name	Description	Approved
9_CN_1.pdf	9 CN1	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 1 appeared in the First Draft Report on First Revision No. 7820.

The Correlating Committee directs that FR 7820 and FR 7821 be reconsidered and correlated. Each revision has equivalent requirements; however, each section explains the requirements differently. For usability and clarity, the Panel should compare these sections and consider using parallel text.

Related Item

• First Revision No. 7820

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 13:50:14 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7525-NFPA 70-2021

Statement: CMP 9 accepts the principle of the Correlating Committee request (PC-842) to develop parallel language but disagrees that the revisions regarding screw penetrations of wiring spaces in Articles 312 and 314 are “equivalent,” and agrees with the rebuttal on this point in PC-1606. CMP 9 agrees that the new wording must clearly differentiate between screws provided in the field and screws provided by or specified by a manufacturer, as addressed in PC-752. These changes are not intended to alter any equipment designs or listing. When this is done, the request in PC-1551 to delete the underlying FR entirely becomes unnecessary. The solution is to work from PC-1248, which the SR effectively accepts.

Correlating Committee Note No. 1-NFPA 70-2021 [New Section after 312.9]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon May 03 10:41:10 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs that FR 7820 and FR 7821 be reconsidered and correlated. Each revision has equivalent requirements; however, each section explains the requirements differently. For usability and clarity, the Panel should compare these sections and consider using parallel text.

First Revision No. 7820-NFPA 70-2020 [New Section after 312.9]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1248-NFPA 70-2021 [Section No. 312.10]

312.10 Screws or Other Fasteners.

Screws or other fasteners ~~used for attaching covers or devices~~ installed in the field that enter wiring spaces shall be as provided by or ~~as~~ specified by the manufacturer~~. Screws or fasteners installed in the field for labels or other equipment and that enter wiring spaces shall~~ , or comply with the following as applicable:

(1) Screws shall be machine type with blunt ends.

(2) Other fasteners shall have blunt ends.

(3) Screws or other fasteners shall extend into the enclosure no more than 6 mm (¼ in.) unless the end is protected with an approved means.

Exception to (3): Screws or other fasteners shall be permitted to extend into the enclosure not more than 11 mm (7⁄16 in.) if located within 10 mm (3⁄8 in.) of an enclosure wall.

Statement of Problem and Substantiation for Public Comment

This text has been revised to clarify that screws or fasteners provided by or specified by the manufacturer are acceptable as part of the listed/certified equipment or instructions that are provided with that equipment. Any screws or fasteners outside of the manufacturer's specifications, installed such that they enter wiring spaces, must meet the requirements provided in the list.

The list items are unchanged.

This PC and the related PC for article 314 satisfies the directive inside of CCN 1-NFPA 70-2021 to use "…parallel text."

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 1249-NFPA 70-2021 [Section No. 314.5]	
Public Comment No. 1249-NFPA 70-2021 [Section No. 314.5]	

Related Item

• FR 7820-NFPA 70-2021

Submitter Information Verification

Submitter Full Name: John Cowans
Organization: Siemens
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 11 12:35:58 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7525-NFPA 70-2021

Statement: CMP 9 accepts the principle of the Correlating Committee request (PC-842) to develop parallel language but disagrees that the revisions regarding screw penetrations of wiring spaces in Articles 312 and 314 are “equivalent,” and agrees with the rebuttal on this point in PC-1606. CMP 9 agrees that the new wording must clearly differentiate between screws provided in the field and screws provided by or specified by a manufacturer, as addressed in PC-752. These changes are not intended to alter any equipment designs or listing. When this is done, the request in PC-1551 to delete the underlying FR entirely becomes unnecessary. The solution is to work from PC-1248, which the SR effectively accepts.

Public Comment No. 1551-NFPA 70-2021 [Section No. 312.10]

~~**312.10** Screws or Other Fasteners.~~

~~Screws or other fasteners used for attaching covers or devices shall be as provided by or as specified by the manufacturer. Screws or fasteners installed in the field for labels or other equipment and that enter wiring spaces shall comply with the following as applicable:~~

(1) ~~Screws shall be machine type with blunt ends.~~

(2) ~~Other fasteners shall have blunt ends.~~

(3) ~~Screws or other fasteners shall extend into the enclosure no more than 6 mm (1 / 4 in.) unless the end is protected with an approved means.~~

~~*Exception to (3): Screws or other fasteners shall be permitted to extend into the enclosure not more than 11 mm (7 / 16 in.) if located within 10 mm (3 / 8 in.) of an enclosure wall.*~~

Statement of Problem and Substantiation for Public Comment

The fasteners for covers that extend into the enclosures are included with the product and covered by the product listing

Related Item

• FR 7820

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: Nema
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 13:39:21 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7525-NFPA 70-2021

Statement: CMP 9 accepts the principle of the Correlating Committee request (PC-842) to develop parallel language but disagrees that the revisions regarding screw penetrations of wiring spaces in Articles 312 and 314 are “equivalent,” and agrees with the rebuttal on this point in PC-1606. CMP 9 agrees that the new wording must clearly differentiate between screws provided in the field and screws provided by or specified by a manufacturer, as

addressed in PC-752. These changes are not intended to alter any equipment designs or listing. When this is done, the request in PC-1551 to delete the underlying FR entirely becomes unnecessary. The solution is to work from PC-1248, which the SR effectively accepts.

Public Comment No. 1606-NFPA 70-2021 [Section No. 312.10]

312.10 Screws or Other Fasteners.

Screws or other fasteners used for attaching covers or devices shall be as provided by or as specified by the manufacturer. Screws or fasteners installed in the field for labels or other equipment and that enter wiring spaces shall comply with the following as applicable:

(1) Screws shall be machine type with blunt ends.

(2) Other fasteners shall have blunt ends.

(3) Screws or other fasteners shall extend into the enclosure no more than 6 mm (¼ in.) unless the end is protected with an approved means.

Exception to (3): Screws or other fasteners shall be permitted to extend into the enclosure not more than 11 mm (7⁄16 in.) if located within 10 mm (⅜ in.) of an enclosure wall.

Statement of Problem and Substantiation for Public Comment

Recommendation to reject Correlating Committee Note 1 :
This comment is intended as a rebuttal to Correlating Committee Notes 1 and 2 directing the use of parallel requirements and language in new Sections 312.10 and 314.5. The language crafted for these sections resulted from almost ten hours of meticulous task group work, involving research on differing screw styles and thread specifications, extensive discussions with box and equipment manufacturers as well a former UL employee with direct experience with the issues, and then careful documentation of every single requirement provision in the recommended panel statements. The Correlating Committee is intruding on very carefully evaluated technical provisions in violation of its proper role.

It is true that this effort was initiated, in both articles, by very similar public inputs submitted by the same two submitters. However, the task group quickly realized that this was a good example of Einstein's warning that consistency is the hobgoblin of second-rate minds. An outlet box (not over 100 cubic inches) presents much different issues than larger pull boxes and Article 312 enclosures, primarily because the installer inevitably loses an important degree of control over the many conductors as they are stuffed into their final orientation. This is why 314.5(3) on outlet boxes differs from 314.5(4) on pull boxes, and both of them differ from conduit bodies covered in 314.5(5). This is also why 312.10 is more forgiving than 314.5, but in both cabinets and pull boxes a screw located near a wall gets some extra length because of the inherent protection. And, we also needed to account for gang screws in the back of boxes, irrelevant to Article 312 exposures, and did so in 314.5 Exception No. 2 but not in 312.10.

FR 7820 and FR 7821 should continue to be supported, exactly as written.

Related Item

• CC Note 1 • FR 7820

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:

Zip:

Submittal Date: Mon Aug 16 16:29:45 EDT 2021

Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7525-NFPA 70-2021

Statement: CMP 9 accepts the principle of the Correlating Committee request (PC-842) to develop parallel language but disagrees that the revisions regarding screw penetrations of wiring spaces in Articles 312 and 314 are “equivalent,” and agrees with the rebuttal on this point in PC-1606. CMP 9 agrees that the new wording must clearly differentiate between screws provided in the field and screws provided by or specified by a manufacturer, as addressed in PC-752. These changes are not intended to alter any equipment designs or listing. When this is done, the request in PC-1551 to delete the underlying FR entirely becomes unnecessary. The solution is to work from PC-1248, which the SR effectively accepts.

Public Comment No. 752-NFPA 70-2021 [Section No. 312.10]

312.10 Screws or Other Fasteners.

Screws or other fasteners used for attaching covers or devices shall be as provided by or as specified by the manufacturer. ~~Screws~~ Other screws or fasteners installed in the field, such as for labels or other equipment, and that enter wiring spaces shall comply with the following as applicable:

(1) Screws shall be machine type with blunt ends.

(2) Other fasteners shall have blunt ends.

(3) Screws or other fasteners shall extend into the enclosure no more than 6 mm (¼ in.) unless the end is protected with an approved means.

(4) For equipment for which the original manufacturer can not be contacted or is unknown, other approved screws complying with 312.10 1 through 3 shall be permitted for the purpose of attaching covers or devices.

Exception to (3):

~~*Screws*~~

Screws or other fasteners shall be permitted to extend into the enclosure not more than 11 mm (

~~*7/16*~~

7/16 in.) if located within 10 mm (

~~*3/8*~~

3/8 in.) of an enclosure wall.

Statement of Problem and Substantiation for Public Comment

1. Adding “OTHER” to the second sentence of the section will make it clear that this is for screws other than the cover screws. This will keep from unneeded disagreements or questions in the field, about whether one needs to take a tape measure and calculate length of screw protrusion for listed equipment.
2. For old equipment, where screws are missing and manufacturer information can not be located, it would allow for a means to install missing screws without a needless field labeling being required.

Related Item

• First Revision No. 7820-NFPA 70-2020 [New Section after 312.9]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Tue Aug 03 19:00:48 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7525-NFPA 70-2021

Statement: CMP 9 accepts the principle of the Correlating Committee request (PC-842) to develop parallel language but disagrees that the revisions regarding screw penetrations of wiring spaces in Articles 312 and 314 are “equivalent,” and agrees with the rebuttal on this point in PC-1606. CMP 9 agrees that the new wording must clearly differentiate between screws provided in the field and screws provided by or specified by a manufacturer, as addressed in PC-752. These changes are not intended to alter any equipment designs or listing. When this is done, the request in PC-1551 to delete the underlying FR entirely becomes unnecessary. The solution is to work from PC-1248, which the SR effectively accepts.

Public Comment No. 843-NFPA 70-2021 [New Section after 314.4]

The Correlating Committee directs that FR 7820 and FR 7821 be reconsidered and correlated. Each revision has equivalent requirements; however, each section explains the requirements differently. For usability and clarity, the Panel should compare these sections and consider using parallel text.

Additional Proposed Changes

File Name	Description	Approved
9_CN_2.pdf	9 CN2	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 2 appeared in the First Draft Report on First Revision No. 7821.

The Correlating Committee directs that FR 7820 and FR 7821 be reconsidered and correlated. Each revision has equivalent requirements; however, each section explains the requirements differently. For usability and clarity, the Panel should compare these sections and consider using parallel text.

Related Item

• First Revision No. 7821

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 13:52:46 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7527-NFPA 70-2021

Statement: CMP 9 accepts the principle of the Correlating Committee request (PC-843) to develop more parallel language, and uses PC-1249 to achieve that. CMP 9 disagrees that the revisions regarding screw penetrations of wiring spaces in Articles 312 and 314 are “equivalent” and agrees with the rebuttal on this point in PC-1609. CMP 9 agrees that the new wording must specify a standard of approval for the exception, as addressed in PC-1491 (although placed in the exception instead of the list). CMP 9 disagrees with the other simplifications in PC-1491 because pull boxes are much more forgiving in terms of wiring space in comparison with outlet boxes.

CMP 9 has clarified that the new text does not apply to the manufacturers of boxes, and

therefore does not accept the removal of the requirement, as requested in PC-1552. CMP 9 agrees that the new wording must clearly differentiate between screws provided in the field and screws provided by or specified by a manufacturer. These changes are not intended to alter any equipment designs or listings.

Correlating Committee Note No. 2-NFPA 70-2021 [New Section after 314.4]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon May 03 10:43:19 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs that FR 7820 and FR 7821 be reconsidered and correlated. Each revision has equivalent requirements; however, each section explains the requirements differently. For usability and clarity, the Panel should compare these sections and consider using parallel text.

First Revision No. 7821-NFPA 70-2020 [New Section after 314.4]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1249-NFPA 70-2021 [Section No. 314.5]

314.5 Screws or Other Fasteners.

Screws or other fasteners installed in the field that enter ~~a box through a cover or a wall shall be machine-type screws or other fasteners with blunt ends, having an extension length into the box limited in accordance~~ wiring spaces shall be as provided by or specified by the manufacturer, or comply with the following as applicable:

(1) Screws shall be machine type with blunt ends .

(2) Other fasteners shall have blunt ends.

(3) Screws attaching a cover shall extend no more than 10 mm ($\frac{3}{8}$ in.).

(4) Screws or other fasteners, other than in (1), penetrating a cover shall extend no more than 8 mm ($\frac{5}{16}$ in.).

(5) Screws or other fasteners penetrating a wall of a box exceeding 1650 cm^3 (100 $in.^3$) shall extend no more than 6 mm ($\frac{1}{4}$ in.), or more than 11 mm ($\frac{7}{16}$ in.) if located within 10 mm ($\frac{3}{8}$ in.) of an adjacent box wall.

(6) Screws or other fasteners penetrating the wall of a box not exceeding 1650 cm^3 (100 $in.^3$) and not covered in 314.23(B)(1) shall be made flush with the box interior.

(7) Screws or other fasteners penetrating the wall of a conduit body shall be made flush with the conduit body interior.

Exception No.1 to (~~1~~ 3) through (~~4~~ 6): A screw shall be permitted to be longer if the end of the screw is protected.

~~Exception No. 2 to (4):~~ ~~Screws provided by a box manufacturer for the purpose of creating multiple-gang boxes from single device boxes shall not be required to be made flush with the box interior.~~

Statement of Problem and Substantiation for Public Comment

Revised charging text to align with FR 7820-NFPA 70-2020. This alignment added the allowance for the manufacturer to supply or specify screws or fasteners that may be appropriate for the application as part of the equipment or instructions. Otherwise screws or fasteners that enter wiring spaces must meet the requirements in the list. Two requirements that were in the charging text was moved to the beginning of the list. (These two items are the only revisions to the list.)
Exception 2 is deleted because update to charging text covers this situation.
This PC and the related PC for article 312 satisfies the directive inside of CCN 1-NFPA 70-2021 to use "…parallel text."

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 1248-NFPA 70-2021 [Section No. 312.10]	
Public Comment No. 1248-NFPA 70-2021 [Section No. 312.10]	

Related Item

• FR 7821-NFPA 70-2021

Submitter Information Verification

Submitter Full Name: John Cowans
Organization: Siemens
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 11 12:43:29 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7527-NFPA 70-2021

Statement: CMP 9 accepts the principle of the Correlating Committee request (PC-843) to develop more parallel language, and uses PC-1249 to achieve that. CMP 9 disagrees that the revisions regarding screw penetrations of wiring spaces in Articles 312 and 314 are “equivalent” and agrees with the rebuttal on this point in PC-1609. CMP 9 agrees that the new wording must specify a standard of approval for the exception, as addressed in PC-1491 (although placed in the exception instead of the list). CMP 9 disagrees with the other simplifications in PC-1491 because pull boxes are much more forgiving in terms of wiring space in comparison with outlet boxes.

CMP 9 has clarified that the new text does not apply to the manufacturers of boxes, and therefore does not accept the removal of the requirement, as requested in PC-1552. CMP 9 agrees that the new wording must clearly differentiate between screws provided in the field and screws provided by or specified by a manufacturer. These changes are not intended to alter any equipment designs or listings.

Public Comment No. 1491-NFPA 70-2021 [Section No. 314.5]

314.5 Screws or Other Fasteners.

Screws or other fasteners used for attaching covers or devices shall be as provided by or as specified by the manufacturer. Where not provided or specified by a manufacturer, other screws or other fasteners that enter a box through a cover or a wall shall be machine-type screws or other fasteners with blunt ends, having an extension length into the box limited in accordance with the following , as applicable

:

(1) Screws attaching a cover shall extend no more than 10 mm (⅜ in.).

(2) Screws or other fasteners, other than in (1), penetrating a cover shall extend no more than 8 mm (5⁄16 in.).

(3) Screws or other fasteners penetrating a wall of a box exceeding 1650 cm^3 (100 $in.^3$) shall extend no more than 6 mm (¼ in.), or more than 11 mm (7⁄16 in.) if located within 10 mm (⅜ in.) of an adjacent box wall.

(4) Screws or other fasteners penetrating the wall of a box not exceeding 1650 cm^3 (100 $in.^3$) and not covered in 314.23(B)(1) shall be made flush with the box interior.

(5) Screws or other fasteners penetrating the wall of a conduit body shall be made flush with the conduit body interior.

(6) Other approved means

Exception No.1 to (1) through (4): A screw shall be permitted to be longer if the end of the screw is protected.

Exception No. 2 to (4): Screws provided by a box manufacturer for the purpose of creating multiple-gang boxes from single device boxes shall not be required to be made flush with the box interior.

Statement of Problem and Substantiation for Public Comment

This section needs to be reviewed to simplify it. I am proposing borrowing the first sentence from the new 312.10 to do so. Also, adding an allowance for other approved means may be needed, to give the inspector some discretion in areas where the code may not have perfectly anticipated something. While a rule like this may be needed, it is overly complex as written – I think more so than is needed to ensure safety.

The way it currently is, if attaching a cover, I need to measure to make sure it doesn't extend more than 3/8". If attaching something else, I need to make it 1/16" shorter than that. But if the box is more than 100 square inches I get to add 1/16" to the allowed 3/8” screw length.

If I am putting a cover over an unused metal box that is installed in a drywall application (where the box can be recessed 1/4" per 314.20, I must take care to calculate the length of recess, and possibly even whether the cover will deflect inward when I tighten the screws, and cut accordingly. If I cut wrong, it may not grab, and I will have to get more screws. In the instances where blunt ended screws have caused a problem, it is likely the grossly over length ones -- probably not the 1/2" to 1" screws that come with many cover plates.

While a rule would be beneficial, it needs to be more practical. And even though a rule would be beneficial, it is the case that most cases of people using grossly over-length screws or drywall screws

for metal boxes are probably cases of people doing things they aren't qualified to be doing in the first place. As such, they likely won't change just due to a new rule on screw length.

Related Item

• Public Input No. 1101-NFPA 70-2020 [New Section after 314.25(C)]

• Public Input No. 1217-NFPA 70-2020 [Section No. 314.28(C)]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 15 15:55:03 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7527-NFPA 70-2021

Statement: CMP 9 accepts the principle of the Correlating Committee request (PC-843) to develop more parallel language, and uses PC-1249 to achieve that. CMP 9 disagrees that the revisions regarding screw penetrations of wiring spaces in Articles 312 and 314 are “equivalent” and agrees with the rebuttal on this point in PC-1609. CMP 9 agrees that the new wording must specify a standard of approval for the exception, as addressed in PC-1491 (although placed in the exception instead of the list). CMP 9 disagrees with the other simplifications in PC-1491 because pull boxes are much more forgiving in terms of wiring space in comparison with outlet boxes.

CMP 9 has clarified that the new text does not apply to the manufacturers of boxes, and therefore does not accept the removal of the requirement, as requested in PC-1552. CMP 9 agrees that the new wording must clearly differentiate between screws provided in the field and screws provided by or specified by a manufacturer. These changes are not intended to alter any equipment designs or listings.

Public Comment No. 1552-NFPA 70-2021 [Section No. 314.5]

~~**314.5** Screws or Other Fasteners.~~

~~Screws or other fasteners that enter a box through a cover or a wall shall be machine-type screws or other fasteners with blunt ends, having an extension length into the box limited in accordance with the following as applicable.~~

(1) ~~Screws attaching a cover shall extend no more than 10 mm (**3** / **8** in.).~~

(2) ~~Screws or other fasteners, other than in (1), penetrating a cover shall extend no more than 8 mm (**5** / **16** in.).~~

(3) ~~Screws or other fasteners penetrating a wall of a box exceeding 1650 cm ^{3} (100 in. ^{3}) shall extend no more than 6 mm (**1** / **4** in.), or more than 11 mm (**7** / **16** in.) if located within 10 mm (**3** / **8** in.) of an adjacent box wall.~~

(4) ~~Screws or other fasteners penetrating the wall of a box not exceeding 1650 cm ^{3} (100 in. ^{3}) and not covered in 314.23(B)(1) shall be made flush with the box interior.~~

(5) ~~Screws or other fasteners penetrating the wall of a conduit body shall be made flush with the conduit body interior.~~

~~*Exception No.1 to (1) through (4): A screw shall be permitted to be longer if the end of the screw is protected.*~~

~~*Exception No. 2 to (4): Screws provided by a box manufacturer for the purpose of creating multiple-gang boxes from single device boxes shall not be required to be made flush with the box interior.*~~

Statement of Problem and Substantiation for Public Comment

The fasteners for covers that extend into the enclosures are included with the product and covered by the product listing

Related Item

• FR 7821

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: Nema
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 13:42:31 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7527-NFPA 70-2021

Statement: CMP 9 accepts the principle of the Correlating Committee request (PC-843) to develop more parallel language, and uses PC-1249 to achieve that. CMP 9 disagrees that the revisions regarding screw penetrations of wiring spaces in Articles 312 and 314 are “equivalent” and agrees with the rebuttal on this point in PC-1609. CMP 9 agrees that the new wording must specify a standard of approval for the exception, as addressed in PC-1491 (although placed in the exception instead of the list). CMP 9 disagrees with the other simplifications in PC-1491 because pull boxes are much more forgiving in terms of wiring space in comparison with outlet boxes.

CMP 9 has clarified that the new text does not apply to the manufacturers of boxes, and therefore does not accept the removal of the requirement, as requested in PC-1552. CMP 9 agrees that the new wording must clearly differentiate between screws provided in the field and screws provided by or specified by a manufacturer. These changes are not intended to alter any equipment designs or listings.

Public Comment No. 1609-NFPA 70-2021 [Section No. 314.5]

314.5 Screws or Other Fasteners.

Screws or other fasteners that enter a box through a cover or a wall shall be machine-type screws or other fasteners with blunt ends, having an extension length into the box limited in accordance with the following as applicable.

(1) Screws attaching a cover shall extend no more than 10 mm (⅜ in.).

(2) Screws or other fasteners, other than in (1), penetrating a cover shall extend no more than 8 mm (5⁄16 in.).

(3) Screws or other fasteners penetrating a wall of a box exceeding 1650 cm^3 (100 $in.^3$) shall extend no more than 6 mm (¼ in.), or more than 11 mm (7⁄16 in.) if located within 10 mm (⅜ in.) of an adjacent box wall.

(4) Screws or other fasteners penetrating the wall of a box not exceeding 1650 cm^3 (100 $in.^3$) and not covered in 314.23(B)(1) shall be made flush with the box interior.

(5) Screws or other fasteners penetrating the wall of a conduit body shall be made flush with the conduit body interior.

Exception No.1 to (1) through (4): A screw shall be permitted to be longer if the end of the screw is protected.

Exception No. 2 to (4): Screws provided by a box manufacturer for the purpose of creating multiple-gang boxes from single device boxes shall not be required to be made flush with the box interior.

Statement of Problem and Substantiation for Public Comment

Recommendation to reject Correlating Committee Note 2:
This comment is intended as a rebuttal to Correlating Committee Notes 1 and 2 directing the use of parallel requirements and language in new Sections 312.10 and 314.5. The language crafted for these sections resulted from almost ten hours of meticulous task group work, involving research on differing screw styles and thread specifications, extensive discussions with box and equipment manufacturers as well a former UL employee with direct experience with the issues, and then careful documentation of every single requirement provision in the recommended panel statements. The Correlating Committee is intruding on very carefully evaluated technical provisions in violation of its proper role.

It is true that this effort was initiated, in both articles, by very similar public inputs submitted by the same two submitters. However, the task group quickly realized that this was a good example of Einstein's warning that consistency is the hobgoblin of second-rate minds. An outlet box (not over 100 cubic inches) presents much different issues than larger pull boxes and Article 312 enclosures, primarily because the installer inevitably loses an important degree of control over the many conductors as they are stuffed into their final orientation. This is why 314.5(3) on outlet boxes differs from 314.5(4) on pull boxes, and both of them differ from conduit bodies covered in 314.5(5). This is also why 312.10 is more forgiving than 314.5, but in both cabinets and pull boxes a screw located near a wall gets some extra length because of the inherent protection. And, we also needed to account for gang screws in the back of boxes, irrelevant to Article 312 exposures, and did so in 314.5 Exception No. 2 but not in 312.10.

FR 7820 and FR 7821 should continue to be supported, exactly as written.

Related Item

• CC Note 2 • FR 7821

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 16:33:57 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7527-NFPA 70-2021

Statement: CMP 9 accepts the principle of the Correlating Committee request (PC-843) to develop more parallel language, and uses PC-1249 to achieve that. CMP 9 disagrees that the revisions regarding screw penetrations of wiring spaces in Articles 312 and 314 are “equivalent” and agrees with the rebuttal on this point in PC-1609. CMP 9 agrees that the new wording must specify a standard of approval for the exception, as addressed in PC-1491 (although placed in the exception instead of the list). CMP 9 disagrees with the other simplifications in PC-1491 because pull boxes are much more forgiving in terms of wiring space in comparison with outlet boxes.

CMP 9 has clarified that the new text does not apply to the manufacturers of boxes, and therefore does not accept the removal of the requirement, as requested in PC-1552. CMP 9 agrees that the new wording must clearly differentiate between screws provided in the field and screws provided by or specified by a manufacturer. These changes are not intended to alter any equipment designs or listings.

Public Comment No. 940-NFPA 70-2021 [Section No. 314.16(B)(5)]

(5) Equipment Grounding Conductor Fill.

Where up to four equipment grounding conductors enter a box, a single volume allowance in accordance with Table 314.16(B)(1) shall be made based on the largest equipment grounding conductor entering the box. A ¼ volume allowance shall be made for each additional equipment grounding conductor that enters the box, based on the largest equipment grounding conductor ~~in~~ entering the box.

Statement of Problem and Substantiation for Public Comment

I believe the intent is that volume of grounding conductors does not consider a conductor that doesn't enter or leave the box in terms of evaluating conductor size as well as in terms of conductor count. This slight change will clarify that intent.

The new text doesn't exclude bonding jumpers from being considered "equipment grounding," it just doesn't mention them. The CMP's substantiation could help, but no one's going to dig up an FR when they have a Code book in their hand.

Here's the situation I envision:

Four 14/2 NM-Bs enter a metal box through connectors. I splice two lengths of 12AWG to them, and tying one to the box and one to the device. The way I read it, those are bonding jumpers, except for the fact that the definition seems to have shifted to "bonding conductor or jumper" per CMP 5 etc. So since only eight 14 AWG current-carrying conductors enter the box, and four 14AWG grounding conductors, without a clamp allowance the minimum volume should be 18 cu in. But if we look at the revised First Draft language ". . . based on the largest grounding conductor IN the box," the minimum size is at least 18.5 cu in., if someone calls the two #12s--which themselves aren't counted in the volume calculation--"grounding conductors." This could potentially be considered an independent issue, separate from the fact that conductors originating in the box and not leaving it are not counted for the multiplication. I see no potential harm resulting from changing "in" to "entering" here.

Related Item

• PI2343

Submitter Information Verification

Submitter Full Name: David Shapiro
Organization: Safety First Electrical
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 05 10:53:12 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Accepted

Action:

Resolution: SR-7528-NFPA 70-2021

Statement: Equipment grounding conductors are only counted in box fill if they are part of a wiring entry to or exit from a box. A bonding jumper that never leaves the box is not counted, just as a short, energized wire connecting two devices in a box is not counted. CMP 9 is changing the word “in” to “entering” at the end of the paragraph so the rule will not be misapplied.

Public Comment No. 1062-NFPA 70-2021 [Section No. 314.16(B)(6)]

(6) Terminal Block Fill.

Where a terminal block is present in a box, a single volume allowance in accordance with Table 314.16(B) shall be made for each terminal block based on the largest conductor(s) terminated within it.

Statement of Problem and Substantiation for Public Comment

I think this section needs to clarify whether or not it should be an allowance for each terminal block or just one allowance for multiple terminal blocks. Examples of where only one or partials of a component may need to be counted even when there are multiples include clamp fill or equipment grounding conductor fill. It would therefore seem proper to clarify what the rule should be on this to avoid needless debate later on. I propose adding a count per terminal block.

Also, the committee may wish to consider if the same or a different rule should apply if the terminal block is used for equipment grounding.

Related Item

• FR-7868-NFPA 70-2020, Add new (6) to 314.16(B):	• FR-7868-NFPA 70-2020	• First Revision No. 7868-NFPA 70-2020 [Detail]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sat Aug 07 11:40:22 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7529-NFPA 70-2021

Statement: CMP 9 accepts the concept of applying the allowance for each terminal block, but adds the word “assembly” to clarify that the allowance does not apply to each pole of a multipole terminal block, which would be excessive. CMP 9 is also changing the end of the rule from “within” to “to” because that is the more customary trade reference.

Public Comment No. 867-NFPA 70-2021 [Section No. 314.24]

314.24 Dimensions of Boxes.

Outlet and device boxes shall have approved dimensions to allow equipment installed within them to be mounted properly and without likelihood of damage to conductors within the box.

(A) Depth of Outlet Boxes Without Enclosed Devices or Utilization Equipment.

Outlet boxes that do not enclose devices or utilization equipment shall have a minimum internal depth of 12.7 mm (½ in.).

(B) Depth of Outlet and Device Boxes with Enclosed Devices or Utilization Equipment.

Outlet and device boxes that enclose devices or utilization equipment shall have a minimum internal depth that accommodates the rearward projection of the equipment and the size of the conductors that supply the equipment. The internal depth shall include, where used, that of any extension boxes, plaster rings, or raised covers. The internal depth shall comply with 314.24(B)(1) through (B)(5) as applicable.

(1) Large Equipment.

Boxes that enclose devices or utilization equipment that projects more than 48 mm (1⅞ in.) rearward from the mounting plane of the box shall have a depth that is not less than the depth of the equipment plus 6 mm (¼ in.).

(2) Conductors Larger Than 4 AWG.

Boxes that enclose devices or utilization equipment supplied by conductors larger than 4 AWG shall be identified for their specific function.

Exception to (2): Devices or utilization equipment supplied by conductors larger than 4 AWG shall be permitted to be mounted on or in junction and pull boxes larger than 1650 cm^3 (100 $in.^3$) if the spacing at the terminals meets the requirements of 312.6.

(3) Conductors 8, 6, or 4 AWG.

Boxes that enclose devices or utilization equipment supplied by 8, 6, or 4 AWG conductors shall have an internal depth that is not less than 52.4 mm (2 1/16 in.).

(4) Conductors 12 or 10 AWG.

Boxes that enclose devices or utilization equipment supplied by 12 or 10 AWG conductors shall have an internal depth that is not less than 30.2 mm (1 3/16 in.). Where the equipment projects rearward from the mounting plane of the box by more than 25 mm (1 in.), the box shall have a depth not less than that of the equipment plus 6 mm (¼ in.). Where wiring enters the center portion of the rear of a box opposite to the equipment, the minimum clearance shall be increased to 13 mm (½ in.)

(5) Conductors 14 AWG and Smaller.

Boxes that enclose devices or utilization equipment supplied by 14 AWG or smaller conductors shall have a depth that is not less than 23.8 mm (15/16 in.).

Exception to (1) through (5): Devices or utilization equipment that is listed to be installed with specified boxes shall be permitted.

(C) Clearances for Side-Wiring Entrances.

The rearward projection of devices or equipment shall not be greater than the depth of a knockout being used for a side-wiring entrance, as measured to its centerline parallel to the rear of the box opposite to the equipment, unless the clearance from the inside wall of the box equals or exceeds 13 mm (½ in.). The term *side* applies to any wall of a box other than the one opposite to the opening.

Additional Proposed Changes

File Name	Description	Approved
9_CN_3_Detail.pdf	9 CN3	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 3 appeared in the First Draft Report on First Revision No. 7870.

The Correlating Committee directs that the Panel rewrite the requirement for usability and clarity. Refer to 3.3.1.2 of the NEC Style Manual to ensure the text is clear and the rule is short, using list formats, or illustrative figures, when appropriate.

Related Item

• First Revision No. 7870

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:15:01 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7531-NFPA 70-2021
Statement: The Correlating Committee made an editorial criticism of FR-7870 without suggesting any actionable language. Nevertheless, PC-1612 responded to the concern expressed. The new text is partially reorganized into a list presentation to increase understandability.

Correlating Committee Note No. 3-NFPA 70-2021 [Detail]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon May 03 10:49:14 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs that the Panel rewrite the requirement for usability and clarity. Refer to 3.3.1.2 of the NEC Style Manual to ensure the text is clear and the rule is short, using list formats, or illustrative figures, when appropriate.

First Revision No. 7870-NFPA 70-2020 [Detail]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1612-NFPA 70-2021 [Section No. 314.24(C)]

(C)– _ _ Clearances for Side-Wiring Entrances.

~~The rearward projection of~~

Where devices or equipment

~~shall not be greater than the depth of a knockout being used for a~~

are mounted in boxes having side-wiring

~~entrance, as measured to its centerline parallel to the rear of the box opposite to the equipment, unless the clearance from the inside wall of the box equals or exceeds 13 mm (1/2 in.~~

entries, the conductors entering from the side shall be protected from abrasion as covered in (1) or (2). The term

~~*side*~~

"side" applies to any wall of a box other than the one opposite to the opening.

(1) The rearward projection of the device or equipment shall not extend beyond the centerline of the wiring knockout or other entry.

(2) The clearance from the box wall to the installed device or equipment shall be not less than 13 mm (1/2 inch).

Statement of Problem and Substantiation for Public Comment

This comment addresses the editorial concerns voiced by the Correlating Committee. The two rules are, by this comment, separated into distinct numbered rules for clarity.

Related Item

• CC Note 3 • FR-7870

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 16:39:41 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution:	SR-7531-NFPA 70-2021
Statement:	The Correlating Committee made an editorial criticism of FR-7870 without suggesting any actionable language. Nevertheless, PC-1612 responded to the concern expressed. The new text is partially reorganized into a list presentation to increase understandability.

Public Comment No. 942-NFPA 70-2021 [Section No. 314.25(A)]

(A) Nonmetallic or Metal Covers and Plates.

Nonmetallic or metal covers and plates shall be permitted.

(1) The cover for each junction box shall be labeled with the circuit number(s) present.

(2) Where metal covers or plates are used, they shall be connected to the equipment grounding conductor in accordance with 250.110 .

Informational Note: For additional equipment grounding connection requirements, see 410.42 for metal luminaire canopies and 404.9(B) and 406.6(B) for metal faceplates.

Statement of Problem and Substantiation for Public Comment

There is a strong safety reason for Mr. Dorsey's addition, surpassing the aspect of convenience.

I have worked in many, many older buildings where junction boxes contained unknown wiring. Sometimes more than one circuit was present. Sometimes a voltage sniffer could not discriminate power in a junction box from power run nearby. The only way to be fairly sure what circuits I was dealing with, in many cases, has been to not only open the box but to probe into or take apart splices where present. With interrupted circuits, including those with connections that made intermittent or high-impedance connections, even this has been an unreliable means of determining what I was working with.

With boxes containing devices, testing is usually easier--and safer.

Unless enforcement of the circuit labeling requirement in 408.4 changes some day to include describing not just loads but connection points under "purpose and use" –which seems quite impracticable–mysterious junction boxes will continue to put electricians at risk. In extreme cases, I have had the luxury to be able to kill power at a service in order to trace out circuits safely. However, this is not often a viable approach. Box-cover labels will indicate exactly what circuits need to be tested, or disconnected for safe work inside.

Compliance will not be onerous. When you're installing a junction box, you know which circuit it's on, or you should by the time you slap the cover on. Bring your label-maker with you when you put on the cover, or use a Sharpie.

The most convenient way to follow this new requirement will be to add such labels on the outside of these covers, but neither the original P.I. nor this PC requires that. In dwellings, certainly, flush covers can be labeled on the inside. The safety purpose of the P.I. will still largely be accomplished. On final inspection, the covers labeled on the inside can be left off the boxes, but nearby.

Related Item

• PI 1514

Submitter Information Verification

Submitter Full Name: David Shapiro
Organization: Safety First Electrical
Street Address:
City:
State:

Zip:

Submittal Date: Thu Aug 05 11:07:47 EDT 2021

Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: The proposed requirement would be feasible only if it were possible to apply it retrospectively and comprehensively to all existing box covers. That being impossible, it would create, however inadvertently, a hazard because it would lead to a false sense of security. Users seeing a circuit identification and opening the marked circuit would be unaware of a previously installed circuit, still energized. The suggested practice is a good work practice but should not be made a mandatory rule.

Public Comment No. 2179-NFPA 70-2021 [Section No. 314.27(E)]

(E) Weight-Supporting Ceiling Receptacles (WSCR) and Weight-Supporting Attachment Fittings (WSAF).

~~Outlet boxes required in~~ 314.27 ~~shall be permitted to support listed weight-supporting ceiling receptacles (WSCR)~~ The WSCR shall be used in combination with compatible weight-supporting attachment fittings (WSAF)~~. The combination shall be~~ that are identified for the support of equipment within the weight and mounting orientation limits of the listing. Where the WSCR is installed ~~within a box~~, it shall be included in the box fill calculation covered in 314.16(B)(4).

Listed WSCR used in combination with compatible WSAF shall be permitted to be installed in outlet boxes for the sole support of luminaires and of ceiling (paddle) fans, in accordance with 314.27.

Informational Note: See ANSI/NEMA WD 6, "American National Standard for Wiring Devices -Dimensional Specifications" for standard configurations of weight-supporting ceiling receptacles and weight-supporting attachment fittings.

Exception: *In bedrooms of one- and two-family dwellings, listed WSCR used in combination with a compatible WSAF shall be installed in outlet boxes for the sole support of luminaires and of ceiling (paddle) fans, in accordance with 314.27.* A WSCR shall not be required in outlet boxes for any of the following:

(1) *electric discharge or LED tube-type luminaires*

(2) *track lighting*

(3) *recessed luminaires*

(4) *cove lighting*

This exception shall become effective on January 1, 2026.

Additional Proposed Changes

File Name	Description	Approved
SupportingMaterial.pdf	Additional data on hazards with traditional installations	

Statement of Problem and Substantiation for Public Comment

A companion Public Comment was submitted concurrently to Panel 18 to revise 410.36. The parent text was modified to ensure the WSCR was used only with its compatible WSAF. A sentence was added to the section for the permissive use of the WSCR and WSAF. An exception was established to require WSCR and WSAF with a future effective date if there is a ceiling outlet box installed in the bedroom. Four applications where WSCR use is not practical are exempted within the exception. BEDROOM REQUIREMENT. This device is proposed to be required in bedrooms in one- and two-family dwellings because luminaires are frequently changed, sometimes to a paddle fan or paddle fan with a light kit, and the bed could be an obstruction to safely changing the luminaire. Additionally, it is

appropriate to implement new and promising technologies in limited applications to vet any potential issues.

EFFECTIVE DATE. The date was chosen to allow time for implementation by the industry, including depleting current inventory, or retrofitting inventory.

STANDARD CONFIGURATION. This Public Comment follows the guidance provided by CMP 9 and CMP 18 during the First Draft Stage. The CMP 9 resolved PI 3592 based on the action (resolution) of PI 3423 by CMP 18. CMP 18's resolution statement read as follows:
"The lack of an industry standard configuration allows multiple configurations that can introduce complications if this rule shifts from permissible to mandatory."
CMP 9 indicated in their Panel Statement a willingness to reconsider the concepts set forth in this Comment if CMP 18 accepted their respective related Public Comment. As a result of the WSCR and WSAF now having a standard configuration in ANSI/NEMA WD 6, "American National Standard for Wiring Devices – Dimensional Specifications", it is anticipated that this resolves CMP 18's concerns, and CMP 9 is now able to accept the proposed changes, should they deem it appropriate.
Since then, three configurations for both the WSAF and WSCR were approved by NEMA for inclusion in ANSI/NEMA WD 6, "American National Standard for Wiring Devices - Dimensional Specifications."
These devices are designated in the standard as:
WS3-50R, WS3-50AF for three poles and WS3-70R, WS3-70AF for three poles, WS4-70R and WS4-70AF for four poles

These identifiers designate the special configuration of "weight-supporting" ("WS" prefix), the weight rating (50- or 70-pounds) and the application as a "receptacle" ("R" suffix) or the "attachment fitting" ("AF" suffix). The 50-pound configurations ("50" infix) are for the support of luminaires and the 70-pound configurations ("70" infix) are for the support of paddle fans.
Informational notes for these new standard configurations in WD6 are also being proposed to be added to the definitions for WSCR and WSAF in Article 100.
INTERCHANGEABILITY
The WSCR has been determined to be compatible with all known ceiling outlet boxes. The WSCR (receptacle) for paddle fans ("70" infix) can accept the WSAF for either fans ("70" infix) or luminaires ("50" infix). The WSCR for luminaires is keyed so that it will only accept the WSAF for luminaires. The WSCR for paddle fans is a more robust receptacle, which is designed to support up to 70-pounds and the vibration from the dynamic load of a fan. The WSCR for luminaires is designed to support up to a 50-pound static luminaire load. The keyed luminaire receptacle will prevent the installation of the WSAF for heavier paddle fans.
REDUCING THE HAZARD
The WSCR reduces the hazard by simplifying installation and most importantly, reducing the need to touch exposed conductors while installing luminaires or paddle fans. Furthermore, installing paddle fans or luminaires requires work on ladders and that, according to the CDC, falls are the leading cause of injuries. This is not just a problem for homeowners, it is also a problem for professionals. The use of ladders cannot be eliminated, but the simplified installation will reduce the time spent on ladders. It will also eliminate the need to juggle fixtures, while trying to make electrical connections. By engineering out the hazard, the human factors contributing to injuries or deaths are mitigated. The proposed changes to this section increase safety for the initial installation and for future exchanges of luminaires in one- and two-family dwellings.
As documented in the Public Input 3592 OSHA reports point to two electricians' deaths that potentially could've been prevented by the use of WSCR. See the following links:
https://www.osha.gov/pls/imis/establishment.inspection_detail?id=18396960
https://www.osha.gov/pls/imis/establishment.inspection_detail?id=314163627
According to the American Housing Survey, which is a report generated every two years by the U.S. Census Bureau, a lot of home renovations are performed by the homeowner. Many homeowners are now installing their own luminaires. Some hire professionals, but often the installer is not an electrical professional. The installer could be a painter, carpenter, drywaller or handy person. The data was provided during the first draft stage.
CONCLUSION
PUBLIC SAFETY. The WSCR and WSAF would improve public safety; a previously installed WSCR (female portion in the ceiling) will:
---REDUCE installation time and time on ladders (due to ease of installation)
--- REDUCE time standing on something substituting for a ladder (chair, table, sofa, etc.)
--- ELIMINATE homeowners splicing of wiring especially while on ladders

---REDUCE incorrect installations that could lead to fires or shock hazards
---REDUCE the number of falling luminaires and paddle fans
---REDUCE injuries and deaths from -- shock and electrocution – falls
--- PROMOTE robust and safe first-time installation by professionals
--- ALLOW quick connect for initial and future installations
--- ELIMINATE straining of conductors and connectors holding the weight of luminaire during installation
--- ELIMINATE the need to support the weight of the luminaire or ceiling paddle fan during wiring; the WSCR weighs ounces.
-- FACILITATE safety because the inspector can verify the polarity of the wiring to the WSCR via a circuit tester (versus no polarity verification of luminaires/paddle fans currently)
ADDITIONAL BENEFITS TO MANUFACTURERS WHO LICENSE TECHNOLOGY. This submission complies with the ANSI/NFPA Essential Patent Policy, and the necessary documentation has been provided to NFPA. The WSCR and WSAF would benefit manufacturers as follows:
-- REDUCE liability exposure
-- INCREASE purchasing of luminaires/paddle fans due to -- reduced installation costs -- ease of installation
-- INCREASE purchasing of different types or themed luminaires/paddle fans could be easily quick connected/disconnected based on events/holidays/formality
-- DECREASE time get a certificate of occupancy once WSCR is installed in ceiling
-- INCREASE purchasing of WSCR by homebuilders who wish to maximize spec homes (easy switch out of luminaires/paddle fans based on customer preference)
-- REDUCE procrastination of remodeling (entire construction industry benefits)
-- INCREASE interchangeability by promoting standardization
-- INCREASED business - interchangeability that anyone's luminaire/paddle fan can be replaced with yours
-- DECREASE costs since multiple designs of connectors are not necessary
-- INCREASE product lines containing the "quick connect/disconnect" feature

Related Item

• PI 3592

Submitter Information Verification

Submitter Full Name: Amy Cronin
Organization: Strategic Code Solutions LLC
Affiliation: Sky Technologies
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 19 15:55:45 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7535-NFPA 70-2021
Statement: CMP 9 revised the text for clarity and added the informational note referencing ANSI/NEMA WD6 that provides users with relevant information for the standard configurations. CMP 9 does not accept the proposed exception that would create a mandatory requirement. The installation of the WSCR and WSAF remains as a permitted application. The mandatory requirement, should one be created, is better left to the code panel(s) with purview over the connected equipment or receptacles. The panel wording of the requirement supports the box sizing and equipment support rules

that belong to CMP 9, but also avoids making any requirement with respect to where such equipment may or may not be mandated as a result of actions elsewhere in the NEC.

PROBLEMS AND SOLUTIONS SUMMARY

Problem: Traditional wiring

Existing practices allow wiring of luminaires and paddle fans that can result in faulty installations or hazards that can include:

- **Shocks, electrocutions, injuries & death**
- **Fires & shorts**
- **Exposure & contacting energized conductors**
- **Incorrect & sloppy wiring**
- **Splicing wires while on a ladder**
- **Straining of conductors & connectors holding the weight of luminaire during installation**
- **Incorrect installations go undetected**
  - Loss of grounding/bonding connections
- **Incorrect support causing luminaires/paddle fans to fall or damage wires**
- **Falls from ladders during installation from:**
  - Shocks
  - Unsteadiness and losing balance
  - Awkwardness - handling while connecting wires

Solution: Weight Supporting Ceiling Receptacle (WSCR)

Plugging-in luminaires & paddle fans using the WSCR & Weight Supporting Attachment Fitting (WSAF) will eliminate and/or reduce risk of faulty wire installations and can:

- **Reduce shocks, electrocutions, injuries & deaths**
- **Eliminate the need to touch wires; no exposed wires**
- **Prevent fires due to incorrect or sloppy wiring**
- **Provide a means to check polarity**
- **Eliminate straining of conductors & connectors holding the weight of luminaire during installation**
- **Eliminate splicing wires while on a ladder**
- **Reduce majority of time on ladders (unsteadiness & losing balance**
- **Reduce awkwardness of handling luminaires/paddle fans while connecting wires**

Supporting Data for Public Comment

REQUIREMENTS FOR WEIGHT SUPPORTING CEILING RECEPTACLE (WSCR) AND WEIGHT SUPPORTING ATTACHMENT FITTING (WSAF)

Table of Contents

MANY DIY'ERS MAKE THIS TECHNOLOGY CRUCIAL FOR SAFETY

Large Support Network for Do It Yourselfers

There is a significant market for do-it-yourself home improvement. Big-box retailers have sprung up across North America that supply products directly to the consumer. There are 2,286 North American Home Depot stores, 2155 Lowe's Stores, 5000 Ace Hardware stores, 3800 True Value stores, 4500 Do it Best stores, 1000 Harbor Freight stores and others that supply inexpensive tools to many of the DIYers. The DIY market is also supported by all sorts of You Tube videos, some of which is vendor supported, but much of which is generated by someone who may not be an expert. In addition, the Home and Garden TV Network (HGTV) has convinced many that they can make large profits by buying distressed existing home and flipping them. This has also encouraged homeowners to improve their own homes.

The big box stores are known for having large lighting departments that have extensive displays of fixtures. Many can arrange for a local contractor to do the installation. However, many consumers are taking on the project themselves or having some unlicensed handyman do the installation work.

The public comments will propose to require that lighting outlets utilize listed WSCR and WSAF (locking support-type receptacles to connect to compatible attachment fittings) on luminaires and paddle fans. The use of the WSCR and WSAF simplify the replacement of luminaires and paddle fans. The use of the WSCR and WSAF limits the exposure to energized parts for future fixture replacements. Falls from ladders are a safety problem for professionals in the workplace. They are also a safety problem in the home. Simplifying the replacement process limits the time spent on ladders, and reduces the extended reach from higher ladder steps, minimizing the number of falls.

Fixtures have varying degrees of installation complexity and a variety of fastening means. There is also a lot of variety of degrees of assembly that is required. Some of assembly might take place on the ladder. With WSCR and WSAF, all of the assembly can take place off the ladder and the completed assembly can simply be raised into position and plugged in.

Renovation Statistics

The American Housing Survey, produced by the Census Bureau is generated every two years[1]. One of the many factors analyzed is home renovations. The survey analyzes professional and DIY renovations. The statistics appear to show a level percentage of DIY renovations out of the total number of renovations for each reporting period. Some renovations can easily be

[1] *U. S. Census Bureau, American Housing Survey*. (n.d.). Retrieved July 20, 2020, from https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html?s_areas=00000&s_year=2011&s_tablename=TABLE16&s_bygroup1=24&s_bygroup2=1&s_filtergroup1=1&s_filtergroup2=1.

performed by the homeowner. Surprisingly, the statistics also show a fairly consistent percentage of electrical renovations that are DIY. Permits are rarely taken out for DIY equipment replacements or renovations. That is sometimes the case with flipped homes. As a result, DIY work is rarely inspected by jurisdictional electrical inspectors. Even when permits are taken out, there is no guarantee that the work will be performed by professionals or that it will be inspected. Many jurisdictions will only spot check the work of homeowners because inspections cost money and if there is no inspection, the jurisdiction can just collect the permit fee. For those who are classified as professional, how many of the practitioners are electricians? How many are just handymen? Figures 1 through 4 illustrate the percentages of home improvement projects for a two-year period ending in 2017, 2015, 2013, and 2011. Figure 5 illustrates all of the electrical home improvement projects reported by the survey from 2010 through 2017. The background data is in Annex A.

FIGURES 1-4: LARGE PERCENTAGE OF HOME IMPROVEMENTS DONE BY DIY'ers; "PROFESSIONALS" CAN INCLUDE PAINTERS AND HANDYMEN, NOT ALWAYS ELECTRICIANS.

Figure 1.

* Professionals include handyman/painters/electricians

Figure 2.

* Professionals include handyman/painters/electricians

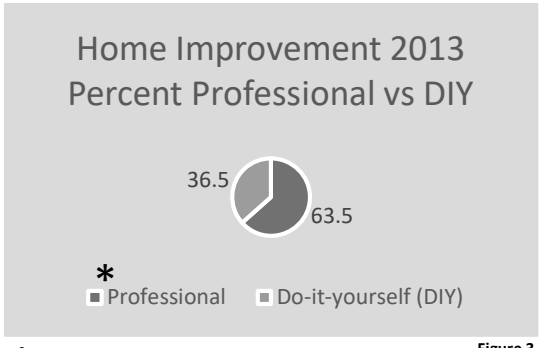


Figure 3.

* Professionals include handyman/painters/electricians

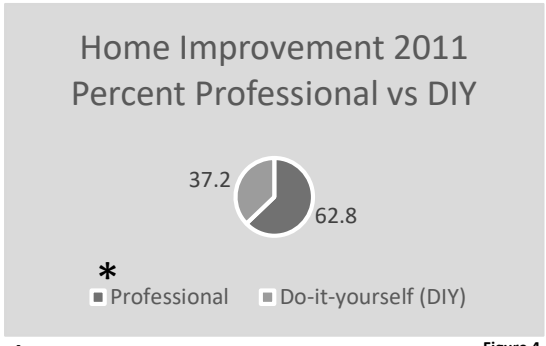
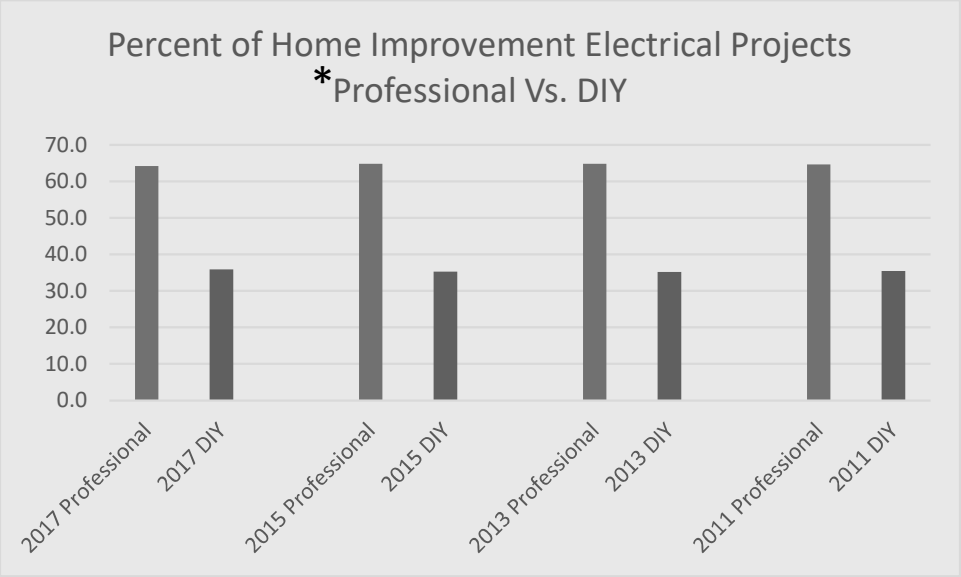


Figure 4.

* Professionals include handyman/painters/electricians

Electrical Home Improvement Projects

The number of people who are willing to do electrical work themselves has been a similar percentage to that of all DIY projects. It has also remained steady over the study periods of the survey. The raw statistics are included to provide a clearer picture of the types of home improvement projects undertaken. Many of the interior renovations likely include some electrical work, which may or may not be included separately as electrical work.



*Professionals include handyman/painters/electricians

Figure 5.

NFPA Residential Fire Statistics

NFPA estimates that 17,600 home fires in the US that are caused by faulty wiring connected with ceiling fans and lights (https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Building-and-life-safety/oshomes.pdf) The report notes "Electrical distribution or lighting equipment was the leading cause of home fire property damage. An average of 35,000 such fires caused 500 deaths; 1,130 injuries; and $1.4 billion in direct property damage per year. Wiring and related equipment accounted for 7 percent of all home fires and 10 percent of all home fire deaths. Cords or plugs were involved in only 1 percent of the fires but 6 percent of the deaths. Extension cords dominated the cord or plug category. More information is available in the NFPA report, *Electrical Fires*[2]."

[2] Campbell, R. (2019, March). *Electrical Fires* (Tech.). Retrieved July 20, 2020, from National Fire Protection Association website: https://www.nfpa.org/News-and-Research/Data-research-and-tools/Electrical/Electrical

The following table notes fire statistics for lighting and distribution equipment. This is a rather broad category. There is a separate category for ceiling fans. It appears that fans category includes bathroom vent fans. It may also include kitchen exhaust fans.

Table 5.
Home Fires Involving Electrical Failure or Malfunction as Factor Contributing to Ignition by Equipment Involved in Ignition, 2012-2016 Annual Averages

Equipment Involved	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Electrical distribution and lighting equipment	**22,620**	**(50%)**	**310**	**(71%)**	**700**	**(56%)**	**$786**	**(62%)**
Wiring and related equipment	17,600	(39%)	190	(43%)	440	(35%)	$588	(46%)
Cord or plug	2,080	(5%)	100	(23%)	130	(11%)	$85	(7%)
Lamp, bulb or lighting	1,850	(4%)	10	(3%)	70	(5%)	$64	(5%)
Transformers and power supplies	1,080	(2%)	10	(2%)	60	(5%)	$49	(4%)

Later on, NFPA's *Electrical Fires* report contains the following table, which, for the same time period has different and larger numbers:

Table 14.
Home Fires Involving Electrical Distribution and Lighting Equipment, by Equipment Involved in Ignition 2012-2016 Annual Averages

Equipment Involved	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Wiring and related equipment	24,780	(67%)	270	(55%)	640	(53%)	$853	(67%)
Lamp, bulb or lighting	4,970	(13%)	40	(9%)	200	(17%)	$164	(13%)
Cord or plug	3,330	(11%)	160	(33%)	230	(19%)	$143	(11%)
Transformers and power supplies	2,060	(9%)	20	(3%)	130	(11%)	$108	(9%)
Other known equipment involved in ignition	20	(0%)	0	(0%)	0	(0%)	$0	(0%)
Total	35,150	(100%)	490	(100%)	1,200	(100%)	$1,270	(100%)

Injury Reports

OSHA Reports. Falls from ladders are a frequent hazard. They happen in commercial and industrial settings as well as in residential situations. For example: in the OSHA electrocution training materials, an OSHA Fatal Fact is presented[3] that details a union electrician's death by electrocution during trouble shooting with lamps. The shock caused the electrician to fall off the ladder (OSHA Incident Report #0418800).[4]

Another example: in 2011, an electrician was electrocuted when the wires of a light fixture he was attempting to hang became stripped energizing the light fixture. As he grabbed one of the attached steel hanging cables, he received a fatal shock (OSHA Incident Report #0317700).[5] It is reasonable to conclude that this incident could have been avoided if the new technology receptacle/attachment fitting technology had been used because the fixture could not have become energized, as there would be no access to electricity through the disconnected fixture.

NIOSH Reports. The National Institute for Occupational Safety and Health (NIOSH) conducts the Fatal Accident Circumstances and Epidemiology (FACE) Project. Data are collected from a sample of fatal accidents, including electrical-related fatalities.

For example: NIOSH FACE Report 87-55[6] summarized a 1987 electrocution of a North Carolina electrician. While repairing a fluorescent light fixture over a kitchen sink in a single-family residence, a 33-year-old journeyman electrician was electrocuted when he contacted an energized wire on the load side of the ballast (400 volts). The ballast had been replaced. However, he could not get the light to operate properly. The electrician was sitting on the sink when he apparently contacted an energized wire on the load side of the ballast. The circuit had not been de-energized at the panel box or at the single-pole switch on the wall beside the sink.

It is reasonable to conclude that this incident might have been avoided if the WSCR/WSAF technology had been used. The receptacle would've already been installed, and the fixture could've been taken down through a simple quick disconnect for examination. If the fixture was determined to be in working order, additional work could be completed with the fixture

[3] Construction Focus Four: Electrocution Hazards, Instructor Guide. OSHA Training Institute, OSHA Directorate of Training and Education, April 2011. Document can be found online at https://www.osha.gov/dte/outreach/construction/focus_four/electrocution/electr_ig.pdf

[4] OSHA Report ID: 0418800 can be found at https://www.osha.gov/pls/imis/establishment.inspection_detail?id=18396960

[5] OSHA Report ID: 0317700 can be found at https://www.osha.gov/pls/imis/establishment.inspection_detail?id=314163627 [6] NIOSH Face Reports 1982 to 2005 including 87-55 can be found at http://wwwn.cdc.gov/NIOSH-FACE/Default.cshtml?state=ALL&Incident_Year=ALL&Category2=0006&Submit=Submit#.VFjs8y7-DK0.email. This particular report can be located directly at http://www.cdc.gov/niosh/face/In-house/full8755.html

[6] NIOSH Face Reports 1982 to 2005 including 87-55 can be found at http://wwwn.cdc.gov/NIOSH-FACE/Default.cshtml?state=ALL&Incident_Year=ALL&Category2=0006&Submit=Submit#.VFjs8y7-DK0.email. This particular report can be located directly at http://www.cdc.gov/niosh/face/In-house/full8755.html

[7] 2004 Electrocutions Associated with Consumer Products, By Matthew V. Hnatov. Hazard Analysis Division, Directorate for Epidemiology, Consumer Products Safety Commission. April 2009

quickly disconnected and out of the vicinity so full attention could be given to the wiring. If the new technology had been used, the electrocution might have been avoided.

CPSC Data. It is important to note that CPSC data includes only the data the CPSC becomes aware of, and it is understood that there are many other incidents that are not reported or do not come to their attention. Consumers are not obligated to report incidents to the CPSC. The research from the National Electronic Injury Surveillance System (NEISS) database from 2009 to 2013 included the following:

- CPSC estimates 4 electrocution deaths per year associated with lighting products.[7]
- There were 38 incidents involving the installation of light fixtures that resulted in hospital emergency room visits;
- 32 of those incidents involved falls and at least four of those incidents involved the victims being shocked.

With the new technology, after the receptacle is installed in the ceiling, there is no additional wiring necessary, no weight or bulk of the fixture during the initial receptacle installation, certainty of connection of the fixture to the equipment grounding conductor, and no shock hazard during the quick connect of the fixture. Without the weight/bulk, the falls may not have occurred. With the new technology receptacle in place, installation of the luminaire is a quick connect and no shock would have occurred.

- There were 418 incidents involving changing light bulbs that resulted in hospital emergency room visits;
- 390 involved falls and at least six of those incidents involved the victims being shocked.
- There were 9 additional incidents associated with cleaning the light fixture that resulted in hospital emergency room visits; 8 of those involved falls.

Many of these incidents could have been avoided or minimized if the new technology receptacle/attachment fitting technology had been used. The fixture is simply disconnected and any bulb or fixture maintenance or cleaning can be done on a table, not at an elevation, thereby reducing the time at an elevated level, thereby reducing the hazard.

- There were 55 incidents involving a luminaire falling from the ceiling onto the victim that resulted in hospital emergency room visits.

If the receptacle/attachment fitting (WSCR/WSAF) technology had been used, many of these incidents could have been avoided or minimized. The new technology must pass weight support requirements in the UL product safety standards well beyond what the NEC permits.

[7] 2004 Electrocutions Associated with Consumer Products, By Matthew V. Hnatov. Hazard Analysis Division, Directorate for Epidemiology, Consumer Products Safety Commission. April 2009

The NEC does not permit the assembly to support a luminaire weighing more than 50 lbs or a ceiling fan weighing more than 70 lbs, therefore the fixtures would not fall.

CDC Data. According to the Centers for Disease Control and Prevention (CDC), falls are the number one cause of injury. From 2001-2017, there were 144,895,242 falls reported to CDC. During the same period, there were 443,576 deaths from falls. It is not unreasonable to assume that many of these falls involved working on a luminaire. Ladder related accidents are common. In addition, some will resort to stools, chairs, and chairs with boxes or books on them to get to the right height. Detailed information can be found in Annex B. There is little information on what the victims were doing when they fell.

In 1997, Industrial Safety and Hygiene News (ISHN) noted "According the American Academy of Orthopedic Surgeons, every year 500,000 people are treated for ladder-related injuries and approximately 300 of these incidents prove to be fatal. The Liberty Mutual Research Institute for Safety found that in 2007 alone, more than 400 people died as a result of falls on or from ladders or scaffolding[8].

Summary

When viewing data contained in the Annexes, it is important to note that there is no way to know the exact number of improper installations. For example, if there were one million annual installations of luminaires (it could be argued that there are significantly *more* annual installations per Annex A) and just 2% of them were improperly installed by an untrained do-it-yourselfers, that would result in 20,000 improperly installed luminaires.

[8] 500,000 Falls from Ladders Annually; 97 Percent Occur at Home or on Farms. (July 6, 2017). *Industrial Safety and Hygiene News*. Retrieved July 20, 2020, from https://www.ishn.com/articles/106830-000-falls-from-ladders-annually-97-percent-occur-at-home-or-on-farms

Annex A. Home Renovations Reported in the American Housing Survey

Survey Notes: Estimates and Margins of Error in thousands of housing units, except as indicated. Medians are rounded to four significant digits as part of disclosure avoidance protocol. Margin of Error is calculated at the 90% confidence interval. Weighting consistent with Census 2010. Blank cells represent zero; Z rounds to zero; '.' Represents not applicable or no cases in sample; S represents estimates that did not meet publication standards or withheld to avoid disclosure.

Characteristics	Professional/Do-It-Yourself Total Estimate	Professional Estimate	Do-It-Yourself Estimate
HOME IMPROVEMENT ACTIVITY IN LAST TWO YEARS (2017)			
Total			
Number of projects (1,000)	113,155	69,975	43,181
Median expenditures ($)	1,364	2,408	600
Total expenditures (1,000)	450,089,818	368,366,827	81,722,991
Disaster Repairs[1]			
Earthquake			
Number of projects (1,000)	S	S	S
Median expenditures ($)	S	S	300
Total expenditures (1,000)	S	S	S
Tornado/hurricane			
Number of projects (1,000)	418	303	115
Median expenditures ($)	7,000	7,000	S
Total expenditures (1,000)	4,490,105	3,276,862	S
Landslide			
Number of projects (1,000)	S	S	.
Median expenditures ($)	6,020	6,020	.
Total expenditures (1,000)	S	S	.
Fire			

Number of projects (1,000)	113	85	S
Median expenditures ($)	10,000	10,000	S
Total expenditures (1,000)	S	S	S
Flood			
Number of projects (1,000)	197	121	76
Median expenditures ($)	S	13,500	S
Total expenditures (1,000)	5,283,698	S	S
Other			
Number of projects (1,000)	867	734	133
Median expenditures ($)	9,500	10,500	3,800
Total expenditures (1,000)	10,898,601	10,190,039	708,562
Room Additions and Renovations			
Bedroom			
Number of projects (1,000)	419	184	235
Median expenditures ($)	7,000	23,000	2,000
Total expenditures (1,000)	7,289,971	6,000,692	1,289,280
Bath			
Number of projects (1,000)	274	162	112
Median expenditures ($)	6,400	10,000	4,000
Total expenditures (1,000)	3,258,882	2,493,137	765,746
Recreation Room			
Number of projects (1,000)	196	105	91
Median expenditures ($)	S	24,000	3,750
Total expenditures (1,000)	4,880,565	3,875,457	S
Kitchen			
Number of projects (1,000)	159	94	65
Median expenditures ($)	S	30,000	S
Total expenditures (1,000)	4,559,506	3,686,182	S
Other			

Number of projects (1,000)	827	444	383
Median expenditures ($)	6,500	12,500	S
Total expenditures (1,000)	13,508,584	11,125,843	2,382,741
Remodeling			
Bath			
Number of projects (1,000)	5,739	3,001	2,738
Median expenditures ($)	3,000	5,250	1,500
Total expenditures (1,000)	35,305,520	26,856,855	8,448,665
Kitchen			
Number of projects (1,000)	4,184	2,358	1,826
Median expenditures ($)	6,000	10,000	3,000
Total expenditures (1,000)	49,553,906	37,772,420	11,781,486
Exterior Additions and Replacements			
Attached garage/carport			
Number of projects (1,000)	736	389	347
Median expenditures ($)	2,800	4,500	2,200
Total expenditures (1,000)	6,120,015	4,365,016	1,754,999
Porch/deck/patio/terrace			
Number of projects (1,000)	3,331	1,798	1,533
Median expenditures ($)	2,500	4,400	1,000
Total expenditures (1,000)	18,805,519	14,757,663	4,047,856
Roofing			
Number of projects (1,000)	6,766	5,656	1,110
Median expenditures ($)	6,000	6,800	2,200
Total expenditures (1,000)	50,222,041	45,937,650	4,284,391
Siding			
Number of projects (1,000)	1,937	1,264	672
Median expenditures ($)	3,000	4,800	920

Total expenditures (1,000)	9,468,686	8,030,873	1,437,813
Windows/doors			
Number of projects (1,000)	7,443	4,799	2,644
Median expenditures ($)	1,400	2,300	500
Total expenditures (1,000)	24,777,309	21,119,910	3,657,399
Chimney/stairs/other exterior additions			
Number of projects (1,000)	1,531	1,087	444
Median expenditures ($)	1,072	1,440	480
Total expenditures (1,000)	3,856,308	3,133,861	722,448
Interior Additions and Replacements			
Insulation			
Number of projects (1,000)	2,712	1,451	1,261
Median expenditures ($)	750	1,250	400
Total expenditures (1,000)	3,886,216	2,948,857	937,359
Water pipes			
Number of projects (1,000)	3,014	1,792	1,221
Median expenditures ($)	550	1,000	200
Total expenditures (1,000)	4,549,002	3,972,440	576,562
Plumbing fixtures			
Number of projects (1,000)	8,192	3,924	4,268
Median expenditures ($)	400	700	250
Total expenditures (1,000)	10,766,188	8,227,445	2,538,743
Electrical wiring/fuse boxes/breaker switches			
Number of projects (1,000)	4,487	2,879	1,609
Median expenditures ($)	600	1,000	300
Total expenditures (1,000)	6,388,526	5,088,660	1,299,866
Security system			
Number of projects (1,000)	4,286	2,933	1,353

Median expenditures ($)	400	400	400
Total expenditures (1,000)	2,605,279	1,732,909	872,370
Flooring/carpeting/paneling/ceiling tiles			
Number of projects (1,000)	10,438	6,364	4,074
Median expenditures ($)	2,000	2,875	920
Total expenditures (1,000)	33,135,645	26,515,795	6,619,850
HVAC			
Number of projects (1,000)	9,930	8,571	1,359
Median expenditures ($)	3,600	4,000	2,000
Total expenditures (1,000)	43,413,330	39,616,745	3,796,585
Septic tank			
Number of projects (1,000)	355	300	55
Median expenditures ($)	3,000	3,000	S
Total expenditures (1,000)	1,474,779	1,387,439	S
Water heater/dishwasher/garbage disposal			
Number of projects (1,000)	14,569	8,457	6,113
Median expenditures ($)	500	700	400
Total expenditures (1,000)	10,813,487	7,882,752	2,930,735
Other interior			
Number of projects (1,000)	1,901	1,250	651
Median expenditures ($)	1,700	2,143	1,000
Total expenditures (1,000)	S	S	1,348,948
Lot or Yard Additions & Replacements			
Driveways/walkways			
Number of projects (1,000)	3,858	2,627	1,231
Median expenditures ($)	1,800	2,640	550
Total expenditures (1,000)	12,015,598	10,545,199	1,470,399
Fencing/walls			

Number of projects (1,000)	4,449	2,303	2,146
Median expenditures ($)	1,300	2,600	601
Total expenditures (1,000)	10,140,802	7,603,533	2,537,269
Swimming pool/tennis court/recreational structures			
Number of projects (1,000)	967	537	431
Median expenditures ($)	3,500	7,500	748
Total expenditures (1,000)	11,131,910	10,170,999	960,911
Shed/detached garage/other building			
Number of projects (1,000)	2,337	1,095	1,243
Median expenditures ($)	2,000	3,100	1,000
Total expenditures (1,000)	11,680,657	7,570,385	4,110,272
Landscaping/sprinkler system			
Number of projects (1,000)	5,541	2,279	3,262
Median expenditures ($)	900	2,000	500
Total expenditures (1,000)	13,390,741	9,353,303	4,037,438
Other			
Number of projects (1,000)	964	612	352
Median expenditures ($)	2,000	3,000	500
Total expenditures (1,000)	4,583,936	4,169,719	414,217

Characteristics	Professional/Do-It-Yourself		
	Total Estimate	Professional Estimate	Do-It-Yourself Estimate
HOME IMPROVEMENT ACTIVITY IN LAST TWO YEARS (2015)			
Total			
Number of projects (1,000)	123,481	76,277	47,204
Median expenditures ($)	1,200	2,000	600
Total expenditures (1,000)	431,497,494	347,110,853	84,386,641
Disaster Repairs			
Earthquake			
Number of projects (1,000)	23	13	S
Median expenditures ($)	S	S	S
Total expenditures (1,000)	194,698	172,620	S
Tornado/hurricane			
Number of projects (1,000)	339	263	76
Median expenditures ($)	6,000	7,000	S
Total expenditures (1,000)	3,171,864	2,692,720	S
Lightning/fire			
Number of projects (1,000)	142	92	50
Median expenditures ($)	S	S	S
Total expenditures (1,000)	5,161,751	S	S
Flood			
Number of projects (1,000)	211	139	72
Median expenditures ($)	8,150	8,685	S
Total expenditures (1,000)	2,999,016	S	S
Other			
Number of projects (1,000)	823	708	115

Median expenditures ($)	8,550	9,000	3,000
Total expenditures (1,000)	10,029,780	9,309,961	S
Room Additions and Renovations			
Bedroom			
Number of projects (1,000)	516	259	257
Median expenditures ($)	5,000	17,000	2,000
Total expenditures (1,000)	10,997,017	8,903,760	2,093,257
Bath			
Number of projects (1,000)	303	162	141
Median expenditures ($)	S	10,000	2,500
Total expenditures (1,000)	3,463,143	2,847,832	615,311
Recreation Room			
Number of projects (1,000)	253	124	130
Median expenditures ($)	S	15,000	2,800
Total expenditures (1,000)	3,036,052	2,510,855	525,197
Kitchen			
Number of projects (1,000)	198	133	65
Median expenditures ($)	12,110	15,000	5,000
Total expenditures (1,000)	4,355,845	3,925,883	S
Other			
Number of projects (1,000)	861	453	408
Median expenditures ($)	5,000	8,000	2,000
Total expenditures (1,000)	9,920,768	7,905,575	2,015,193
Remodeling			
Bath			
Number of projects (1,000)	6,547	3,406	3,141
Median expenditures ($)	3,000	5,000	1,500
Total expenditures (1,000)	37,537,408	28,304,879	9,232,529

Kitchen			
Number of projects (1,000)	4,740	2,595	2,145
Median expenditures ($)	5,000	7,000	3,000
Total expenditures (1,000)	47,380,831	34,471,023	12,909,808
Exterior Additions and Replacements			
Attached garage/carport			
Number of projects (1,000)	717	403	314
Median expenditures ($)	4,000	5,000	2,500
Total expenditures (1,000)	5,304,691	3,745,563	1,559,127
Porch/deck/patio/terrace			
Number of projects (1,000)	3,616	1,953	1,663
Median expenditures ($)	2,500	4,000	1,200
Total expenditures (1,000)	18,899,196	14,824,455	4,074,741
Roofing			
Number of projects (1,000)	8,035	6,543	1,492
Median expenditures ($)	5,500	6,000	2,500
Total expenditures (1,000)	52,948,893	47,088,310	5,860,584
Siding			
Number of projects (1,000)	2,275	1,607	667
Median expenditures ($)	3,000	4,000	1,000
Total expenditures (1,000)	12,524,667	10,787,609	1,737,057
Windows/doors			
Number of projects (1,000)	8,693	5,580	3,114
Median expenditures ($)	1,500	2,000	600
Total expenditures (1,000)	27,257,002	22,199,593	5,057,410
Chimney/stairs/other exterior additions			
Number of projects (1,000)	1,479	983	496
Median expenditures ($)	1,050	1,500	450
Total expenditures (1,000)	3,427,485	2,944,792	482,694

Interior Additions and Replacements			
Insulation			
Number of projects (1,000)	3,531	1,862	1,669
Median expenditures ($)	750	1,200	400
Total expenditures (1,000)	4,991,329	3,779,128	1,212,201
Water pipes			
Number of projects (1,000)	3,540	2,080	1,461
Median expenditures ($)	500	900	200
Total expenditures (1,000)	5,259,795	4,233,234	1,026,561
Plumbing fixtures			
Number of projects (1,000)	9,116	4,313	4,804
Median expenditures ($)	400	550	250
Total expenditures (1,000)	9,667,129	6,882,298	2,784,831
Electrical wiring/fuse boxes/breaker switches			
Number of projects (1,000)	5,018	3,249	1,769
Median expenditures ($)	600	916	240
Total expenditures (1,000)	7,302,161	6,141,821	1,160,340
Security system			
Number of projects (1,000)	3,707	2,943	764
Median expenditures ($)	350	300	400
Total expenditures (1,000)	2,194,706	1,705,733	488,973
Flooring/carpeting/paneling/ceiling tiles			
Number of projects (1,000)	12,051	7,224	4,827
Median expenditures ($)	1,674	2,300	800
Total expenditures (1,000)	32,026,087	24,970,431	7,055,656
HVAC			
Number of projects (1,000)	10,301	8,915	1,387
Median expenditures ($)	3,150	3,429	1,800
Total expenditures (1,000)	40,379,006	36,507,489	3,871,517

Septic tank			
Number of projects (1,000)	387	319	68
Median expenditures ($)	3,000	3,000	900
Total expenditures (1,000)	1,584,211	1,255,016	S
Water heater/dishwasher/garbage disposal			
Number of projects (1,000)	15,838	9,316	6,522
Median expenditures ($)	500	700	400
Total expenditures (1,000)	11,087,649	7,899,118	3,188,531
Other interior			
Number of projects (1,000)	1,661	1,192	469
Median expenditures ($)	1,200	1,500	754
Total expenditures (1,000)	4,660,744	3,947,101	713,642
Lot or Yard Additions and Replacements			
Driveways/walkways			
Number of projects (1,000)	4,099	2,712	1,387
Median expenditures ($)	1,500	2,000	500
Total expenditures (1,000)	10,744,436	9,123,787	1,620,649
Fencing/walls			
Number of projects (1,000)	4,369	2,289	2,080
Median expenditures ($)	1,000	2,000	600
Total expenditures (1,000)	9,239,951	6,722,489	2,517,462
Swimming pool/tennis court/recreational structures			
Number of projects (1,000)	806	445	361
Median expenditures ($)	4,000	7,000	800
Total expenditures (1,000)	8,864,172	7,345,981	1,518,191
Shed/detached garage/other building			
Number of projects (1,000)	2,359	1,023	1,337
Median expenditures ($)	1,500	2,500	1,000

Total expenditures (1,000)	9,333,571	5,637,621	3,695,950
Landscaping/sprinkler system			
Number of projects (1,000)	6,096	2,467	3,630
Median expenditures ($)	800	2,000	500
Total expenditures (1,000)	12,123,260	8,640,867	3,482,393
Other			
Number of projects (1,000)	829	514	315
Median expenditures ($)	1,500	2,250	S
Total expenditures (1,000)	3,429,179	2,945,964	483,215

Characteristics	Professional/Do-It-Yourself		
	Total Estimate	Professional Estimate	Do-It-Yourself Estimate
HOME IMPROVEMENT ACTIVITY IN LAST TWO YEARS (2013)			
Total			
Number of projects (1,000)	93,558	59,411	34,147
Median expenditures ($)	1,000	2,000	500
Total expenditures (1,000)	300,831,306	246,338,538	54,492,768
Remodeling			
Kitchen			
Number of projects (1,000)	2,954	1,700	1,253
Median expenditures ($)	5,000	6,200	3,000
Total expenditures (1,000)	26,626,680	18,827,473	7,799,207
Bath			
Number of projects (1,000)	4,064	2,168	1,896
Median expenditures ($)	2,500	4,000	1,500
Total expenditures (1,000)	18,685,777	13,962,662	4,723,115
Room Additions and Renovations			
Kitchen			
Number of projects (1,000)	45	34	11
Median expenditures ($)	35,000	35,821	15,000
Total expenditures (1,000)	1,584,009	1,441,692	142,317
Bath			
Number of projects (1,000)	546	293	253
Median expenditures ($)	5,000	8,221	3,000
Total expenditures (1,000)	4,600,965	3,556,359	1,044,605

Bedroom			
Number of projects (1,000)	907	451	456
Median expenditures ($)	3,343	8,500	1,600
Total expenditures (1,000)	12,578,231	10,045,582	2,532,649
Recreation Room			
Number of projects (1,000)	320	136	184
Median expenditures ($)	5,000	6,627	3,700
Total expenditures (1,000)	2,899,929	1,581,672	1,318,257
Other			
Number of projects (1,000)	1,624	798	826
Median expenditures ($)	3,500	6,866	1,848
Total expenditures (1,000)	14,945,765	11,958,530	2,987,235
Systems and Equipment			
Plumbing/pipes			
Number of projects (1,000)	2,767	1,716	1,051
Median expenditures ($)	500	800	200
Total expenditures (1,000)	3,604,401	3,009,925	594,475
Electrical system			
Number of projects (1,000)	3,716	2,409	1,307
Median expenditures ($)	500	800	200
Total expenditures (1,000)	4,269,937	3,549,517	720,420
Plumbing fixtures			
Number of projects (1,000)	6,881	3,437	3,444
Median expenditures ($)	331	500	200
Total expenditures (1,000)	5,957,561	4,210,317	1,747,244
HVAC			
Number of projects (1,000)	7,250	6,340	910
Median expenditures ($)	3,000	3,200	1,500
Total expenditures (1,000)	26,516,143	24,496,257	2,019,885

Appliances/major equipment			
Number of projects (1,000)	14,838	9,177	5,661
Median expenditures ($)	400	500	334
Total expenditures (1,000)	8,617,672	6,333,578	2,284,094
Exterior Additions and Replacements			
Roofing			
Number of projects (1,000)	5,851	4,876	975
Median expenditures ($)	5,000	5,500	1,800
Total expenditures (1,000)	36,079,462	33,223,391	2,856,071
Siding			
Number of projects (1,000)	1,677	1,219	458
Median expenditures ($)	3,000	4,200	500
Total expenditures (1,000)	7,437,346	6,749,185	688,161
Windows/doors			
Number of projects (1,000)	6,491	4,108	2,383
Median expenditures ($)	1,100	1,800	500
Total expenditures (1,000)	16,670,157	13,622,788	3,047,369
Interior Additions and Replacements			
Insulation			
Number of projects (1,000)	2,681	1,617	1,065
Median expenditures ($)	573	955	300
Total expenditures (1,000)	3,060,617	2,498,934	561,683
Flooring/paneling/ceiling			
Number of projects (1,000)	14,241	8,534	5,706
Median expenditures ($)	1,000	1,647	500
Total expenditures (1,000)	27,522,730	21,585,632	5,937,098
Other interior			
Number of projects (1,000)	1,761	1,236	524

Median expenditures ($)	1,200	1,500	800
Total expenditures (1,000)	5,620,345	4,070,664	1,549,681
Other Additions and Replacements			
Deck/porch			
Number of projects (1,000)	489	282	207
Median expenditures ($)	3,000	5,373	1,200
Total expenditures (1,000)	2,625,615	2,236,047	389,568
Patio/terrace/detached deck			
Number of projects (1,000)	2,737	1,534	1,203
Median expenditures ($)	2,000	3,500	1,000
Total expenditures (1,000)	11,324,775	9,034,084	2,290,691
Garage			
Number of projects (1,000)	94	73	21
Median expenditures ($)	18,000	24,000	500
Total expenditures (1,000)	2,206,566	2,140,830	65,736
Carport			
Number of projects (1,000)	94	58	37
Median expenditures ($)	1,400	2,269	500
Total expenditures (1,000)	440,123	381,558	58,565
Shed			
Number of projects (1,000)	1,547	746	801
Median expenditures ($)	1,400	2,500	800
Total expenditures (1,000)	8,344,883	6,885,567	1,459,315
Swimming pool/tennis court/recreational structures			
Number of projects (1,000)	628	359	269
Median expenditures ($)	3,000	5,075	600
Total expenditures (1,000)	4,951,069	4,436,168	514,901
Other exterior			
Number of projects (1,000)	7,548	4,620	2,928

Median expenditures ($)	1,500	2,000	500
Total expenditures (1,000)	19,708,734	16,325,326	3,383,408
Disaster Repairs			
Number of projects (1,000)	1,807	1,490	316
Median expenditures ($)	7,000	7,600	2,000
Total expenditures (1,000)	23,951,815	20,174,799	3,777,017
Other interior			
Number of projects (1,000)	1,661	1,192	469
Median expenditures ($)	1,200	1,500	754
Total expenditures (1,000)	4,660,744	3,947,101	713,642
Lot or Yard Additions and Replacements[1]			
Driveways/walkways			
Number of projects (1,000)	4,099	2,712	1,387
Median expenditures ($)	1,500	2,000	500
Total expenditures (1,000)	10,744,436	9,123,787	1,620,649
Fencing/walls			
Number of projects (1,000)	4,369	2,289	2,080
Median expenditures ($)	1,000	2,000	600
Total expenditures (1,000)	9,239,951	6,722,489	2,517,462
Swimming pool/tennis court/recreational structures			
Number of projects (1,000)	806	445	361
Median expenditures ($)	4,000	7,000	800
Total expenditures (1,000)	8,864,172	7,345,981	1,518,191
Shed/detached garage/other building			
Number of projects (1,000)	2,359	1,023	1,337
Median expenditures ($)	1,500	2,500	1,000
Total expenditures (1,000)	9,333,571	5,637,621	3,695,950

Landscaping/sprinkler system			
Number of projects (1,000)	6,096	2,467	3,630
Median expenditures ($)	800	2,000	500
Total expenditures (1,000)	12,123,260	8,640,867	3,482,393
Other			
Number of projects (1,000)	829	514	315
Median expenditures ($)	1,500	2,250	S
Total expenditures (1,000)	3,429,179	2,945,964	483,215

Characteristics	Professional/Do-It-Yourself		
	Total	Professional	Do-It-Yourself
HOME IMPROVEMENT ACTIVITY IN LAST TWO YEARS (2011)			
Total			
Number of projects (1,000)	116,263	73,015	43,248
Median expenditures ($)[1]	1,000	1,999	500
Total expenditures (1,000)	348,536,558	287,026,972	61,509,586
Remodeling[2]			
Kitchen			
Number of projects (1,000)	3,608	2,081	1,527
Median expenditures ($)[1]	5,000	7,993	3,000
Total expenditures (1,000)	34,661,061	26,886,023	7,775,039
Bath			
Number of projects (1,000)	4,825	2,503	2,323
Median expenditures ($)[1]	2,500	4,000	1,500
Total expenditures (1,000)	22,723,885	16,388,045	6,335,840
Room Additions and Renovations[2]			
Kitchen			
Number of projects (1,000)	63	52	11
Median expenditures ($)[1]	27,353	30,000	8,000
Total expenditures (1,000)	1,830,275	1,683,443	146,832
Bath			
Number of projects (1,000)	713	392	321
Median expenditures ($)[1]	3,500	5,882	2,000
Total expenditures (1,000)	4,523,881	3,460,385	1,063,497
Bedroom			

Number of projects (1,000)	1,142	506	636
Median expenditures ($)	2,500	5,000	1,500
Total expenditures (1,000)	8,537,461	5,954,937	2,582,524
Recreation Room			
Number of projects (1,000)	490	202	288
Median expenditures ($)	3,000	6,882	1,600
Total expenditures (1,000)	3,486,584	2,662,713	823,871
Other			
Number of projects (1,000)	1,978	997	981
Median expenditures ($)	3,000	5,000	1,500
Total expenditures (1,000)	16,627,399	13,298,699	3,328,700
Systems and Equipment			
Plumbing/pipes			
Number of projects (1,000)	3,312	2,082	1,231
Median expenditures ($)	500	900	180
Total expenditures (1,000)	4,506,681	3,955,534	551,146
Electrical system			
Number of projects (1,000)	4,434	2,864	1,569
Median expenditures ($)	500	800	200
Total expenditures (1,000)	4,976,258	4,231,366	744,892
Plumbing fixtures			
Number of projects (1,000)	7,944	3,811	4,133
Median expenditures ($)	305	500	200
Total expenditures (1,000)	6,207,328	4,125,458	2,081,870
HVAC			
Number of projects (1,000)	9,574	8,365	1,209
Median expenditures ($)	3,000	3,176	1,500
Total expenditures (1,000)	33,214,557	30,498,058	2,716,499
Appliances/major equipment			

Number of projects (1,000)	17,913	11,276	6,637
Median expenditures ($)[1]	400	500	320
Total expenditures (1,000)	10,213,056	7,588,909	2,624,147
Exterior Additions and Replacements[2]			
Roofing			
Number of projects (1,000)	7,269	5,950	1,319
Median expenditures ($)[1]	4,800	5,276	1,807
Total expenditures (1,000)	42,534,922	38,896,570	3,638,351
Siding			
Number of projects (1,000)	2,154	1,444	710
Median expenditures ($)[1]	3,000	4,500	762
Total expenditures (1,000)	10,342,508	8,965,278	1,377,230
Windows/doors			
Number of projects (1,000)	8,676	5,629	3,047
Median expenditures ($)[1]	1,282	2,000	500
Total expenditures (1,000)	23,145,692	19,648,147	3,497,546
Interior Additions and Replacements[2]			
Insulation			
Number of projects (1,000)	4,085	2,116	1,970
Median expenditures ($)[1]	500	1,000	300
Total expenditures (1,000)	4,287,875	3,214,117	1,073,757
Flooring/paneling/ceiling			
Number of projects (1,000)	18,320	10,907	7,413
Median expenditures ($)[1]	1,000	1,510	500
Total expenditures (1,000)	31,910,709	25,087,900	6,822,809
Other interior			
Number of projects (1,000)	1,780	1,218	561
Median expenditures ($)[1]	1,000	1,500	500

Total expenditures (1,000)	4,129,829	3,416,024	713,805
Other Additions and Replacements[2]			
Deck/porch			
Number of projects (1,000)	505	287	217
Median expenditures ($)	2,000	3,000	1,342
Total expenditures (1,000)	2,701,309	2,290,101	411,208
Patio/terrace/detached deck			
Number of projects (1,000)	3,500	1,835	1,665
Median expenditures ($)	2,000	3,176	1,000
Total expenditures (1,000)	13,022,905	9,963,322	3,059,583
Garage			
Number of projects (1,000)	158	87	71
Median expenditures ($)	15,000	20,250	5,000
Total expenditures (1,000)	2,621,310	2,165,996	455,314
Carport			
Number of projects (1,000)	158	82	76
Median expenditures ($)	1,500	1,600	1,300
Total expenditures (1,000)	399,581	240,654	158,927
Shed			
Number of projects (1,000)	2,098	977	1,121
Median expenditures ($)	1,429	2,600	800
Total expenditures (1,000)	8,599,423	5,927,181	2,672,242
Swimming pool/tennis court/recreational structures			
Number of projects (1,000)	713	414	300
Median expenditures ($)	2,500	6,000	500
Total expenditures (1,000)	7,417,915	7,102,007	315,908
Other exterior			
Number of projects (1,000)	9,003	5,419	3,584
Median expenditures ($)	1,247	2,000	500

Total expenditures (1,000)	22,898,421	18,263,708	4,634,713
Disaster Repairs			
Number of projects (1,000)	1,846	1,519	327
Median expenditures ($)	7,000	8,000	2,736
Total expenditures (1,000)	23,015,733	21,112,396	1,903,337
Other interior			
Number of projects (1,000)	1,661	1,192	469
Median expenditures ($)	1,200	1,500	754
Total expenditures (1,000)	4,660,744	3,947,101	713,642
Lot or Yard Additions & Replacements			
Driveways/walkways			
Number of projects (1,000)	4,099	2,712	1,387
Median expenditures ($)	1,500	2,000	500
Total expenditures (1,000)	10,744,436	9,123,787	1,620,649
Fencing/walls			
Number of projects (1,000)	4,369	2,289	2,080
Median expenditures ($)	1,000	2,000	600
Total expenditures (1,000)	9,239,951	6,722,489	2,517,462
Swimming pool/tennis court/recreational structures			
Number of projects (1,000)	806	445	361
Median expenditures ($)	4,000	7,000	800
Total expenditures (1,000)	8,864,172	7,345,981	1,518,191
Shed/detached garage/other building			
Number of projects (1,000)	2,359	1,023	1,337
Median expenditures ($)	1,500	2,500	1,000
Total expenditures (1,000)	9,333,571	5,637,621	3,695,950
Landscaping/sprinkler system			
Number of projects (1,000)	6,096	2,467	3,630

Median expenditures ($)	800	2,000	500
Total expenditures (1,000)	12,123,260	8,640,867	3,482,393
Other			
Number of projects (1,000)	829	514	315
Median expenditures ($)	1,500	2,250	S
Total expenditures (1,000)	3,429,179	2,945,964	483,215

Annex B - CDC Injury Data

2001 - 2017, United States
Fall Deaths and Rates per 100,000
All Races, Both Sexes, All Ages
ICD-10 Codes: W00-W19,X80,Y01,Y30

Number of Deaths	Population***	Crude Rate	Age-Adjusted Rate**
443,576	5,200,918,231	8.53	7.93

Reports for All Ages include those of unknown age.

* Rates based on 20 or fewer deaths may be unstable. Use with caution.

** Standard Population is 2000, all races, both sexes.

*** Population estimates are aggregated for multi-year reports to produce rates.

Produced by: National Center for Injury Prevention and Control, CDC
Data Source: NCHS Vital Statistics System for numbers of deaths. Bureau of Census for population estimates.

10 Leading Causes of Nonfatal Unintentional Emergency Department Visits, United States

2001 - 2017, All Races, Both Sexes, Disposition: All Cases

	Age Groups										
Rank	<1	1-4	5-9	10-14	15-24	25-34	35-44	45-54	55-64	65+	All Ages
1	Unintentional Fall 2,203,241	Unintentional Fall 14,695,505	Unintentional Fall 10,895,788	Unintentional Fall 10,193,254	Unintentional Struck by/ Against 16,379,505	Unintentional Fall 12,925,580	Unintentional Fall 12,965,891	Unintentional Fall 14,643,385	Unintentional Fall 13,392,906	Unintentional Fall 38,484,766	Unintentional Fall 144,895,252
2	Unintentional Struck by/ Against 533,293	Unintentional Struck by/ Against 6,058,063	Unintentional Struck by/ Against 6,868,690	Unintentional Struck by/ Against 9,721,402	Unintentional Fall 14,486,086	Unintentional Overexertion 11,152,537	Unintentional Overexertion 9,867,239	Unintentional Overexertion 7,534,235	Unintentional Struck by/ Against 4,040,364	Unintentional Struck by/ Against 4,271,311	Unintentional Struck by/ Against 74,260,233
3	Unintentional Other Bite/ Sting 211,421	Unintentional Other Bite/ Sting 2,496,959	Unintentional Cut/Pierce 1,921,531	Unintentional Overexertion 4,798,474	Unintentional MV-Occupant 12,889,729	Unintentional Struck by/ Against 10,688,727	Unintentional Struck by/ Against 8,646,276	Unintentional Struck by/ Against 6,849,399	Unintentional Overexertion 3,954,803	Unintentional Overexertion 3,338,390	Unintentional Overexertion 55,470,069
4	Unintentional Foreign Body 168,685	Unintentional Foreign Body 2,115,187	Unintentional Other Bite/ Sting 1,684,445	Unintentional Cut/Pierce 2,290,666	Unintentional Overexertion 12,057,868	Unintentional MV-Occupant 9,764,377	Unintentional MV-Occupant 7,404,124	Unintentional MV-Occupant 6,008,660	Unintentional MV-Occupant 3,674,071	Unintentional MV-Occupant 3,274,416	Unintentional MV-Occupant 46,257,031
5	Unintentional Fire/Burn 166,348	Unintentional Cut/Pierce 1,416,767	Unintentional Pedal Cyclist 1,438,614	Unintentional Pedal Cyclist 1,809,487	Unintentional Cut/Pierce 7,710,641	Unintentional Cut/Pierce 7,154,265	Unintentional Cut/Pierce 5,711,252	Unintentional Cut/Pierce 4,715,968	Unintentional Cut/Pierce 2,910,149	Unintentional Cut/Pierce 2,329,593	Unintentional Cut/Pierce 36,268,894
6	Unintentional Other Specified 134,502	Unintentional Overexertion 1,315,913	Unintentional Overexertion 1,354,807	Unintentional Unknown/ Unspecified 1,628,755	Unintentional Other Specified 4,030,764	Unintentional Other Specified 4,205,722	Unintentional Other Specified 4,087,399	Unintentional Other Specified 4,369,757	Unintentional Other Specified 2,336,522	Unintentional Other Bite/ Sting 1,433,760	Unintentional Other Specified 21,953,757
7	Unintentional Inhalation/ Suffocation 117,464	Unintentional Other Specified 932,167	Unintentional MV-Occupant 1,089,855	Unintentional MV-Occupant 1,437,342	Unintentional Other Bite/ Sting 2,956,648	Unintentional Other Bite/ Sting 2,807,584	Unintentional Poisoning 2,848,707	Unintentional Poisoning 3,189,281	Unintentional Poisoning 1,858,449	Unintentional Poisoning 1,409,344	Unintentional Other Bite/ Sting 18,634,091
8	Unintentional Cut/Pierce 106,012	Unintentional Fire/Burn 903,828	Unintentional Foreign Body 982,591	Unintentional Other Bite/ Sting 1,067,652	Unintentional Unknown/ Unspecified 2,697,889	Unintentional Poisoning 2,717,196	Unintentional Other Bite/ Sting 2,357,389	Unintentional Other Bite/ Sting 2,183,425	Unintentional Other Bite/ Sting 1,434,421	Unintentional Other Specified 1,124,089	Unintentional Poisoning 15,608,986
9	Unintentional Overexertion 94,101	Unintentional Poisoning 757,380	Unintentional Dog Bite 751,546	Unintentional Other Transport 903,792	Unintentional Poisoning 2,398,193	Unintentional Unknown/ Unspecified 1,865,642	Unintentional Unknown/ Unspecified 1,532,981	Unintentional Unknown/ Unspecified 1,303,370	Unintentional Unknown/ Unspecified 799,484	Unintentional Other Transport 1,096,837	Unintentional Unknown/ Unspecified 12,386,141
10	Unintentional Unknown/ Unspecified 90,681	Unintentional Unknown/ Unspecified 752,229	Unintentional Other Transport 689,682	Unintentional Dog Bite 598,757	Unintentional Other Transport 2,006,159	Unintentional Other Transport 1,563,933	Unintentional Other Transport 1,316,897	Unintentional Other Transport 1,149,322	Unintentional Other Transport 753,041	Unintentional Unknown/ Unspecified 1,054,400	Unintentional Foreign Body 9,979,708

National Center for Injury Prevention and Control, CDC

NEISS All Injury Program operated by the Consumer Product Safety Commission (CPSC).

Public Comment No. 868-NFPA 70-2021 [Section No. 314.27(E)]

(E) Weight-Supporting Ceiling Receptacles (WSCR) and Weight-Supporting Attachment Fittings (WSAF).

Outlet boxes required in 314.27 shall be permitted to support listed weight-supporting ceiling receptacles (WSCR) used in combination with compatible weight-supporting attachment fittings (WSAF). The combination shall be identified for the support of equipment within the weight and mounting orientation limits of the listing. Where the WSCR is installed within a box, it shall be included in the fill calculation covered in 314.16(B)(4).

Additional Proposed Changes

File Name	Description	Approved
9_CN_4_PC.pdf	9 CN4	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 4 appeared in the First Draft Report on First Revision No. 7761.

The Correlating Committee refers FR 7761 to CMP 18 for information.

Related Item

• First Revision No. 7761

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:17:37 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: This comment does not present actionable text as directed in 4.4.4.3(c) of the Regulations, and therefore the most appropriate action that the system allows for this PC is to reject. CMP 9 understands that CMP 18 has been advised of CMP 9's action at the first revision stage. CMP 9 also agrees that CMP 18 has principal jurisdiction over the content of this subject. See also SR-7535.

Correlating Committee Note No. 4-NFPA 70-2021 [Section No. 314.27(E)]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon May 03 10:56:34 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee refers FR 7761 to CMP 18 for information.

First Revision No. 7761-NFPA 70-2020 [Section No. 314.27(E)]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1882-NFPA 70-2021 [Section No. 404.1]

404.1 Scope.

This article covers all switches, switching devices, and circuit breakers used as switches operating at 1000 volts and below, unless specifically referenced elsewhere in this *Code* for higher voltages.

This article does not cover wireless control equipment to which circuit conductors are not connected.

Informational Note: See 210.70 for additional information related to branch circuits that include switches or wall mounted control devices.

Statement of Problem and Substantiation for Public Comment

Changes made to Section 210.70 are significant and the scope of Article 404 is directly related. This comment seeks to provide reference to Section 210.70 to further clarify the use of wall mounted control devices relative to being connected to branch circuit wiring, and associated conditions including wall mounted control devices that may include batteries.

Related Item

• FR 7889

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz
Organization: NECA
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 18 13:36:53 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7551-NFPA 70-2021

Statement: An informational note is added to reference Section 210.70 as it has information on wireless devices.

There is no need to reference connection to building wiring since it specifically indicates the scope does not apply to wireless control equipment to which circuit conductors are not connected.

Refer this information to CMP 2 and task group for wireless control.

Public Comment No. 872-NFPA 70-2021 [Section No. 404.1]

404.1 Scope.

This article covers all switches, switching devices, and circuit breakers used as switches operating at 1000 volts and below, unless specifically referenced elsewhere in this *Code* for higher voltages.

This article does not cover wireless control equipment to which circuit conductors are not connected.

Additional Proposed Changes

File Name	Description	Approved
9_CN_5.pdf	9 CN5	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 5 appeared in the First Draft Report on First Revision No. 7889.

The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel action. The Correlating Committee refers FR 7889 to CMP 2 for information.

A task group is established between CMP 9 and CMP 2 to correlate the terminology changes for "listed wall-mounted switch" to "listed wall-mounted control device". CMP 9 has modified the scope of Article 404 to exclude wireless devices. The task group will review and establish a recommended direction for wireless control.

Related Item

• First Revision No. 7889

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:21:41 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7551-NFPA 70-2021

Statement: An informational note is added to reference Section 210.70 as it has information on wireless devices.

There is no need to reference connection to building wiring since it specifically indicates the scope does not apply to wireless control equipment to which circuit conductors are not connected.

Refer this information to CMP 2 and task group for wireless control.

Correlating Committee Note No. 5-NFPA 70-2021 [Section No. 404.1]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon May 03 10:57:58 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel action. The Correlating Committee refers FR 7889 to CMP 2 for information.

A task group is established between CMP 9 and CMP 2 to correlate the terminology changes for “listed wall-mounted switch” to “listed wall-mounted control device”. CMP 9 has modified the scope of Article 404 to exclude wireless devices. The task group will review and establish a recommended direction for wireless control.

First Revision No. 7889-NFPA 70-2020 [Section No. 404.1]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 950-NFPA 70-2021 [Section No. 404.1]

404.1 Scope.

This article covers all switches, switching devices, and circuit breakers used as switches connected directly to building wiring operating at 1000 volts and below, unless specifically referenced elsewhere in this *Code* for higher voltages.

This article does not cover wireless control equipment to which circuit conductors are not connected.

Statement of Problem and Substantiation for Public Comment

While Article 100 includes definitions of various switches, it does not offer a general definition of "switch" nor or "wireless control equipment." Therefore, the parent language of 404.1 refers to switches as they are generally understood–the dictionary meaning. The general understanding can include these wireless control devices. Consequently, if we mean to remove them we need to say so explicitly. I have seen electricians' and inspectors' questions about what rules apply to them.

Related Item

• PI 2299 • FR7889

Submitter Information Verification

Submitter Full Name: David Shapiro
Organization: Safety First Electrical
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 05 11:34:48 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7551-NFPA 70-2021

Statement: An informational note is added to reference Section 210.70 as it has information on wireless devices.

There is no need to reference connection to building wiring since it specifically indicates the scope does not apply to wireless control equipment to which circuit conductors are not connected.

Refer this information to CMP 2 and task group for wireless control.

Public Comment No. 1710-NFPA 70-2021 [Section No. 404.2(C)]

(C) Switches Controlling Lighting Loads.

The grounded circuit conductor for the controlled lighting circuit shall be installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit serving bathrooms, hallways, stairways, and habitable rooms or occupiable spaces ~~as defined in the applicable building code~~ . Where multiple switch locations control the same lighting load such that the entire floor area of the room or space is visible from the single or combined switch locations, the grounded circuit conductor shall only be required at one location. A grounded conductor shall not be required to be installed at lighting switch locations under any of the following conditions:

(1) Where conductors enter the box enclosing the switch through a raceway, provided that the raceway is large enough for all contained conductors, including a grounded conductor

(2) Where snap switches with integral enclosures comply with 300.15(E)

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

(4) Where a switch controls a receptacle load

The grounded conductor shall be extended to any switch location as necessary and shall be connected to switching devices that require line-to-neutral voltage to operate the electronics of the switch in the standby mode and shall meet the requirements of 404.22.

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

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

Statement of Problem and Substantiation for Public Comment

The deletion of the building code reference is conditioned on the acceptance by CMP 1 of expanded wording of the occupiable space definition so it will accurately correlate with building code definitions. If this is done, then the building code reference here is superfluous and can be removed.

Related Item

• FR-9576 • PC-1706

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:

Submittal Date: Tue Aug 17 13:43:31 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7858-NFPA 70-2021
Statement: CMP 1 has a first revision (FR-9576) and pending public comment (PC-1706) to expand the wording of the occupiable space definition so it will accurately correlate with building code definitions. If this is not changed, then the building code reference here can be removed.

Public Comment No. 899-NFPA 70-2021 [Section No. 404.8]

404.8 Accessibility and Grouping.

(A) Location.

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

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

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

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

(B) Voltage Between Adjacent Devices.

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

(C) Multipole Snap Switches.

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

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

Additional Proposed Changes

File Name	Description	Approved
9_CN_251.pdf	9 CN251	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 251 appeared in the First Draft Report on First Revision No. 7951.

The Correlating Committee directs the panel to reconsider the text in this section to remove redundant requirements in accordance with 4.1.1 of the NEC Style Manual and correlate with FR 8577 and FR 8663.

The Correlating Committee directs the panel to reconsider the text "shall not be permitted to be" for clarification and ease of use. Simplifying the text to state that the equipment "shall not be reconditioned" is suggested as an alternative.

The Correlating Committee directs the panel to reconsider the text in subdivision (A) and consider retaining the opening sentence in this section and moving the remaining requirements into a section for replacements.

Related Item

• First Revision No. 7951

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:49:39 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7583-NFPA 70-2021

Statement: The changes separate the requirements for replacement panelboards, which are now located in a new Section 408.9, from the requirements for reconditioning in Section 408.8.

The panel considered the directive from the Correlating Committee that requirements pertaining to reconditioned equipment should be located at the beginning of the article. However, the current location is the most appropriate and user-friendly location in the context of Article 408.

Replacement panelboard requirements are clarified.

The title was changed from "reconditioning" to "reconditioned" in accordance with the Correlating Committee instruction in CC Note 259.

The phrasing in 408.8(A), "shall not be permitted to be reconditioned," is changed to "shall not be reconditioned" in accordance with Correlating Committee Note 251.

Panelboard replacements are often thought of as a reconditioning process, which they are not, and the present location provides clarity regarding the distinction between panelboards and switchboards/switchgear and what is permitted for each.

References to the reconditioning requirements in Sections 110.20 and 110.21 are removed, as they were redundant.

Correlating Committee Note No. 251-NFPA 70-2021 [Section No. 408.8]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Thu May 06 09:36:51 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs the panel to reconsider the text in this section to remove redundant requirements in accordance with 4.1.1 of the NEC Style Manual and correlate with FR 8577 and FR 8663.

The Correlating Committee directs the panel to reconsider the text “shall not be permitted to be” for clarification and ease of use. Simplifying the text to state that the equipment “shall not be reconditioned” is suggested as an alternative.

The Correlating Committee directs the panel to reconsider the text in subdivision (A) and consider retaining the opening sentence in this section and moving the remaining requirements into a section for replacements.

First Revision No. 7951-NFPA 70-2020 [Section No. 408.8]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1614-NFPA 70-2021 [Section No. 404.11]

404.11 Circuit Breakers as Switches.

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

Informational Note: See 240.81 and 240.~~83~~ - 83 _ for requirements for circuit breakers relative to indication of state and required markings. .

Statement of Problem and Substantiation for Public Comment

This comment responds to Correlating Committee Note 6 relating to the need for explanatory text in the note regarding the purpose of the referenced code sections.

Related Item

• CC Note 6

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 16:46:52 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7562-NFPA 70-2021
Statement: CMP 9 added explanatory text in the note regarding the purpose of the referenced code sections.

Public Comment No. 874-NFPA 70-2021 [Section No. 404.11]

404.11 Circuit Breakers as Switches.

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

Informational Note: See 240.81 and 240.83.

Additional Proposed Changes

File Name	Description	Approved
9_CN_6.pdf	9 CN6	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 6 appeared in the First Draft Report on First Revision No. 7863.

The Correlating Committee directs the Panel to revise the informational note, in accordance with 3.1.3.1 of the NEC Style Manual, to include explanatory text for what is contained in 240.81 and 240.83.

Related Item

• First Revision No. 7863

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:24:59 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7562-NFPA 70-2021
Statement: CMP 9 added explanatory text in the note regarding the purpose of the referenced code sections.

Correlating Committee Note No. 6-NFPA 70-2021 [Section No. 404.11]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon May 03 11:13:27 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs the Panel to revise the informational note, in accordance with 3.1.3.1 of the NEC Style Manual, to include explanatory text for what is contained in 240.81 and 240.83.

First Revision No. 7863-NFPA 70-2020 [Section No. 404.11]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1460-NFPA 70-2021 [Section No. 404.14(D)]

(D) Snap ~~Switches with Push-in Terminals.~~

~~Push-in terminals of snap switches rated 15 amperes shall only be connected directly to 14 AWG solid copper conductors. For use with~~

Switch Terminations.

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

Snap switches installed using screwless terminals of the conductor push-in type construction (also known as *push-in terminals*) shall be installed on 15-ampere branch circuits and shall be connected with 14 AWG solid copper wire only.

Exception: Snap switches installed using screwless terminals of the conductor push-in type construction (also known as push-in terminals) shall be permitted to be connected using conductors other than 14 AWG solid copper

~~, the snap switch shall be~~
if listed and marked for

~~the specific use~~
other types of conductors .

Additional Proposed Changes

File Name	Description	Approved
Public_Comment_for_404.14_D_Fnl.docx	This file is provided to clearly show the intended code text in legislative format due to Terra issues.	

Statement of Problem and Substantiation for Public Comment

The Correlating Committee Bimetallics Task Group submitted 19 public inputs in a coordinated effort to recognize 14 AWG copper-clad aluminum with a 60ºC rating of 10 amps. The results in the first draft by CMP-2, CMP-6, CMP-9, CMP-10 and CMP-18 had general acceptance of these public inputs and the addition of the new conductor size and rating.

CMP-9 accepted the concept for snap switches as 404.14(D) in the first draft but created different text than what was in the public input. CMP-18 also accepted a change in the first draft but that new text created a correlation issue. The text for both the sections is significantly different for what is essentially the same requirement. The requirement for snap switches in 404.14(D) and for receptacles in 406.3(D) should not have differences that could lead to confusion on why there are differences. A companion public comment with parallel language has been submitted for 406.3(D) to be considered by CMP-18 to bring both sections into alignment.

This public comment text revises the language to accomplish three things:

-- To bring into the Code that wiring devices rated 15 and 20 amperes are suitable for installation with copper and copper-clad aluminum as provided in the UL guide information. This will help alleviate questions regarding wiring device termination that are being constantly asked by installers.

-- With the new allowance for 14 copper-clad aluminum, to ensure the Code is clear that the use of

push-in type terminals is presently only suitable for 14 AWG copper. The UL standard and associated guide information under category code WJQR for snap switches with push-in terminals permits only 14 AWG solid copper conductors to be used at this time.

-- By the exception, to provide for a future allowance for other conductors, such as 14 AWG copper-clad aluminum, to be installed using push-in type terminals where the additional evaluation to the applicable UL standards has been completed and the listing and device markings permit the application.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 1462-NFPA 70-2021 [Section No. 406.3(D)]	Provides for parallel text for same requirements.
Public Comment No. 1462-NFPA 70-2021 [Section No. 406.3(D)]	

Related Item

- PI 3256 and FR 7881

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: Cdcmello Consulting Llc
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 13 16:50:46 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7859-NFPA 70-2021
Statement: CMP 9 made the change for the following reasons:

-To bring into the Code that wiring devices rated 15 and 20 amperes are suitable for installation with copper and copper-clad aluminum as provided in the UL guide information. This will help alleviate questions regarding wiring device termination that are being constantly asked by installers.

-With the new allowance for 14 AWG copper-clad aluminum, to ensure the Code is clear that the use of push-in type terminals is presently only suitable for 14 AWG copper. The UL standard and associated guide information under category code WJQR for snap switches with push-in terminals permits only 14 AWG solid copper conductors to be used at this time.

-To provide for a future allowance for other conductors, such as 14 AWG copper-clad aluminum, to be installed using push-in type terminals where the additional evaluation to the applicable UL standards has been completed and the listing and device markings permit the application.

Public Comment Proposed Code Text

404.14(D) Snap Switch Terminations

~~Push-in terminals of snap switches rated 15 amperes shall only be connected directly to 14 AWG solid copper conductors. For use with conductors other than 14 AWG solid copper, the snap switch shall be listed and marked for the specific use.~~

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

Snap switches installed using screwless terminals of the conductor push-in type construction (also known as *push-in terminals*) shall be installed on 15-ampere branch circuits and shall be connected with 14 AWG solid copper wire only.

Exception: Snap switches installed using screwless terminals of the conductor push-in type construction (also known as push-in terminals) shall be permitted to be connected using conductors other than 14 AWG solid copper if listed and marked for other types of conductors.

PC Substantiation

The Correlating Committee Bimetallics Task Group submitted 19 public inputs in a coordinated effort to recognize 14 AWG copper-clad aluminum with a 60ºC rating of 10 amps. The results in the first draft by CMP-2, CMP-6, CMP-9, CMP-10 and CMP-18 had general acceptance of these public inputs and the addition of the new conductor size and rating.

CMP-9 accepted the concept for snap switches as 404.14(D) in the first draft but created different text than what was in the public input. CMP-18 also accepted a change in the first draft but that new text created a correlation issue. The text for both the sections is significantly different for what is essentially the same requirement. The requirement for snap switches in 404.14(D) and for receptacles in 406.3(D) should not have differences that could lead to confusion on why there are differences. A companion public comment with parallel language has been submitted for 406.3(D) to be considered by CMP-18 to bring both sections into alignment.

This public comment text revises the language to accomplish three things:

-- To bring into the Code that wiring devices rated 15 and 20 amperes are suitable for installation with copper and copper-clad aluminum as provided in the UL guide information. This will help alleviate questions regarding wiring device termination that are being constantly asked by installers.

-- With the new allowance for 14 copper-clad aluminum, to ensure the Code is clear that the use of push-in type terminals is presently only suitable for 14 AWG copper. The UL standard and associated guide information under category code WJQR for snap switches with push-in terminals permits only 14 AWG solid copper conductors to be used at this time.

-- By the exception, to provide for a future allowance for other conductors, such as 14 AWG copper-clad aluminum, to be installed using push-in type terminals where the additional evaluation to the applicable UL standards has been completed and the listing and device markings permit the application.

Public Comment No. 898-NFPA 70-2021 [Section No. 404.14(F)]

(F) Dimmer and Electronic Control Switches.

General-use dimmer switches shall be used only to control permanently installed incandescent luminaires unless listed for the control of other loads and installed accordingly. Other electronic control switches, such as timing switches and occupancy sensors, shall be used to control permanently connected loads. They shall be marked by their manufacturer with their current and voltage ratings and used for loads that do not exceed their ampere rating at the voltage applied.

Additional Proposed Changes

File Name	Description	Approved
9_CN_250.pdf	9 CN250	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 250 appeared in the First Draft Report on First Revision No. 7859.

The Correlating Committee directs the panel to reconsider the text in this section to remove redundant requirements in accordance with 4.1.1 of the NEC Style Manual and correlate with FR 8577 and FR 8663.

The Correlating Committee directs the panel to reconsider the text "shall not be permitted to be" for clarification and ease of use. Simplifying the text to state that the equipment "shall not be reconditioned" is suggested as an alternative.

Related Item

• First Revision No. 7859

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:47:42 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7560-NFPA 70-2021
Statement: The text is revised to remove redundant requirements.

Correlating Committee Note No. 250-NFPA 70-2021 [New Section after 404.14(F)]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Thu May 06 09:34:13 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs the panel to reconsider the text in this section to remove redundant requirements in accordance with 4.1.1 of the NEC Style Manual and correlate with FR 8577 and FR 8663.

The Correlating Committee directs the panel to reconsider the text “shall not be permitted to be” for clarification and ease of use. Simplifying the text to state that the equipment “shall not be reconditioned” is suggested as an alternative.

First Revision No. 7859-NFPA 70-2020 [New Section after 404.14(F)]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1231-NFPA 70-2021 [Section No. 404.16]

404.16 Reconditioned Equipment.

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

Lighting, dimmer, and electronic control switches shall not be permitted to be reconditioned.

(B) Snap Switches.

Snap switches of any type shall not be permitted to be reconditioned.

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

Knife switches, switches with butt contacts, and bolted pressure contact switches shall be permitted to be reconditioned. The reconditioning process shall use design qualified parts verified under applicable standards and shall be performed in accordance with any instructions provided by the manufacturer. If equipment has been damaged by fire, products of combustion, corrosive influences, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service. Reconditioned switches shall be listed or field labeled as reconditioned and marked in accordance with 110.21(A)(2).

(D) Molded-Case Switches

Molded-case switches shall not be permitted to be reconditioned.

Statement of Problem and Substantiation for Public Comment

I commend CMP 9 for identifying which type of switches may or may not be reconditioned. I would note that one common switch type is missing from the list in Section 404.16. Molded-case switches are commonly used for a variety of switching applications in electrical distribution, including use as a service disconnecting means. These devices are similar to molded-case circuit breakers in that these are sealed, not user serviceable, have complex operating mechanisms, and may also have an instantaneous tripping function which could open the switch in a fault condition. In the 2020 edition of the National Electrical Code, CMP10 had acted in Article 240 to restrict molded-case circuit breakers from being reconditioned due to these factors. CMP 9 should take similar action and add molded case switches to the new Section 404.16, as a type of switch that “shall not be permitted to be reconditioned”.

Related Item

• First Revision No. 7859

Submitter Information Verification

Submitter Full Name: Danish Zia
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 11 09:49:47 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action:	Rejected but see related SR
Resolution:	SR-7860-NFPA 70-2021
Statement:	The revisions in 404.16(A) and (B) are editorial and remove redundant language. The deleted requirements in 404.16(C) were redundant to Sections 110.20 and 110.21. Molded-case switches were added as a new 404.16(D), as they are similar to molded-case circuit breakers and should not be reconditioned.

Public Comment No. 1622-NFPA 70-2021 [Section No. 404.16(A)]

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

Lighting, dimmer, and electronic control switches shall not be ~~permitted to be~~ reconditioned.

Statement of Problem and Substantiation for Public Comment

This comment responds to the observation of the Correlating Committee that the words "permitted to be" in the reconditioning prohibition are redundant.

Related Item

• CC Note 250 • FR-7859

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 17:03:16 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7860-NFPA 70-2021

Statement: The revisions in 404.16(A) and (B) are editorial and remove redundant language.

The deleted requirements in 404.16(C) were redundant to Sections 110.20 and 110.21.

Molded-case switches were added as a new 404.16(D), as they are similar to molded-case circuit breakers and should not be reconditioned.

Public Comment No. 1626-NFPA 70-2021 [Section No. 404.16(B)]

(B) Snap Switches.

Snap switches of any type shall not be ~~permitted to be~~ reconditioned.

Statement of Problem and Substantiation for Public Comment

This comment deletes the redundant phrase "permitted to be" in accordance with Correlating Committee Note 250.

Related Item

• CC Note 250 • FR-7859

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 17:13:51 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7860-NFPA 70-2021

Statement: The revisions in 404.16(A) and (B) are editorial and remove redundant language.

The deleted requirements in 404.16(C) were redundant to Sections 110.20 and 110.21.

Molded-case switches were added as a new 404.16(D), as they are similar to molded-case circuit breakers and should not be reconditioned.

Public Comment No. 1628-NFPA 70-2021 [Section No. 404.16(C)]

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

Knife switches, switches with butt contacts, and bolted pressure contact switches shall be permitted to be reconditioned. The reconditioning process shall use design qualified parts verified under applicable standards and shall be performed in accordance with any instructions provided by the manufacturer. If equipment has been damaged by fire, products of combustion, corrosive influences, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service. Reconditioned switches shall be listed or field labeled as reconditioned and marked in accordance with 110.21(A)(2).

Statement of Problem and Substantiation for Public Comment

This comment expresses disagreement with the request in Correlating Committee Note 250 relative to redundant requirements. Although this paragraph partially duplicates material in 110.20, it only does so in the context of adding additional qualifying information relative to prior exposures to adverse conditions. It should be retained as written.

Related Item

• CC Note 250

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 17:19:01 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: The submitter did not recommend any changes as required by the Regulations Governing the Development of NFPA Standards, Section 4.4.4(C).

Public Comment No. 876-NFPA 70-2021 [New Section after 404.28]

The Correlating Committee requests that the requirement be reviewed for clarity and consistency with the committee statement. The Correlating Committee refers FR 7861 to CMP's 4 and 11 for information.

Additional Proposed Changes

File Name	Description	Approved
9_CN_7.pdf	9 CN7	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 7 appeared in the First Draft Report on First Revision No. 7861.

The Correlating Committee requests that the requirement be reviewed for clarity and consistency with the committee statement. The Correlating Committee refers FR 7861 to CMP's 4 and 11 for information.

Related Item

• First Revision No. 7861

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:27:19 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7566-NFPA 70-2021
Statement: CMP 9 changed the text to improve clarity of the requirement.

Correlating Committee Note No. 7-NFPA 70-2021 [New Section after 404.28]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon May 03 11:16:43 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee requests that the requirement be reviewed for clarity and consistency with the committee statement. The Correlating Committee refers FR 7861 to CMP's 4 and 11 for information.

First Revision No. 7861-NFPA 70-2020 [New Section after 404.28]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1514-NFPA 70-2021 [Section No. 404.30]

404.30 Switch Enclosures with Doors.

~~Switch mechanisms~~
When switch mechanism(s) are mounted within

~~enclosures with doors~~
enclosure(s) with hinged covers that, when opened

,
would expose uninsulated live parts

~~shall be constructed so that either a tool is required to open the door or other approved means to restrict interior access by unqualified persons are provided~~
, the enclosure(s) shall have provisions requiring a tool to open, or they shall be equipped with permanent provisions for installation of a lock.

Exception: Where access to a facility or installation is restricted to qualified persons, this provision shall not apply .

Statement of Problem and Substantiation for Public Comment

The original public input that lead to this seemed to be over concerns about disconnects without the interlocks that are designed to prohibit opening of the door while the switch blades are closed. What we got on this first draft is something that requires it 100% of the time, which would make more sense for protection of the public.

Substantiation for edits:

Requiring that the disconnects “shall have” provisions rather than “be constructed” with them might allow more minor field modifications to add provisions for locking, if such modifications could be acceptable to the AHJ, or allowed by the manufacturers.

Clarifying that a lock is one of the provisions allowed instead of just requiring “approved means” will make achieving compliance simpler. It would mean that many existing disconnects would meet the standard, as many have a location for placement of a lock. Where a lock is chosen, I think the NEC’s responsibility should end at the provision of means for placement of a lock. Local building inspectors, insurance companies, or facility owners should have the competence to decide on placement of the lock(s).

Finally, the proposed exception is to recognize that some installations don’t need this restriction. For instance, disconnects are installed in fenced in customer owned substations for 240V power. Or they may be installed in a factory having restrictions on access to employees only, and those employees are trained on whether or not they are the ones allowed to open up disconnects.

Related Item

- First Revision No. 7861-NFPA 70-2020 [New Section after 404.28]
- Public Input No. 4109-NFPA 70-2020 [New Section after 404.28]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: [Not Specified]

Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 15 20:19:57 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: CC-7566-NFPA 70-2021
Statement: CMP 9 changed the text to improve clarity of the requirement.

Public Comment No. 1617-NFPA 70-2021 [Section No. 404.30]

404.30 Switch Enclosures with Doors.

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

Statement of Problem and Substantiation for Public Comment

This comment responds to concerns by the Correlating Committee that the text of the rule did not adequately accomplish the intent as expressed in the panel statement.

Related Item

• CC Note 7 • FR-7861

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 16:52:58 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: CC-7566-NFPA 70-2021
Statement: CMP 9 changed the text to improve clarity of the requirement.

Public Comment No. 1671-NFPA 70-2021 [Section No. 404.30]

404.30 Switch Enclosures with Doors.

Switch ~~mechanisms mounted within~~ enclosures with doors or covers that, when opened, expose uninsulated live parts shall ~~be constructed so that either a tool is required to open the door~~ comply with 404.30(1) and (2).

(1) The enclosure shall be arranged so the door cannot be readily opened with the switch in the closed position. In that state the door shall require the use of a tool, or other approved means to restrict interior access

~~by unqualified persons are provided.~~

(1) .

(2) For one- and two-family dwelling units, switch enclosures shall require a tool to open regardless of the switch position.

Statement of Problem and Substantiation for Public Comment

The additional requirements for switch enclosures in FR-7861 should be clarified in regards to the conditions in which a tool or similar means is required to open the enclosure door. In one- and two-family dwelling units the access to the interior of the enclosure should be restricted regardless of the switch position for additional safety.

Related Item

• FR-7861

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 17 07:49:22 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: CC-7566-NFPA 70-2021
Statement: CMP 9 changed the text to improve clarity of the requirement.

Public Comment No. 879-NFPA 70-2021 [Section No. 408.4]

408.4 Descriptions Required.

(A) Circuit Directory or Circuit Description.

Every circuit and circuit modification shall be legibly and permanently described as to its clear, evident, and specific purpose or use. The description 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 description shall be included in a circuit directory that is located on the face of, 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.

(B) Source of Supply.

All switchboards, switchgear, and panelboards supplied by a feeder(s) in other than one- or two-family dwellings shall be permanently marked to indicate each device or equipment where the power originates and its physical location. The label shall be permanently affixed, of sufficient durability to withstand the environment involved, and not handwritten.

Additional Proposed Changes

File Name	Description	Approved
9_CN_8.pdf	9 CN8	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 8 appeared in the First Draft Report on First Revision No. 7895.

The Correlating Committee directs that the Panel rewrite the requirement for usability and clarity. Refer to 3.3.1.2 of the NEC Style Manual to ensure the text is clear and the rule is short, using list formats when appropriate.

Related Item

• First Revision No. 7895

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:30:10 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Rejected but see related SR

Action:	
Resolution:	SR-7861-NFPA 70-2021
Statement:	The text is revised to clarify the requirements into a list format. The text “Clear in explaining abbreviations and symbols when used” was added to provide direction when symbols or abbreviations are used.

Correlating Committee Note No. 8-NFPA 70-2021 [Section No. 408.4]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon May 03 11:21:29 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs that the Panel rewrite the requirement for usability and clarity. Refer to 3.3.1.2 of the NEC Style Manual to ensure the text is clear and the rule is short, using list formats when appropriate.

First Revision No. 7895-NFPA 70-2020 [Section No. 408.4]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1645-NFPA 70-2021 [Section No. 408.4(A)]

(A) Circuit Directory or Circuit Description.

(A) Circuit Directory or Circuit Description. Every circuit and circuit modification shall be legibly and permanently described as to its clear, evident, and specific purpose or use.

~~The description 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 description shall be included in~~
A panelboard shall have a circuit directory
~~that is~~
located on the face of, inside of, or in an approved location adjacent to the panel door
~~in the case of a panelboard and~~
or enclosure front. Switchboards and switchgear shall have descriptions at each switch or circuit breaker , or in a
~~switchboard or switchgear.~~
directory in an approved location. Circuit directories that utilize abbreviations or symbols shall include an explanation of their meaning. The descriptions shall comply with (1), (2), and (3).

(1) Each description shall include an approved degree of detail that allows the circuit to be distinguished from all others.

(2) Spare positions that contain unused overcurrent devices or switched shall be described accordingly.

(3) No circuit shall be described in a manner that depends on transient conditions of occupancy.

Statement of Problem and Substantiation for Public Comment

This rewrite is intended to fully respond to the reservations expressed by the Correlating Committee in their Note 8, asking for improvements in usability and clarity. As it turns out, this rule is very amenable to a list format. This comment also better responds to PI -2725 (asking for standard English); that is unworkable, but insisting that the use of abbreviations and symbols be explained will further address the concerns in that PI. The comment also addresses the problem in the literal text of the FR that a circuit directory could be posted at each circuit position. Instead, the obvious intent is for individual descriptions to be posted at each position. However, this comment also allows for an actual directory for this equipment, at an approved location. This correlates with an equivalent permission for panelboards.

Related Item

• CC Note 8 • FR-7895 • PI-2725

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:

Submittal Date: Mon Aug 16 21:19:58 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7861-NFPA 70-2021
Statement: The text is revised to clarify the requirements into a list format.

The text “Clear in explaining abbreviations and symbols when used” was added to provide direction when symbols or abbreviations are used.

Public Comment No. 51-NFPA 70-2021 [Section No. 408.4(A)]

(A) Circuit Directory or Circuit Description.

Every circuit and circuit modification shall be legibly and permanently described as to its clear, evident, and specific purpose or use. The description 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 description shall be included in a circuit directory that is ~~located~~ printed in terms found in a standard dictionary, and located on the face of, 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.

Statement of Problem and Substantiation for Public Comment

This attempts to resolve the concerns raised in two PIs, while avoiding their shortcomings. Mr. Nieves has observed descriptions in illegible handwriting. As a result, his P.I. 590 sought to ban handwritten directories. The CMP pointed out that some handwritten directories are legible, so banning the use of handwriting might be overly restrictive. Requiring the directories to be printed seems like a possible compromise. Eliminating the use of script will at least improve the legibility of some handwritten circuit descriptions.

My proposal sought to ban circuit descriptions that rely on idiosyncratic language and odd abbreviations, which not only users but some other electricians, reviewers and inspectors had trouble figuring out. The Panel was concerned with my specifying standard English. Substituting "standard dictionary terms" may resolve this issue, as the NEC itself expects users to rely on a standard dictionary where it does not add special definitions in Article 100 or the .2 sections of other articles.

Related Item

• Attempts to resolve CMP concerns with two PIs: 590 and 2725

Submitter Information Verification

Submitter Full Name: David Shapiro
Organization: Safety First Electrical
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 30 17:20:46 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected
Resolution: Dictionary definitions may not match typical descriptions of home areas.

Public Comment No. 1391-NFPA 70-2021 [Section No. 408.4(B)]

(B) Source of Supply.

All switchboards, switchgear, and panelboards supplied by a feeder(s) in other than one- or two-family dwellings shall be permanently marked to indicate each device or equipment where the power originates and its physical location. The label shall be permanently affixed, of sufficient durability to withstand the environment involved, and not handwritten.

Informational Note: Considerations for testing for the absence of voltage should be made at the time of installation. If test points are insulated or not readily accessible due to the presence of barriers or guards, consider utilizing a permanently mounted absence of voltage tester (AVT). NFPA 70E provides guidance for safely verifying the absence of voltage.

Statement of Problem and Substantiation for Public Comment

With insulation and barrier requirements becoming more common, it is increasingly difficult in certain situations to safely test for the absence of voltage with a portable tester. NFPA 70E has recognized both portable testers and permanently mounted absence of voltage testers as acceptable methods for verifying the absence of voltage since 2018. Permanently mounted absence of voltage testers can significantly reduce risk and exposure to electrical hazards when testing for absence of voltage. However, because it is permanently mounted, the tester has to be considered during the installation of the equipment. Adding an informational note that encourages equipment designers and installers to consider how absence of voltage testing will be performed will lead to increased safety of those who operate and maintain the equipment after it is installed, regardless of whether portable or permanently-mounted testers are used. This informational note does not require absence of voltage testers, but only seeks to make people aware that there are multiple methods to accomplish this task and points the user of the standard to NFPA 70E for more information on this topic. If this topic is not considered at the time of installation, it may not be possible to mitigate testing risks later during the life of the equipment.

Related Item

• PI 3980

Submitter Information Verification

Submitter Full Name: Rachel Bugaris
Organization: Panduit Corp
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 12 14:17:19 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected
Resolution: The informational note does not have any relation to the existing text.

Public Comment No. 248-NFPA 70-2021 [Section No. 408.4(B)]

(B) Source of Supply.

All switchboards, switchgear, and panelboards supplied by a feeder(s) in other than one- or two-family dwellings shall be permanently marked to indicate each device or equipment where the power originates ~~and its physical location~~ . The label shall be permanently affixed, of sufficient durability to withstand the environment involved, and not handwritten.

Statement of Problem and Substantiation for Public Comment

While this revision would certainly improve safety in many installations, it may not be practical for all installations. In some facilities, a description of the area in which the supply side disconnect for a piece of equipment is may be infeasible. In others, the description of the location could become quite large. This requirement would also rely on the design having designated a name for each room, and one that will be marked permanently, such that all future users of the building may benefit from it. Not all buildings are so constructed, and thus not all buildings would benefit from this.

In a number of cases, such as large scale solar facilities, the name of an overcurrent device protecting a piece of equipment (and that could be used as the disconnect) may be marked such on a map. So for instance switchboard 1 CKT#4 may be the name of both the supplying equipment, and the marked location on the map. Encouraging an improvisation of naming locations may impede safety.

If the committee does adopt this language, it would be requested to add an exception for installations where conditions of maintenance and supervision ensure that only qualified persons service the installation. In those installations, a marking of the source name but not location may suffice. Otherwise, make the language more restrictive such that it would apply to those installations that would benefit from the rule.

Related Item

• Public Input No. 1113-NFPA 70-2020 [Section No. 408.4(B)]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: Josh Weaver
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 15 18:45:01 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected
Resolution: The physical location description should remain in the requirement as it will help to locate the source of the circuit.

Public Comment No. 1553-NFPA 70-2021 [Section No. 408.8]

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 manufacturer. If equipment has been damaged by fire, products of combustion, corrosive influences, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service. ~~Reconditioned equipment shall be listed or field labeled as reconditioned switchboards and marked in accordance with 110.21(A)(2).~~

(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 switchboards and switchgear shall be listed or field labeled as reconditioned.

Statement of Problem and Substantiation for Public Comment

Text on listing and field labeling in the charging text points only to subsection (B) because panelboards have different requirements. This requirement is then repeated in the subsection(B). This requirement in the charging text is deleted to improve clarity.

Related Item

• FR 7951

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: Nema
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 13:46:33 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7583-NFPA 70-2021

Statement: The changes separate the requirements for replacement panelboards, which are now located in a new Section 408.9, from the requirements for reconditioning in Section 408.8.

The panel considered the directive from the Correlating Committee that requirements pertaining to reconditioned equipment should be located at the beginning of the article. However, the current location is the most appropriate and user-friendly location in the context of Article 408.

Replacement panelboard requirements are clarified.

The title was changed from "reconditioning" to "reconditioned" in accordance with the Correlating Committee instruction in CC Note 259.

The phrasing in 408.8(A), "shall not be permitted to be reconditioned," is changed to "shall not be reconditioned" in accordance with Correlating Committee Note 251.

Panelboard replacements are often thought of as a reconditioning process, which they are not, and the present location provides clarity regarding the distinction between panelboards and switchboards/switchgear and what is permitted for each.

References to the reconditioning requirements in Sections 110.20 and 110.21 are removed, as they were redundant.

Public Comment No. 1646-NFPA 70-2021 [Section No. 408.8]

408.8 ~~Reconditioning of~~ Reconditioned 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 manufacturer.~~ comply with 110.20. If equipment has been damaged by fire, products of combustion, corrosive influences, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service. Reconditioned equipment shall be ~~listed or field labeled as reconditioned switchboards and~~ marked in accordance with 110.21(A)(2).

(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 switchboards and switchgear shall be listed or field labeled as reconditioned.~~

Statement of Problem and Substantiation for Public Comment

This comment changes the title from "reconditioning" to "reconditioned" in accordance with the Correlating Committee instruction in CC Note 259. The phrasing in (A), "shall not be permitted to be reconditioned," is changed to "shall not be reconditioned" in accordance with Correlating Committee Note 251. This comment, however, recommends that 408.8(A), covering in part panelboard replacements, continue its present general structure. Panelboard replacements are often thought of as a reconditioning process, which they are not, and the present location provides clarity regarding the distinction between panelboards and switchboards/switchgear and what is permitted for each. The immediate proximity of (A) on panels and (B) on boards and gear highlights the differences. Note that this all follows from the unusual history going back well over 100 years, during which time the rather unique distinction between panelboards and their enclosures has been consistently applied in the NEC,

Related Item

• FR-7951 • CC Note 251 • CC Note 259

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 21:28:51 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7583-NFPA 70-2021

Statement: The changes separate the requirements for replacement panelboards, which are now located in a new Section 408.9, from the requirements for reconditioning in Section 408.8.

The panel considered the directive from the Correlating Committee that requirements pertaining to reconditioned equipment should be located at the beginning of the article. However, the current location is the most appropriate and user-friendly location in the context of Article 408.

Replacement panelboard requirements are clarified.

The title was changed from "reconditioning" to "reconditioned" in accordance with the Correlating Committee instruction in CC Note 259.

The phrasing in 408.8(A), "shall not be permitted to be reconditioned," is changed to "shall not be reconditioned" in accordance with Correlating Committee Note 251.

Panelboard replacements are often thought of as a reconditioning process, which they are not, and the present location provides clarity regarding the distinction between panelboards and switchboards/switchgear and what is permitted for each.

References to the reconditioning requirements in Sections 110.20 and 110.21 are removed, as they were redundant.

Public Comment No. 184-NFPA 70-2021 [Section No. 408.8(A)]

(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.

Informational Note: reconditioning differs from replacement. Replacement of a panelboard in a cabinet does not constitute reconditioning. For more information, see definitions of panelboard, cabinet, and reconditioned in article 100.

Statement of Problem and Substantiation for Public Comment

I believe this is unneeded because by definition, this clause does not prevent the replacement of a panelboard within an enclosure, as per article 100, a panelboard is made to be installed in a cabinet or cutout box, which falls under article 312. Adding more unneeded language to the code simply because of a misinterpretation comes with the negative effect of making the code unnecessarily long and conflicting. Inspectors have the advantage of contacting NFPA for free if they have questions about the definition of a panelboard or cabinet. This should be used, rather than adding more language that could in time conflict, take on unintended meaning, or if later removed due to its being not needed cause people to think an allowance was removed from the code.

Secondly, if it was necessary to by this clause give special permission to replace a panelboard in a cabinet, then this would imply that perhaps since there's no specific permission granted here, it is not allowed to replace parts of a panelboard with manufacturer listed replacement parts. This would end up being another misinterpretation of the code caused by this language being put in place to deal with other instances of people misinterpreting it.

If the committee really feels this is needed, perhaps instead we should have an informational note instead that says:

Informational Note: reconditioning differs from replacement. Replacement of a panelboard in a cabinet does not constitute reconditioning. For more information, see definitions of panelboard, cabinet, and reconditioned in article 100.

Related Item

• Public Input No. 4513-NFPA 70-2020 [Section No. 408.8(A)]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: Not Applicable
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 09 18:32:54 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7583-NFPA 70-2021

Statement: The changes separate the requirements for replacement panelboards, which are now located in a new Section 408.9, from the requirements for reconditioning in Section 408.8.

The panel considered the directive from the Correlating Committee that requirements pertaining to reconditioned equipment should be located at the beginning of the article. However, the current location is the most appropriate and user-friendly location in the context of Article 408.

Replacement panelboard requirements are clarified.

The title was changed from "reconditioning" to "reconditioned" in accordance with the Correlating Committee instruction in CC Note 259.

The phrasing in 408.8(A), "shall not be permitted to be reconditioned," is changed to "shall not be reconditioned" in accordance with Correlating Committee Note 251.

Panelboard replacements are often thought of as a reconditioning process, which they are not, and the present location provides clarity regarding the distinction between panelboards and switchboards/switchgear and what is permitted for each.

References to the reconditioning requirements in Sections 110.20 and 110.21 are removed, as they were redundant.

Public Comment No. 952-NFPA 70-2021 [Section No. 408.8(A)]

(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 or classified 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.

Statement of Problem and Substantiation for Public Comment

Mr. Brackett's addendum might not be necessary, but electricians think of classified parts as different from listed parts. If a replacement panelboard is not found in the original directory, but has been investigated by a NRTL authorized to test to the standard and certified as being suitable for use as its replacement, its approval should not require hiring a FEB.

Related Item

• PI 4513 • FR7951

Submitter Information Verification

Submitter Full Name: David Shapiro
Organization: Safety First Electrical
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 05 11:41:51 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: The term "classified" isn't a defined term with regard to panelboards and is covered by the term "Listed."

Public Comment No. 2202-NFPA 70-2021 [Section No. 408.8(B)]

(B) Switchboards and Switchgear.

Switchboards and switchgear, or sections of switchboards or switchgear, shall be permitted to be reconditioned. Reconditioned switchboards and switchgear shall be listed or field labeled as reconditioned.

Statement of Problem and Substantiation for Public Comment

This public comment is submitted to further oppose the requirement for, or informational note for, an absence of voltage tester, as per public input 3980. These testers have their limits in usefulness or on their impact on safety. They are not a substitute for qualified people. Also, there is no reason why the NEC should promote them above that of the other 70E required or allowed means.

I do not believe the statements given in the public input that created this constitute substantiation. We should be using the NEC to drive safety, not sales of products. This is one of multiple ways to test for absence of voltage, thus it shouldn't have its own informational note to elevate it above others. A public input to require or to discuss these devices was submitted for many articles, and in most other cases, rejected.

Here's why I don't believe there is substantiation given in the public input:

Report ID 0950631
Firstly, this is an incident involving medium voltage, which 408 doesn't apply to. According to the text in the public input, this tragedy was caused by a number of improper acts and conditions. Untrained persons. People unfamiliar with the voltage or hazards involved, people assuming they knew what breaker needed to be de-energized (a similar error could be made by assuming you know what exact part of a piece of equipment the absence of voltage tester is connected to), people using the wrong tester for a given voltage class. This case should not be one used to create an argument that absence of voltage testers protect from unqualified persons becoming injured.

Disconnect recall notices:

Example 1:
The author mentions some instances of improper manufacture of disconnects that lead to incidents. Such a thing is possible with these relatively new devices as well.
Example 2:
The author mentions some instances of improper manufacture of disconnects that lead to incidents. Such a thing is possible with these relatively new devices as well.
Example 3:
The author mentions more issues with manufacturing and/or installation. This time, toggle or drum switches. In this case it's not clear if these were toggle switches controlling utilization loads or a contactor. If the latter, it goes to illustrate how an improper install of a multi-component system (including one with absence of voltage testers) can lead to a hazardous situation. Again, no evidence that these components can't be faultily manufactured or applied just like the case of these drum/toggle switches.

These devices don't replace qualified people – in most cases they only indicate what part of a piece of equipment are de-energized, and thus they are only useful to qualified persons. They could create greater hazards to unqualified persons.

These devices are only accurate if installed on the correct location of a circuit. In some industrial facilities, there may be stickers indicating the one line throughout the switch gear. These facilities take great care to document and properly install their equipment. In these facilities, one might be able to

trust that one of these is properly installed, and usable to a qualified person. In other facilities, these devices may be improperly interpreted as to what points of a circuit are deenergizd when they indicate a de-energized position. Thus, these devices have their limits and risks.

These devices may be best used by facility owners who have the confidence in the work they did to install and maintain them, in order to allow their employees to rely on them. Installing them on every piece of equipment may not help safety due to both possible improper install, neglect, improper interpretation of what they indicate. The idea that these will improve safety across the board would have to be routed in an idea that they are a replacement for qualified people, when they aren't.

These very useful devices will continue to have a positive impact on the industry. Requiring them everywhere, and putting notes about them in the NEC may not promote safety, however, for the reasons stated above.

Other examples were given in related public inputs to require this elsewhere in the code, which seem not to substantiate their need:

1. Report ID: 0728900
From the information in the public input, it can not be determined that if the disconnect (normally not located on the equipment) had been off, locked out, and verified de-energized with one of these absence of voltage testers, that the employee would not have been able to be injured by contact with the capacitor.
2. Report ID: 0420600
Again like above here, no evidence is given in the public input that the capacitor would have been discharged, had the absence of voltage tester been on the disconnect. Many times, it wouldn't have been. It could be downstream of the disconnect with the tester and on the load side of a contactor, such that the absence of voltage tester wouldn't have seen it. In both this and the case above, the narrative in the report doesn't support even an idea that had the employee locked out the disconnect and tested it (with or without the absence of voltage tester), that the hazard caused by the capacitor wouldn't have presented itself.
3. Report ID: 0316300
In this case, an employee had a possibly untrained helper shut off a breaker. Report doesn't say if said breaker is at the equipment or in a panelboard (which might be seperate from the purview of this article). Regardless, the employee failed to verify a de-energized condition. The narrative that had the tester device been present, the unqualified person would have known what it meant and would have told the other worker may be incorrect. These devices are only helpful to qualified persons.
4. Report ID: 0452110
From the text given in the public input, we can not determine that an absence of voltage tester would have mitigated this tragedy. It involved an unlabeled breaker, and an assumption someone shouldn't have made. The absense of voltage tester can present the same hazards if improperly applied or maintained. Furthermore, even if the absense of voltage tester had been properly installed at the panelboard, it would still be hazardous to rely on it meaning a wire in the junction box is safe to work on for the same reason. Someone relying on one of these devices located in a breaker panel to clearly indicate that a wire in a multi circuit junction box far from it is de-energized would be hazardous for a number of reasons. If anything, this would be a cautionary tale of the dangers of over-applying these devices.
5. Report ID 0522300
This one doesn't indicate at all that an absence of voltage tester would have prevented this incident. It seems there was no regard for shutting off the equipment at all. The device only works if someone cares to shut the equipment off.
6. Report ID 0729700
Again, another tragedy caused by improper workmanship and improper work practices. From the text of the report in this public input, we see nothing to conclude that had one of these been installed, that the wiring that was associated with another circuit would have been detected.

Related Item

• Public Input No. 3980-NFPA 70-2020 [New Section after 408.8(B)]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 19 16:31:47 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: The public comment was not submitted in accordance with section 4.4.4.3(c) of the Regulations Governing the Development of NFPA Standards. No changes to first draft text were provided.

Public Comment No. 183-NFPA 70-2021 [Section No. 408.8 [Excluding any Sub-Sections]]

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 shall be ~~performed~~ manufactured in accordance with ~~any instructions provided by the manufacturer.~~ 110.3B. If equipment has been damaged by fire, products of combustion, corrosive influences, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service. Reconditioned equipment shall be listed or field labeled as reconditioned switchboards and marked in accordance with 110.21(A)(2).

Statement of Problem and Substantiation for Public Comment

This new set of text specific to switchboards could allow any manufacturer to for reasons of profitability and not safety, issue instructions prohibiting any reconditioning of its equipment; or prohibit reconditioning of its product by anyone other than itself. 408.8B (the section that allows it for switchgear) already requires that it be listed or field labeled. 110.2 requires approval. 110.3B requires compliance with listing and labeling instructions. Currently for the next revision, 110.17 and 110.20 also have language regarding due care to be used when reconditioning equipment. It would seem this would be sufficient.

Related Item

• Public Input No. 2298-NFPA 70-2020 [Section No. 408.8(B)]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: Not Applicable
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 09 18:23:34 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7583-NFPA 70-2021

Statement: The changes separate the requirements for replacement panelboards, which are now located in a new Section 408.9, from the requirements for reconditioning in Section 408.8.

The panel considered the directive from the Correlating Committee that requirements pertaining to reconditioned equipment should be located at the beginning of the article. However, the current location is the most appropriate and user-friendly location in the context of Article 408.

Replacement panelboard requirements are clarified.

The title was changed from "reconditioning" to "reconditioned" in accordance with the Correlating Committee instruction in CC Note 259.

The phrasing in 408.8(A), "shall not be permitted to be reconditioned," is changed to "shall not be reconditioned" in accordance with Correlating Committee Note 251.

Panelboard replacements are often thought of as a reconditioning process, which they are not, and the present location provides clarity regarding the distinction between panelboards and switchboards/switchgear and what is permitted for each.

References to the reconditioning requirements in Sections 110.20 and 110.21 are removed, as they were redundant.

Public Comment No. 1383-NFPA 70-2021 [Section No. 408.38]

408.38 Enclosure.

Panelboards shall be mounted in cabinets, cutout boxes, or identified enclosures and shall be dead-front. Where the available fault current is greater than 10,000 amperes, the panelboard and enclosure combination shall be ~~evaluated~~ listed or field-labeled for the application.

Exception: Panelboards other than of the dead-front, externally operable type shall be permitted where accessible only to qualified persons.

Statement of Problem and Substantiation for Public Comment

Everything has to be evaluated [110.3(A)], so the first revision doesn't add anything. It seems that listing or field labeling is appropriate and would harmonize with 408.8.

Related Item

• FR 7950

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Ryan Jackson
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 12 13:29:25 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: The wording “shall be evaluated” accurately explains the requirement. UL 67 requires panelboards to be dead-front type and, if provided without an enclosure, to be rated no greater than 10,000 amperes rms symmetrical unless they are marked for use with a specific enclosure. If the panelboard is rated more than 10,000 amperes rms symmetrical it shall be marked with the enclosure requirement which indicates it has been evaluated and listed for the combination.

Public Comment No. 1487-NFPA 70-2021 [Section No. 408.38]

408.38 Enclosure.

Panelboards shall be mounted in cabinets, cutout boxes, or identified enclosures and shall be dead-front. ~~Where the available fault current is greater than 10,000 amperes, the panelboard and enclosure combination shall be evaluated for the application~~ .

Exception: Panelboards other than of the dead-front, externally operable type shall be permitted where accessible only to qualified persons.

Statement of Problem and Substantiation for Public Comment

This language implies that the only time a panelboard should be evaluated for the application is when the available fault current is greater than 10kA. There are many aspects of an assembly that must be evaluated regardless of the amount of available fault current. Voltages must be considered, environmental conditions must be evaluated, ampere rating of the equipment must be evaluated. The added language is vague and could lead to miss application.

Related Item

• FR 7950

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 15 12:20:45 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: The wording “shall be evaluated” accurately explains the requirement. UL 67 requires panelboards to be dead-front type and, if provided without an enclosure, to be rated no greater than 10,000 amperes rms symmetrical unless they are marked for use with a specific enclosure. If the panelboard is rated more than 10,000 amperes rms symmetrical it shall be marked with the enclosure requirement which indicates it has been evaluated and listed for the combination.

Public Comment No. 185-NFPA 70-2021 [Section No. 408.38]

408.38 Enclosure.

Panelboards shall be mounted in cabinets, cutout boxes, or identified enclosures and shall be dead-front. ~~Where the available fault current is greater than 10,000 amperes, the~~ Both the panelboard and its enclosure ~~combination~~ shall be ~~evaluated~~ suitable for the ~~application~~ available fault current .

Exception: Panelboards other than of the dead-front, externally operable type shall be permitted where accessible only to qualified persons.

Statement of Problem and Substantiation for Public Comment

It would seem more appropriate if possible, for this to be moved to article 312 as it is concerning the cabinet that the panelboard. However:
1. The use of the term "evaluated" could communicate a possible need to do more than what the code is intending to do here. It could communicate that something more than ensuring the proper compatibility and fault current rating is required. It could cause some to think engineering supervision is needed to replace a panelboard in an old cabinet rather than simply confirming the ratings and compatability of the cabinet and the panelboard. Such could have a negative effect on safety as it could discourage replacement, as was eluded to in the concern of committee members who voted "affirmative with comments" to this section. I suggest use of the word "suitable" and/or "approved." These words have better understood meaning.
2. Unless the NEC specifies that panelboards are to be rated minimum 10,000 KAIC, it would seem we should keep this a general rule, compatible with the available fault current. This especially if the concern may be ensuring the proper installation of any replacement components or upgrades. Per article 240, circuit breakerscan be as low as 5000 ampr interrupting. There's no minimum short circuit current capability for panelboards or cabinets containing panelboards that is in the NEC. It would seem possible that there could be some replacements where available fault current of less than 10,000 amps could still need to be considered.

Related Item

• First Revision No. 7950-NFPA 70-2020 [Section No. 408.38]

Submitter Information Verification

Submitter Full Name: Josh Weaver
Organization: Not Applicable
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 09 18:42:42 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: The wording “shall be evaluated” accurately explains the requirement. UL 67 requires panelboards to be dead-front type and, if provided without an enclosure, to be rated no greater than 10,000 amperes rms symmetrical unless they are marked for use with a specific enclosure. If the panelboard is rated more than 10,000 amperes rms symmetrical it shall be marked with the enclosure requirement which indicates it has been evaluated and listed for the combination.

Public Comment No. 1899-NFPA 70-2021 [Section No. 408.43]

408.43 Panelboard Orientation.

Panelboards shall not be installed in the face-up or face-down position.

Exceptoin: A listed commercial appliance outlet center shall be permitted to be installed in a face-up orientation in a floor, provided the installation complies with (1), (2), and (3):

(1) The number of circuit positions does not exceed 8

(2) There is not less than 900 mm (3 ft) of clear floor workspace on at least three sides of the outlet center.

(3) There are no obstructions above the outlet center or above the required workspace

Statement of Problem and Substantiation for Public Comment

Some relief is in order for equipment that has been listed and applied for generations. This wording accords with minimum safety requirements. Electricians periodically work on hands and knees, and do so safely. If this or comparable action is not taken, the manufacturers will presumably be looking at a file review that will effectively remove this product from the market. That result is excessive and not supportable, and in my opinion is on the hairy edge of constituting a restraint of trade. It also should be addressed generally; the application does not seem to require an occupancy limitation by location in Chapter 5.

Related Item

• PI-1705

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 18 14:47:15 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: CMP 9 is aware of some equipment that is listed within UL category AUUZ that contains assemblies that qualify as having panelboard components. However, this equipment was never designed for general applications. The allowance, if given, for these applications should be met with language in Chapter 5. CMP 9 is aware that this is currently under review by CMP 15 for potential location in Section 518.5 (see Public Comment 2223).

Public Comment No. 884-NFPA 70-2021 [Section No. 450.1]

450.1 Scope.

This article covers the installation of all transformers other than the following:

(1) Current transformers

(2) Dry-type transformers that constitute a component part of other apparatus and comply with the requirements for such apparatus

(3) Transformers that are an integral part of an X-ray, high-frequency, or electrostatic-coating apparatus

(4) Transformers used with Class 2 and Class 3 circuits

(5) Transformers for sign and outline lighting

(6) Transformers for electric-discharge lighting

(7) Transformers used for power-limited fire alarm circuits

(8) Transformers used for research, development, or testing, where effective arrangements are provided to safeguard persons from contacting energized parts

Additional Proposed Changes

File Name	Description	Approved
9_CN_9.pdf	9 CN9	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 9 appeared in the First Draft Report on First Revision No.7782.

The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel action.

Related Item

• First Revision No. 7782

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:35:34 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Rejected

Action:

Resolution: Reject The Correlating Committee has accepted the proposed first revision of the Article 450 scope and provided no recommendation to revise the First Draft action.

Correlating Committee Note No. 9-NFPA 70-2021 [Section No. 450.1]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon May 03 11:24:10 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel action.

First Revision No. 7782-NFPA 70-2020 [Section No. 450.1]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 504-NFPA 70-2021 [Sections 450.3(A), 450.3(B)]

Sections 450.3(A), 450.3(B)

(A) Transformers

~~Over~~

1000 Volts, Nominal

~~.~~

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

~~(B) Transformers 1000 Volts~~

,

~~Nominal,~~

or Less.

Overcurrent protection shall be provided in accordance with Table 450.3(

~~B~~

A) unless the transformer is installed as a motor control circuit transformer in accordance with 430.72(C)(1) through (C)(5).

Table 450.3(A) Maximum Rating or Setting of Overcurrent Protection for Transformers

~~Over~~

1000 Volts

~~(as a Percentage of Transformer-Rated Current) Location Limitations Transformer Rated Impedance - Primary Protection over 1000 Volts - Secondary Protection [2] - - Over 1000 Volts - 1000 Volts or Less - Circuit Breaker [4] Fuse Rating - Circuit Breaker [4] Fuse Rating - Circuit Breaker or Fuse Rating Any location Not more than 6% - 600% [1]~~

~~300% [1]~~

~~- 300% [1]~~

~~250% [1]~~

~~- 125% [1]~~

~~More than 6%~~

~~**and**~~

~~not more than 10% - 400% [1]~~

~~300% [1]~~

~~- 250% [1]~~

~~225% [1]~~

~~- 125% [1]~~

~~Supervised locations only [3] Any - 300% [1]~~

~~250% [1]~~

~~- Not required Not required - Not required Not more than 6% - 600% 300% - 300% [5]~~

~~250% [5]~~

~~- 250% [5]~~

~~More than 6%~~

~~and not more than 10% - 400% 300% - 250% [5]~~

225% [5]

- 250% [5]

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

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

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

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

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

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

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

Table 450.3(B) Maximum Rating or Setting of Overcurrent Protection for Transformers 1000 Volts and

Less (as a Percentage of Transformer-Rated Current)

Protection Method	**Primary Protection**		
	Secondary Protection [2]		
	Currents of 9 Amperes or More	**Currents Less Than 9 Amperes**	**Currents Less Than 2 Amperes**
Primary only protection	125% [1]	167%	300%
Primary and secondary protection	Not required 250% [3]	Not required 250% [3]	250% [3]

-

~~125%~~ [1]	~~167%~~

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

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

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

Statement of Problem and Substantiation for Public Comment

450.3(A) and Table 450.3(A) are addressed in new section 495.103 and not applicable to Transformers under 1000v

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 502-NFPA 70-2021 [Section No. 450.21(C)]	
Public Comment No. 514-NFPA 70-2021 [Section No. 450.24]	
Public Comment No. 515-NFPA 70-2021 [Section No. 450.23(A)]	

Related Item

• 3728-NFPA 70-2020

Submitter Information Verification

Submitter Full Name: Andrew Kasznay
Organization: Avangrid
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 28 14:30:45 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected
Resolution: Article 495 will not include requirements for transformers. Therefore, the recommended changes are rejected.

Public Comment No. 502-NFPA 70-2021 [Section No. 450.21(C)]

~~(C) Over 35,000 Volts.~~

~~Dry-type transformers rated over 35,000 volts shall be installed in a vault complying with Part III of this article.~~

Statement of Problem and Substantiation for Public Comment

450.21(C) is fully addresed in new section 495.104(C) and does not apply to Transformers under 1000v

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 504-NFPA 70-2021 [Sections 450.3(A), 450.3(B)]	

Related Item

- 3728-NFPA 70-2020

Submitter Information Verification

Submitter Full Name: Andrew Kasznay
Organization: Avangrid
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 28 14:26:03 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: Article 495 will not include requirements for transformers. Therefore, the recommended changes are rejected.

Public Comment No. 515-NFPA 70-2021 [Section No. 450.23(A)]

(A) Indoor Installations.

Indoor installations shall be permitted in accordance with one of the following:

(1) In Type I or Type II buildings, in areas where all of the following requirements are met:

(2) ~~The transformer is rated 35,000 volts or less.~~

a. No combustible materials are stored.

b. A liquid confinement area is provided.

c. The installation complies with all the restrictions provided for in the listing of the liquid.

Informational Note: Such restrictions can include, but are not limited to, maximum pressure of the tank, use of a pressure relief valve, appropriate fuse types, and proper sizing of overcurrent protection.

(3) If an automatic fire extinguishing system and a liquid confinement area is present~~, provided the transformer is rated 35,000 volts or less~~

(4) If the installation complies with 450.26

Statement of Problem and Substantiation for Public Comment

450.23 (A)(1)(a) is addresed in 495.106(A)1(a)

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 504-NFPA 70-2021 [Sections 450.3(A), 450.3(B)]	

Related Item

• 3728-NFPA 70-2020

Submitter Information Verification

Submitter Full Name: Andrew Kasznay
Organization: Avangrid
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 28 15:38:12 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action:	Rejected
Resolution:	Article 495 will not include requirements for transformers. Therefore, the recommended changes are rejected.

Public Comment No. 1648-NFPA 70-2021 [Section No. 450.23(B)]

(B) Outdoor Installations.

Less-flammable liquid-filled transformers shall be permitted to be installed outdoors, attached to, adjacent to, or on the roof of buildings, if installed in accordance with either of the following:

(1) For Type I and Type II buildings, the installation shall comply with all the restrictions provided for in the listing of the liquid.

Informational Note No. 1: See 450.27 for ~~information about~~ examples of additional safeguards that can be required for installations adjacent to combustible material, fire escapes, or door and window openings ~~that can require additional safeguards~~ .

Informational Note No. 2: Such restrictions can include, but are not limited to, maximum pressure of the tank, use of a pressure relief valve, appropriate fuse types, and proper sizing of overcurrent protection.

(2) In accordance with 450.27.

Informational Note No. 3: See NFPA 220-2021, *Standard on Types of Building Construction*, for definitions of Type I and Type II building ~~construction.~~ constructions . as used in this section. *Combustible materials* refers to those materials not classified as noncombustible or limited-combustible in that standard.

Informational Note No. 4: See Article 100 for definition of *Listed*.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee, in their Note #10, has, however inadvertently, flagged some problems with the First Revision (FR-7840). The 2020 NEC cites [in I.N 1 to (B)(1)] the 450.27 locations using the terminology “such as 450.27,” which is not exclusive. The panel set up 450.27 as the exclusive list. The wording suggested in this comment adds “examples of” to retain the former meaning. Also, in I.N. 2 to (B((2), the second sentence of the 2020 NEC wording was omitted, and is restored below without repeating the name of the standard.

Related Item

• FR-7840 • CC Note 10

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 22:00:05 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Rejected but see related SR

Action:	
Resolution:	SR-7682-NFPA 70-2021
Statement:	Informational Note 1 has been edited to improve wording. Informational Notes 1 and 3 locations were switched to associate each note with the proper text. Informational Note 4 was deleted since it was not needed. CMP-9 considered additional text submitted on PC-1648 to explain the usage of the term “combustible material” and determined that the text was unnecessary.

Public Comment No. 886-NFPA 70-2021 [Section No. 450.23(B)]

(B) Outdoor Installations.

Less-flammable liquid-filled transformers shall be permitted to be installed outdoors, attached to, adjacent to, or on the roof of buildings, if installed in accordance with either of the following:

(1) For Type I and Type II buildings, the installation shall comply with all the restrictions provided for in the listing of the liquid.

Informational Note No. 1: See 450.27 for information about installations adjacent to combustible material, fire escapes, or door and window openings that can require additional safeguards.

Informational Note No. 2: Such restrictions can include, but are not limited to, maximum pressure of the tank, use of a pressure relief valve, appropriate fuse types, and proper sizing of overcurrent protection.

(2) In accordance with 450.27.

Informational Note No. 3: See NFPA 220-2021, *Standard on Types of Building Construction*, for definitions of Type I and Type II building construction.

Informational Note No. 4: See Article 100 for definition of *Listed*.

Additional Proposed Changes

File Name	Description	Approved
9_CN_10.pdf	9 CN10	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 10 appeared in the First Draft Report on First Revision No. 7840.

The Correlating Committee directs that the Panel review the location of the Informational Notes to ensure they are properly located based on the rules to which they apply.

Related Item

• First Revision No. 7840

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:37:42 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action:	Rejected but see related SR
Resolution:	SR-7682-NFPA 70-2021
Statement:	Informational Note 1 has been edited to improve wording. Informational Notes 1 and 3 locations were switched to associate each note with the proper text. Informational Note 4 was deleted since it was not needed. CMP-9 considered additional text submitted on PC-1648 to explain the usage of the term “combustible material” and determined that the text was unnecessary.

Correlating Committee Note No. 10-NFPA 70-2021 [Section No. 450.23(B)]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon May 03 11:25:42 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs that the Panel review the location of the Informational Notes to ensure they are properly located based on the rules to which they apply.

First Revision No. 7840-NFPA 70-2020 [Section No. 450.23(B)]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 514-NFPA 70-2021 [Section No. 450.24]

450.24 Nonflammable Fluid-Insulated Transformers.

Transformers insulated with a dielectric fluid identified as nonflammable shall be permitted to be installed indoors or outdoors._ Such transformers installed indoors ~~and rated over 35,000 volts~~ shall be ~~installed in a vault. Such transformers installed indoors shall be~~ furnished with a liquid confinement area and a pressure-relief vent. The transformers shall be furnished with a means for absorbing any gases generated by arcing inside the tank, or the pressure-relief vent shall be connected to a chimney or flue that will carry such gases to an environmentally safe area.

Informational Note: Safety may be increased if fire hazard analyses are performed for such transformer installations.

For the purposes of this section, a nonflammable dielectric fluid is one that does not have a flash point or fire point and is not flammable in air.

Statement of Problem and Substantiation for Public Comment

35,000v is not required in 450.24 and is addressed in 495.107

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 504-NFPA 70-2021 [Sections 450.3(A), 450.3(B)]	

Related Item

• 3728-NFPA 70-2020

Submitter Information Verification

Submitter Full Name: Andrew Kasznay
Organization: Avangrid
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 28 15:29:04 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: Article 495 will not include requirements for transformers. Therefore, the recommended changes are rejected.

Public Comment No. 888-NFPA 70-2021 [Section No. 490.1]

490.1 Scope.

This article covers the general requirements for equipment operating at more than 1000 volts, nominal.

Informational Note No. 1: See NFPA *70E*-2021, *Standard for Electrical Safety in the Workplace*, for electrical safety requirements for employee workplaces.

Informational Note No. 2: See ANSI Z535.4-2011, *Product Signs and Safety Labels*, for further information on hazard signs and labels.

Informational Note No. 3: See IEEE 3001.5-2013, *Recommended Practice for the Application of Power Distribution Apparatus in Industrial and Commercial Power Systems*, for information regarding power distribution apparatus.

Additional Proposed Changes

File Name	Description	Approved
9_CN_11.pdf	9 CN11	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 11 appeared in the First Draft Report on First Revision No. 8141.

The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel action.

Related Item

• First Revision No. 8141

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:39:33 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected
Resolution: CMP 9, in creating Article 495, is deleting Article 490.

Correlating Committee Note No. 11-NFPA 70-2021 [Section No. 490.1]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Mon May 03 11:26:59 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel action.

First Revision No. 8141-NFPA 70-2020 [Section No. 490.1]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1650-NFPA 70-2021 [Section No. 490.49]

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 [see~~ comply with 110.20 and reconditioned equipment shall be marked in accordance with 110.21(A)(2) ~~]~~. If equipment has been damaged by fire, products of combustion, or water, it shall be specifically evaluated by its manufacturer or a qualified testing laboratory prior to being returned to service.

Statement of Problem and Substantiation for Public Comment

This comment implements the Correlating Committee Note 256 by avoiding the restatement of applicable rules from elsewhere in the Code, namely 110.20 and 110.21(A)(2). CMP 9 is alsop aware of Correlating Committee Note 259 that suggests sections covering reconditioning be placed very near the beginning of the applicable article. In this case, that would be very user unfriendly, because the applicability of the reconditioning provisions is confined to switchgear covered in Part III of the article.

Related Item

• FR-7966 • CC Note 256 • CC Note 259

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 22:14:03 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7752-NFPA 70-2021

Statement: Section 110.21 requires the original listing mark be removed. Section 110.20 addresses other aspects of reconditioning, and the listing or field labeling of reconditioned equipment. In response to the Correlating Committee Public Comment (PC 1932) reference to removal of the listing mark and other conditions of reconditioning are unnecessary, and therefore removed from the statement. In addition, the requirement only applies to equipment within Article 495, therefore, the statement “within the scope of this article” is unnecessary.

CMP 9 is also aware of Correlating Committee Note 259 that suggests sections covering reconditioning be placed very near the beginning of the applicable article. In this case, that would be user unfriendly, because the applicability of the reconditioning

provisions is confined to switchgear covered in Part III of the article. Therefore, CMP 9 leaves the reconditioning requirement in its present location in 495.49.

Lastly, CMP 9 has retained the last sentence which includes requirements not found in the newly created Section 110.20. This additional requirement addresses equipment damaged by fire, products of combustion, or water, and may be information worth considering as a “general requirement” in future editions of the Code.

Public Comment No. 900-NFPA 70-2021 [Section No. 490.49]

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 *[see 110.21(A)(2)]*. 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.

Additional Proposed Changes

File Name	Description	Approved
9_CN_256.pdf	9 CN256	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 256 appeared in the First Draft Report on First Revision No. 7966.

The Correlating Committee directs the panel to reconsider the text in this section to remove redundant requirements in accordance with 4.1.1 of the NEC Style Manual and correlate with FR 8663 and FR 8577.

Related Item

• First Revision No. 7966

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 04 15:51:48 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7752-NFPA 70-2021
Statement: Section 110.21 requires the original listing mark be removed. Section 110.20 addresses other aspects of reconditioning, and the listing or field labeling of reconditioned equipment. In response to the Correlating Committee Public Comment (PC 1932) reference to removal of the listing mark and other conditions of reconditioning are unnecessary, and therefore removed from the statement. In addition, the requirement only applies to equipment within Article 495, therefore, the statement “within the scope

of this article" is unnecessary.

CMP 9 is also aware of Correlating Committee Note 259 that suggests sections covering reconditioning be placed very near the beginning of the applicable article. In this case, that would be user unfriendly, because the applicability of the reconditioning provisions is confined to switchgear covered in Part III of the article. Therefore, CMP 9 leaves the reconditioning requirement in its present location in 495.49.

Lastly, CMP 9 has retained the last sentence which includes requirements not found in the newly created Section 110.20. This additional requirement addresses equipment damaged by fire, products of combustion, or water, and may be information worth considering as a "general requirement" in future editions of the Code.

Correlating Committee Note No. 256-NFPA 70-2021 [Section No. 490.49]

Submitter Information Verification

Committee: NEC-P09
Submittal Date: Thu May 06 09:44:53 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs the panel to reconsider the text in this section to remove redundant requirements in accordance with 4.1.1 of the NEC Style Manual and correlate with FR 8663 and FR 8577.

First Revision No. 7966-NFPA 70-2020 [Section No. 490.49]

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1824-NFPA 70-2021 [Article 495]

Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal

Part I. General

495.1 Scope.

This article covers the general requirements for equipment operating at more than 1000 volts ac, 1500 volts dc, nominal.

Informational Note No. 1: See NFPA *70E* 2021 , *Standard for Electrical Safety in the Workplace* , for electrical safety requirements for employee workplaces.

Informational Note No. 2: See ANSI Z535.4-2011, *Product Signs and Safety Labels,* for further information on hazard signs and labels.

Informational Note No. 3: See IEEE 3001.5-2013, *Recommended Practice for the Application of Power Distribution Apparatus in Industrial and Commercial Power Systems* , for information regarding power distribution apparatus.

495.2 Definition.

The definition in this section shall apply only within this article.

High Voltage.

A potential difference of more than 1000 volts, nominal.

495.3 Other Articles.

Enclosures in damp or wet locations shall meet the requirements of 312.2 .

495.4 Flexible Cords and Flexible Cable Types.

Flexible cords and flexible cables over 1000 volts shall conform to the description in Table 495.4. The use of flexible cords and flexible cables other than those in Table 495.4 shall require permission by the authority having jurisdiction.

Table 495.4 Flexible Cords and Flexible Cables

------- Nominal Insulation Thickness ---- Trade Name Type Letter Voltage AWG or kcmil Number of Conductors Insulation AWG or kcmil mm mils Braid on Each Conductor Outer Covering Use Portable power cable G 2000 12–500 2–6 plus equipment grounding conductor(s) Thermoset 12–2

1–4/0

250–

500 1.52

2.03

2.41 60

80

95 — Oil-resistant thermoset Portable and extra-hard usage - G-GC* 2000 12–500 3–6 plus equipment grounding conductors and 1 ground check conductor Thermoset 12–2

1–4/0

250–

500 1.52

2.03

2.41 60

80

95 — Oil-resistant thermoset Portable and extra-hard usage Portable power cable PPE* 2000 12–500 1–6 plus optional equipment grounding conductor(s) Thermoplastic elastomer 12–2

1–4/0

250–

500 1.52

2.03

2.41 60

80

95 — Oil-resistant thermo-plastic elastomer Portable and extra-hard usage Portable power cable W* 2000 12–500

501–1000 1–6

1 Thermoset 12–2

1–4/0

250–500

501–

1000 1.52

2.03

2.41

2.80 60

80

95

110 — Oil-resistant thermoset Portable and extra-hard usage

*Types G, G-GC, S, SC, SCE, SCT, SE, SEO, SEOO, SEW, SEOW, SEOOW, SO, SOO, SOW, SOOW, ST, STO, STOO, STW, STOW, STOOW, PPE, and W shall be permitted for use on

theater stages, in garages, and elsewhere where flexible cords are permitted by this *Code*.

Part II. Equipment — Specific Provisions

495.22 Isolating Means.

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

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

An identified fuseholder and fuse shall be permitted as an isolating switch.

495.23 Voltage Regulators.

Proper switching sequence for regulators shall be ensured by use of one of the following:

(1) Mechanically sequenced regulator bypass switch(es)

(2) Mechanical interlocks

(3) Switching procedure prominently displayed at the switching location

495.24 Minimum Space Separation.

In field-fabricated installations, the minimum air separation between bare live conductors and between such conductors and adjacent grounded surfaces shall not be less than the values given in Table 495.24. These values shall not apply to interior portions or exterior terminals of equipment designed, manufactured, and tested in accordance with accepted national standards.

Table 495.24 **Minimum Clearance of Live Parts**

Nominal Voltage Rating (kV) Impulse Withstand, Basic Impulse Level (BIL) (kV) Minimum Clearance of Live Parts Phase-to-Phase Phase-to-Ground Indoors Outdoors Indoors Outdoors Indoors Outdoors mm in. mm in. mm in. mm in. 2

245

9.5 255 10 200 200

460

18.0 460 18 335 13.0 335 13 46 — 200 — — 460 18 — — 335 13 — 250 — — 535 21 — -

17

69 — 250 — — -

535

21 — — 435 17 — 350 — — 790 31 — — 635 25 115 — 550 — — 1350 53 — — 1070 42

Note: The values given are the minimum clearance for rigid parts and bare conductors under favorable service conditions. They shall be increased for conductor movement or under unfavorable service conditions or wherever space limitations permit. The selection of the associated impulse withstand voltage for a particular system voltage is determined by the characteristics of the surge protective equipment.

495.25 Backfeed.

Installations where the possibility of backfeed exists shall comply with 495.25(A) and (B).

(A) Sign.

A permanent sign in accordance with 110.21(B) shall be installed on the disconnecting means enclosure or immediately adjacent to open disconnecting means with the following words or equivalent:

DANGER — CONTACTS ON EITHER SIDE OF THIS DEVICE MAY BE ENERGIZED BY BACKFEED.

(B) Diagram.

A permanent and legible single-line diagram of the local switching arrangement, clearly identifying each point of connection to the high-voltage section, shall be provided within sight of each point of connection.

495.26 Oil-Filled Equipment.

Installation of electrical equipment, other than transformers covered in Part VII containing more than 38 L (10 gal) of flammable oil per unit, shall meet the requirements of Part VII.

Informational Note: The same requirements for oil used in oil-filled transformers are also applicable to other oil-filled equipment.

Part III. Equipment — Switchgear and Industrial Control Assemblies

495.30 General.

Part III covers assemblies of switchgear and industrial control equipment, including, but not limited to, switches and interrupting devices and their control, metering, protection, and regulating equipment where they are an integral part of the assembly, with associated interconnections and supporting structures.

495.31 Arrangement of Devices in Assemblies.

Arrangement of devices in assemblies shall be such that individual components can safely perform their intended function without adversely affecting the safe operation of other components in the assembly.

495.32 Guarding of High-Voltage Energized Parts Within a Compartment.

Where access for other than visual inspection is required to a compartment that contains energized high-voltage parts, barriers shall be provided to prevent accidental contact by persons, tools, or other equipment with energized parts. Exposed live parts shall only be permitted in compartments accessible to qualified persons. Fuses and fuseholders designed to enable future replacement without de-energizing the fuseholder shall only be permitted for use by qualified persons.

495.33 Guarding of Energized Parts Operating at 1000 Volts, Nominal, or Less Within Compartments.

Energized bare parts mounted on doors shall be guarded where the door must be opened for maintenance of equipment or removal of draw-out equipment.

495.34 Clearance for Cable Conductors Entering Enclosure.

The unobstructed space opposite terminals or opposite raceways or cables entering a switchgear or control assembly shall be approved for the type of conductor and method of termination.

495.35 Accessibility of Energized Parts.

(A) High-Voltage Equipment.

Doors that would provide unqualified persons access to high-voltage energized parts shall be locked. Permanent signs in accordance with 110.21(B) shall be installed on panels or doors that provide access to live parts over 1000 volts and shall read DANGER — HIGH VOLTAGE — KEEP OUT.

(B) Control Equipment.

Where operating at 1000 volts, nominal, or less, control equipment, relays, motors, and the like shall not be installed in compartments with high-voltage parts or high-voltage wiring, unless both of the following apply:

(1) The access means is interlocked with the high-voltage switch or disconnecting means to prevent the access means from being opened or removed when the high-voltage switch is in the closed position or a withdrawable disconnecting means is in the connected position.

(2) All high-voltage parts or high-voltage wiring in the compartment that remains energized when a fixed mounted high-voltage switch is in the open position or a withdrawable disconnecting means is in the isolating (fully withdrawn) position are protected by insulating or grounded metal barriers to prevent accidental contact with energized high-voltage parts or wiring.

(C) High-Voltage Instruments or Control Transformers and Space Heaters.

High-voltage instrument or control transformers and space heaters shall be permitted to be installed in the high-voltage compartment without access restrictions beyond those that apply to the high-voltage compartment generally.

495.36 Grounding.

Frames of switchgear and control assemblies shall be connected to an equipment grounding conductor or, where permitted, the grounded conductor.

495.37 Grounding of Devices.

The metal cases or frames, or both, such as those of instruments, relays, meters, and instrument and control transformers, located in or on switchgear or control assemblies, shall be connected to an equipment grounding conductor or, where permitted, the grounded conductor.

496.38 Door Stops and Cover Plates.

External hinged doors or covers shall be provided with stops to hold them in the open position. Cover plates intended to be removed for inspection of energized parts or wiring shall be equipped with lifting handles and shall not exceed 1.1 m^2 (12 ft^2) in area or 27 kg (60 lb) in weight, unless they are hinged and bolted or locked.

495.39 Gas Discharge from Interrupting Devices.

Gas discharged during operating of interrupting devices shall be directed so as not to endanger personnel.

495.40 Visual Inspection Windows.

Windows intended for visual inspection of disconnecting switches or other devices shall be of suitable transparent material.

495.41 Location of Industrial Control Equipment.

Routinely operated industrial control equipment shall meet the requirements of 495.41(A) unless infrequently operated, as covered in 495.41(B).

(A) Control and Instrument Transfer Switch Handles or Push Buttons.

Control and instrument transfer switch handles or push buttons shall be in a readily accessible location at an elevation of not over 2.0 m (6 ft 7 in.).

Exception: Operating handles requiring more than 23 kg (50 lb) of force shall be located no higher than 1.7 m (66 in.) in either the open or closed position.

(B) Infrequently Operated Devices.

Where operating handles for such devices as draw-out fuses, fused potential or control transformers and their primary disconnects, and bus transfer and isolating switches are only operated infrequently, the handles shall be permitted to be located where they are safely operable and serviceable from a portable platform.

495.42 Interlocks — Interrupter Switches.

Interrupter switches equipped with stored energy mechanisms shall have mechanical interlocks to prevent access to the switch compartment unless the stored energy mechanism is in the discharged or blocked position.

495.43 Stored Energy for Opening.

The stored energy operator shall be permitted to be left in the uncharged position after the switch has been closed if a single movement of the operating handle charges the operator and opens the switch.

495.44 Fused Interrupter Switches.

(A) Supply Terminals.

The supply terminals of fused interrupter switches shall be installed at the top of the switch enclosure or, if the terminals are located elsewhere, the equipment shall have barriers installed to prevent persons from accidentally contacting energized parts or dropping tools or fuses into energized parts.

(B) Backfeed.

Where fuses can be energized by backfeed, a sign shall be placed on the enclosure door identifying this hazard.

(C) Switching Mechanism.

The switching mechanism shall be arranged to be operated from a location outside the enclosure where the operator is not exposed to energized parts and shall be arranged to open all ungrounded conductors of the circuit simultaneously with one operation. Switches shall be lockable open in accordance with 110.25 .

495.45 Circuit Breakers — Interlocks.

(A) Circuit Breakers.

Circuit breakers equipped with stored energy mechanisms shall be designed to prevent the release of the stored energy unless the mechanism has been fully charged.

(B) Mechanical Interlocks.

Mechanical interlocks shall be provided in the housing to prevent the complete withdrawal of the circuit breaker from the housing when the stored energy mechanism is in the fully charged position, unless a suitable device is provided to block the closing function of the circuit breaker before complete withdrawal.

495.46 Circuit Breaker Locking.

Circuit breakers shall be capable of being locked in the open position or, if they are installed in a draw-out mechanism, that mechanism shall be capable of being locked in such a position that the mechanism cannot be moved into the connected position. In either case, the provision for locking shall be lockable open in accordance with 110.25 .

495.47 Switchgear Used as Service Equipment.

Switchgear installed as high-voltage service equipment shall include a ground bus for the connection of service cable shields and to facilitate the attachment of safety grounds for personnel protection. This bus shall be extended into the compartment where the service conductors are terminated. Where the compartment door or panel provides access to parts that can only be de-energized and visibly isolated by the serving utility, the warning sign required by 495.35(A) shall include a notice that access is limited to the serving utility or is permitted only following an authorization of the serving utility.

495.48 Substation Design, Documentation, and Required Diagram.

(A) Design and Documentation.

Substations shall be designed by a qualified licensed professional engineer. Where components or the entirety of the substation is listed by a qualified electrical testing laboratory, documentation of internal design features subject to the listing investigation shall not be required. The design shall address but not be limited to the following topics, and the documentation of this design shall be made available to the authority having jurisdiction:

(1) Clearances and exits

(2) Electrical enclosures

(3) Securing and support of electrical equipment

(4) Fire protection

(5) Safety ground connection provisions

(6) Guarding live parts

(7) Transformers and voltage regulation equipment

(8) Conductor insulation, electrical and mechanical protection, isolation, and terminations

(9) Application, arrangement, and disconnection of circuit breakers, switches, and fuses

(10) Provisions for oil-filled equipment

(11) Switchgea

(12) Surge arresters

(B) Diagram.

A permanent, single-line diagram of the switchgear shall be provided in a readily visible location within the same room or enclosed area with the switchgear and shall clearly identify the following:

(1) Interlocks

(2) Isolation means

(3) All possible sources of voltage to the installation under normal or emergency conditions

The marking on the switchgear shall cross-reference the diagram.

Exception: Where the equipment consists solely of a single cubicle or metal-enclosed substation containing only one high-voltage switching device, diagrams shall not be required.

495.49 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.

Part IV. Mobile and Portable Equipment

495.51 General.

(A) Covered.

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

(1) Substations and switch houses mounted on skids

(2) Trailers or cars

(3) Mobile shovels

(4) Draglines

(5) Cranes

(6) Hoists

(7) Drills

(8) Dredges

(9) Compressors

(10) Pumps

(11) Conveyors

(12) Underground excavators

(B) Other Requirements.

The requirements of this part shall be additional to, or amendatory of, those prescribed in Articles 100 through 725 of this *Code* . Special attention shall be paid to Article 250 .

(C) Protection.

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

(D) Disconnecting Means.

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

495.52 Overcurrent Protection.

Motors driving single or multiple dc generators supplying a system operating on a cyclic load basis shall not require overload protection if the thermal rating of the ac drive motor cannot be exceeded under any operating condition. The branch-circuit protective device(s) shall provide short-circuit and locked-rotor protection and shall be permitted to be external to the equipment.

495.53 Enclosures.

All energized switching and control parts shall be enclosed in grounded metal cabinets or enclosures. These cabinets or enclosures shall be marked DANGER — HIGH VOLTAGE — KEEP OUT and shall be locked so that only authorized and qualified persons can enter. The danger marking(s) or label(s) shall comply with 110.21(B) . Circuit breakers and protective equipment shall have the operating means projecting through the metal cabinet or enclosure so these units can be reset without opening locked doors. With doors closed, safe access for normal operation of these units shall be provided.

495.54 Collector Rings.

The collector ring assemblies on revolving-type machines (shovels, draglines, etc.) shall be guarded to prevent accidental contact with energized parts by personnel on or off the machine.

495.55 Power Cable Connections to Mobile Machines.

A metallic enclosure shall be provided on the mobile machine for enclosing the terminals of the power cable. The enclosure shall include terminal connections to the machine frame for the equipment grounding conductor. Ungrounded conductors shall be attached to insulators or be terminated in approved high-voltage cable couplers (which include equipment grounding conductor connectors) of proper voltage and ampere rating. The method of cable termination used shall prevent any strain or pull on the cable from stressing the electrical connections. The enclosure shall have provision for locking so that only authorized and qualified persons can open it and shall be marked as follows:

DANGER — HIGH VOLTAGE — KEEP OUT.

The danger marking(s) or label(s) shall comply with 110.21(B) .

495.56 High-Voltage Portable Cable for Main Power Supply.

Flexible high-voltage cable supplying power to portable or mobile equipment shall comply with Article 250 and Article 400 , Part III.

Part V. Electrode-Type Boilers

495.70 General.

The provisions of Part V shall apply to boilers operating over 1000 volts, nominal, in which heat is generated by the passage of current between electrodes through the liquid being heated.

495.71 Electrical Supply System.

Electrode-type boilers shall be supplied only from a 3-phase, 4-wire solidly grounded wye system, or from isolating transformers arranged to provide such a system. Control circuit voltages shall not exceed 150 volts, shall be supplied from a grounded system, and shall have the controls in the ungrounded conductor.

495.72 Branch-Circuit Requirements.

(A) Rating.

Each boiler shall be supplied from an individual branch circuit rated not less than 100 percent of the total load.

(B) Common-Trip Fault-Interrupting Device.

The circuit shall be protected by a 3-phase, common-trip fault-interrupting device, which shall be permitted to automatically reclose the circuit upon removal of an overload condition but shall not reclose after a fault condition.

(C) Phase-Fault Protection.

Phase-fault protection shall be provided in each phase, consisting of a separate phase-overcurrent relay connected to a separate current transformer in the phase.

(D) Ground Current Detection.

Means shall be provided for detection of the sum of the neutral conductor and equipment grounding conductor currents and shall trip the circuit-interrupting device if the sum of those currents exceeds the greater of 5 amperes or 7 **1**/**2** percent of the boiler full-load current for 10 seconds or exceeds an instantaneous value of 25 percent of the boiler full-load current.

(E) Grounded Neutral Conductor.

The grounded neutral conductor shall be as follows:

(1) Connected to the pressure vessel containing the electrodes

(2) Insulated for not less than 1000 volts

(3) Have not less than the ampacity of the largest ungrounded branch-circuit conductor

(4) Installed with the ungrounded conductors in the same raceway, cable, or cable tray, or, where installed as open conductors, in close proximity to the ungrounded conductors

(5) Not used for any other circuit

495.73 Pressure and Temperature Limit Control.

Each boiler shall be equipped with a means to limit the maximum temperature, pressure, or both, by directly or indirectly interrupting all current flow through the electrodes. Such means shall be in addition to the temperature, pressure, or both, regulating systems and pressure relief or safety valves.

495.74 Bonding.

All exposed non-current-carrying metal parts of the boiler and associated exposed metal structures or equipment shall be bonded to the pressure vessel or to the neutral conductor to which the vessel is connected in accordance with 250.102 , except the ampacity of the bonding jumper shall not be less than the ampacity of the neutral conductor.

Part VI. Motors, Motor Circuits, and Controllers

495.80 General.

Part VI recognizes the additional hazard due to the use of higher voltages. It adds to or amends the other revisions of Article 430 .

495.81 Marking on Controllers.

In addition to the marking required by 430.8 , a controller shall be marked with the control voltage.

495.82 Raceway Connection to Motors.

Flexible metal conduit or liquidtight flexible metal conduit not exceeding 1.8 m (6 ft) in length shall be permitted to be employed for raceway connection to a motor terminal enclosure.

495.83 Size of Conductors.

Conductors supplying motors shall have an ampacity not less than the current at which the motor overload protective device(s) is selected to trip.

495.84 Motor-Circuit Overcurrent Protection.

(A) General.

Each motor circuit shall include coordinated protection to automatically interrupt overload and fault currents in the motor, the motor-circuit conductors, and the motor control apparatus.

Exception: Where a motor is critical to an operation and the motor should operate to failure if necessary to prevent a greater hazard to persons, the sensing device(s) shall be permitted to be connected to a supervised annunciator or alarm instead of interrupting the motor circuit.

(B) Overload Protection.

(1) Type of Overload Device.

Each motor shall be protected against dangerous heating due to motor overloads and failure to start by a thermal protector integral with the motor or external current-sensing devices, or both. Protective device settings for each motor circuit shall be determined under engineering supervision.

(2) Wound-Rotor Alternating-Current Motors.

The secondary circuits of wound-rotor ac motors, including conductors, controllers, and resistors rated for the application, shall be considered as protected against overcurrent by the motor overload protection means.

(3) Operation.

Operation of the overload interrupting device shall simultaneously disconnect all ungrounded conductors.

(4) Automatic Reset.

Overload sensing devices shall not automatically reset after trip unless resetting of the overload sensing device does not cause automatic restarting of the motor or there is no hazard to persons created by automatic restarting of the motor and its connected machinery.

(C) Fault-Current Protection.

(1) Type of Protection.

Fault-current protection shall be provided in each motor circuit as specified by either 495.84(C)(1)(a) or (C)(1)(b).

(1) A circuit breaker of suitable type and rating shall be arranged so that it can be serviced without hazard. The circuit breaker shall simultaneously disconnect all ungrounded conductors. The circuit breaker shall be permitted to sense the fault current by means of integral or external sensing elements.

(2) Fuses of a suitable type and rating shall be placed in each ungrounded conductor. Fuses shall be used with suitable disconnecting means, or they shall be of a type that can also serve as the disconnecting means. They shall be arranged so that they cannot be serviced while they are energized.

(2) Reclosing.

Fault-current interrupting devices shall not automatically reclose the circuit.

Exception: Automatic reclosing of a circuit shall be permitted where the circuit is exposed to transient faults and where such automatic reclosing does not create a hazard to persons.

(3) Combination Protection.

Overload protection and fault-current protection shall be permitted to be provided by the same device.

495.85 Rating of Motor Control Apparatus.

The ultimate trip current of overcurrent (overload) relays or other motor-protective devices used shall not exceed 115 percent of the controller's continuous current rating. Where the motor branch-circuit disconnecting means is separate from the controller, the disconnecting means current rating shall not be less than the ultimate trip setting of the overcurrent relays in the circuit.

495.86 Disconnecting Means.

The controller disconnecting means shall be lockable in accordance with 110.25 .

495.87 Tables for Part VI.

The full load currents for two-phase and three-phase alternating-current motors shall be as specified in Table 495.87(a) and Table 495.87(b).

Table 495.87(a) Full-Load Current, Two-Phase Alternating-Current Motors (4-Wire)

The values of full-load current are for motors running at speeds usual for belted motors and motors with normal torque characteristics. Current in the common conductor of a 2-phase, 3-wire system will be 1.41 times the value given. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 2300 volts to 2400 volts.

Horsepower Induction-Type Squirrel Cage and Wound Rotor (Amperes) 2300

Volts 60 14 75 18 100 23 125 27 150 32 200 43

Table 495.87(b) Full-Load Current, Three-Phase Alternating-Current Motors

The values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 2300 volts to 2400 volts.

Horsepower Induction-Type Squirrel Cage and Wound Rotor (Amperes) Synchronous-Type Unity Power - - Factor * (Amperes) - 2300 Volts 2300
Volts 60 16 12 100 26 20 125 31 25 150 37 30 200 49 40

*For 90 and 80 percent power factor, the figures shall be multiplied by 1.1 and 1.25, respectively.

Part VII. Transformers

495.100 General Provisions.

This part covers the installation of all transformers over 1000 volts on either the primary or secondary. Part VII supplements or amends the other provisions of Article 450 . This part does not cover the following:

(1) Current transformers

(2) Dry-type transformers that constitute a component part of other apparatus and comply with the requirements for such apparatus

(3) Transformers that are an integral part of an X-ray, high-frequency, or electrostatic-coating apparatus

(4) Transformers for sign and outline lighting

(5) Transformers for electric-discharge lighting

(6) Transformers used for research, development, or testing, where effective arrangements are provided to safeguard persons from contacting energized parts

495.102 Exposed Energized Parts.

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

495.103 Overcurrent Protection.

Overcurrent protection of transformers shall comply with Table 495.103. As used in this section, the word *transformer* shall mean a transformer or polyphase bank of two or more single-phase transformers operating as a unit.

Informational Note No. 1: See 240.4 , 240.21 , 240.100 , and 240.101 for overcurrent protection of conductors.

Informational Note No. 2: Nonlinear loads can increase heat in a transformer without operating its overcurrent protective device.

Table 495.103 Maximum Rating or Setting of Overcurrent Protection for Transformers Over 1000 Volts (as a Percentage of Transformer-Rated Current)

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

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

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

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

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

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

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

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

495.104 Dry-Type Transformers Installed Indoors.

(A) Not Over 112 **1/2** kVA.

Dry-type transformers installed indoors and rated 112 **1/2** kVA or less shall have a separation of at least 300 mm (12 in.) from combustible material unless separated from the combustible material by a fire-resistant, heat-insulated barrier.

(B) Over 112 **1/2** kVA.

Individual dry-type transformers of more than 112 **1/2** kVA rating shall be installed in a transformer room of fire-resistant construction having a minimum fire rating of 1 hour.

Exception No. 1: Transformers with Class 155 or higher insulation systems and separated from combustible material by a fire-resistant, heat-insulating barrier or by not less than 1.83 m (6 ft) horizontally and 3.7 m (12 ft) vertically shall not be required to be installed in a transformer room.

Exception No. 2: Transformers with Class 155 or higher insulation systems and completely enclosed except for ventilating openings shall not be required to be installed in a transformer room.

Informational Note: See ASTM E119-18a, *Standard Test Methods for Fire Tests of Building Construction and Materials*, for additional information on fire-resistance ratings.

(C) Over 35,000 Volts.

Dry-type transformers rated over 35,000 volts shall be installed in a vault complying with the provisions of this article.

495.105 Dry-Type Transformers Installed Outdoors.

Dry-type transformers installed outdoors shall have a weatherproof enclosure.

Transformers exceeding 112 **1/2** kVA shall not be located within 300 mm (12 in.) of combustible materials of buildings unless the transformer has Class 155 insulation systems or higher and is completely enclosed except for ventilating openings.

495.106 Less-Flammable Liquid-Insulated Transformers.

Transformers insulated with listed less-flammable liquids that have a fire point of not less than 300°C shall be permitted to be installed in accordance with 495.106(A) or 495.106(B).

(A) Indoor Installations.

Indoor installations shall be permitted in accordance with one of the following:

(1) In Type I or Type II buildings, in areas where all of the following requirements are met:

(2) The transformer is rated 35,000 volts or less.

(3) No combustible materials are stored.

(4) A liquid confinement area is provided.

(5) The installation complies with all the restrictions provided for in the listing of the liquid.

Informational Note: Such restrictions can include, but are not limited to, maximum pressure of the tank, use of a pressure relief valve, appropriate fuse types, and proper sizing of overcurrent protection.

(6) If an automatic fire extinguishing system and a liquid confinement area are present, provided the transformer is rated 35,000 volts or less

(7) If the installation complies with 495.109

(B) Outdoor Installations.

Less-flammable liquid-filled transformers shall be permitted to be installed outdoors, attached to, adjacent to, or on the roof of buildings, if installed in accordance with the following:

(1) For Type I and Type II buildings, the installation shall comply with all the restrictions provided for in the listing of the liquid.

Informational Note No. 1: See 495.110 for information about installations adjacent to combustible material, fire escapes, or door and window openings that might require additional safeguards .

Informational Note No. 2: Such restrictions can include, but are not limited to, maximum pressure of the tank, use of a pressure relief valve, appropriate fuse types, and proper sizing of overcurrent protection.

(2) In accordance with 495.110.

Informational Note No. 3: See NFPA 220-2021, *Standard on Types of Building Construction* , for definitions of Type I and Type II building constructions.

Informational Note No. 4: See Article 100 for the definition of *Listed* .

495.107 Nonflammable Fluid-Insulated Transformers.

Transformers insulated with a dielectric fluid identified as nonflammable shall be permitted to be installed indoors or outdoors. Such transformers installed indoors and rated over 35,000 volts shall be installed in a vault. Such transformers installed indoors shall be furnished with a liquid confinement area and a pressure-relief vent. The transformers shall be furnished with a means for absorbing any gases generated by arcing inside the tank, or the pressure-relief vent shall be connected to a chimney or flue that will carry such gases to an environmentally safe area.

Informational Note: Safety can be increased if fire hazard analyses are performed for such transformer installations.

For the purposes of this section, a nonflammable dielectric fluid is one that does not have a flash point or fire point and is not flammable in air.

495.108 Askarel-Insulated Transformers Installed Indoors.

Askarel-insulated transformers installed indoors and rated over 25 kVA shall be furnished with a pressure-relief vent. Where installed in a poorly ventilated place, they shall be furnished with a means for absorbing any gases generated by arcing inside the case, or the pressure-relief vent shall be connected to a chimney or flue that carries such gases outside the building. Askarel-insulated transformers rated over 35,000 volts shall be installed in a vault.

495.109 Oil-Insulated Transformers Installed Indoors.

Oil-insulated transformers installed indoors shall be installed in a vault constructed as specified in Part VII of this article.

Exception No. 1: Where the total capacity does not exceed 112 1/2 kVA, the vault specified in Part VII of this article shall be permitted to be constructed of reinforced concrete that is not less than 100 mm (4 in.) thick.

Exception No. 2: Where the nominal voltage does not exceed 1000, a vault shall not be required if suitable arrangements are made to prevent a transformer oil fire from igniting other materials and the total capacity in one location does not exceed 10 kVA in a section of the building classified as combustible or 75 kVA where the surrounding structure is classified as fire-resistant construction.

Exception No. 3: Electric furnace transformers that have a total rating not exceeding 75 kVA shall be permitted to be installed without a vault in a building or room of fire-resistant construction if suitable arrangements are made to prevent a transformer oil fire from spreading to other combustible material.

Exception No. 4: A transformer that has a total rating not exceeding 75 kVA and a supply voltage of 1000 volts or less that is an integral part of charged-particle-accelerating equipment shall be permitted to be installed without a vault in a building or room of noncombustible or fire-resistant construction if suitable arrangements are made to prevent a transformer oil fire from spreading to other combustible material.

Exception No. 5: Transformers shall be permitted to be installed in a detached building that does not comply with Part III of this article if neither the building nor its contents present a fire hazard to any other building or property, and if the building is used only in supplying electric service and the interior is accessible only to qualified persons.

Exception No. 6: Oil-insulated transformers shall be permitted to be used without a vault in portable and mobile surface mining equipment (such as electric excavators) if each of the following conditions is met:

(1) Provision is made for draining leaking fluid to the ground.

(2) Safe egress is provided for personnel.

(3) A minimum 6-mm (1/4 -in.) steel barrier is provided for personnel protection.

495.110 Oil-Insulated Transformers Installed Outdoors.

Combustible material, combustible buildings, and parts of buildings, fire escapes, and door and window openings shall be safeguarded from fires originating in oil-insulated transformers installed on roofs, attached to or adjacent to a building or combustible material.

In cases where the transformer installation presents a fire hazard, one or more of the following safeguards shall be applied according to the degree of hazard involved:

(1) Space separations

(2) Fire-resistant barriers

(3) Automatic fire suppression systems

(4) Enclosures that confine the oil of a ruptured transformer tank

Oil enclosures shall be permitted to consist of fire-resistant dikes, curbed areas or basins, or trenches filled with coarse, crushed stone. Oil enclosures shall be provided with trapped drains where the exposure and the quantity of oil involved are such that removal of oil is important.

Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code* , for additional information on transformers installed on poles or structures or underground.

495.111 Modification of Transformers.

When modifications are made to a transformer in an existing installation that change the type of the transformer with respect to Part VII of this article, such transformer shall be marked to show the type of insulating liquid installed, and the modified transformer installation shall comply with the applicable requirements for that type of transformer.

495.112 Transformer Vaults

Vaults shall be located where they can be ventilated to the outside air without using flues or ducts wherever such an arrangement is practicable.

495.113 Accessibility.

All transformer vaults shall be readily accessible to qualified personnel for inspection and maintenance or shall meet the requirements of 450.13(A) or (B).

495.114 Walls, Roofs, and Floors.

The walls and roofs of vaults shall be constructed of materials that have approved structural strength for the conditions with a minimum fire resistance of 3 hours. The floors of vaults in contact with the earth shall be of concrete that is not less than 100 mm (4 in.) thick, but, where the vault is constructed with a vacant space or other stories below it, the floor shall have approved structural strength for the load imposed thereon and a minimum fire resistance of 3 hours. For the purposes of this section, studs and wallboard construction shall not be permitted.

Exception: Where transformers are protected with automatic sprinkler, water spray, carbon dioxide, or halon, construction of 1-hour rating shall be permitted.

Informational Note No. 1: See ASTM E119-18a, *Methods for Fire Tests of Building Construction and Materials* , for additional information.

Informational Note No. 2: A typical 3-hour construction is 150 mm (6 in.) thick reinforced concrete.

495.115 Doorways.

Vault doorways shall be protected in accordance with 495.115(A) through (C).

(A) Type of Door.

Each doorway leading into a vault from the building interior shall be provided with a tight-fitting door that has a minimum fire rating of 3 hours. The authority having jurisdiction shall be permitted to require such a door for an exterior wall opening where conditions warrant.

Exception: *Where transformers are protected with automatic sprinkler, water spray, carbon dioxide, or halon, construction of 1-hour rating shall be permitted.*

Informational Note: See NFPA 80-2022, *Standard for Fire Doors and Other Opening Protectives* , for additional information.

(B) Sills.

A door sill or curb that is of an approved height that will confine the oil from the largest transformer within the vault shall be provided, and in no case shall the height be less than 100 mm (4 in.).

(C) Accessibility.

Doors shall be equipped with locks, and doors shall be kept locked, with access being allowed only to qualified persons. Personnel doors shall be capable of opening not less than 90 degrees in the direction of egress and be equipped with listed fire exit hardware.

495.116 Ventilation Openings.

Where required by 450.9 , openings for ventilation shall be provided in accordance with 495.116(A) through (F).

(A) Location.

Ventilation openings shall be located as far as possible from doors, windows, fire escapes, and combustible material.

(B) Arrangement.

A vault ventilated by natural circulation of air shall be permitted to have roughly half of the total area of openings required for ventilation in one or more openings near the floor and the remainder in one or more openings in the roof or in the sidewalls near the roof, or all of the area required for ventilation shall be permitted in one or more openings in or near the roof.

(C) Size.

For a vault ventilated by natural circulation of air to an outdoor area, the combined net area of all ventilating openings, after deducting the area occupied by screens, gratings, or louvers, shall not be less than 1900 mm^2 (3 $in.^2$) per kVA of transformer capacity in service, and in no case shall the net area be less than 0.1 m^2 (1 ft^2) for any capacity under 50 kVA.

(D) Covering.

Ventilation openings shall be covered with durable gratings, screens, or louvers, according to the treatment required in order to avoid unsafe conditions.

(E) Dampers.

All ventilation openings to the indoors shall be provided with automatic closing fire dampers that operate in response to a vault fire. Such dampers shall possess a standard fire rating of not less than 1 **1** ⁄ **2** hours.

Informational Note: See ANSI/UL 555-2016, *Standard for Fire Dampers* , for additional information on fire dampers.

(F) Ducts.

Ventilating ducts shall be constructed of fire-resistant material.

495.117 Drainage.

Where practicable, vaults containing more than 100 kVA transformer capacity shall be provided with a drain or other means that will carry off any accumulation of oil or water in the vault unless local conditions make this impracticable. The floor shall be pitched to the drain where provided.

495.118 Water Pipes and Accessories.

Any pipe or duct system foreign to the electrical installation shall not enter or pass through a transformer vault. Piping or other facilities provided for vault fire protection, or for transformer cooling, shall not be considered foreign to the electrical installation.

495.119 Storage in Vaults.

Materials shall not be stored in transformer vaults.

Part IX. Capacitors

495.120 Enclosing and Guarding.

(A) Containing More Than 11 L (3 gal) of Flammable Liquid.

Capacitors containing more than 11 L (3 gal) of flammable liquid shall be enclosed in vaults or outdoor fenced enclosures complying with Article 110 , Part III. This limit shall apply to any single unit in an installation of capacitors.

(B) Accidental Contact.

Where capacitors are accessible to unauthorized and unqualified persons, they shall be enclosed, located, or guarded so that persons cannot come into accidental contact or bring conducting materials into accidental contact with exposed energized parts, terminals, or buses associated with them. However, no additional guarding is required for enclosures accessible only to authorized and qualified persons.

495.121 Not Covered.

Surge capacitors or capacitors included as a component part of other apparatus and conforming with the requirements of such apparatus are excluded from these requirements.

This part also covers the installation of capacitors in hazardous (classified) locations as modified by Articles 501 through 503 .

495.122 Switching.

(A) Load Current.

(1)

Group-operated switches shall be used for capacitor switching and shall be capable of the following:

(1) Carrying continuously not less than 135 percent of the rated current of the capacitor installation

(2) Interrupting the maximum continuous load current of each capacitor, capacitor bank, or capacitor installation that will be switched as a unit

(3) Withstanding the maximum inrush current, including contributions from adjacent capacitor installations

(4) Carrying currents due to faults on capacitor side of switch

(B) Isolation.

(1) General.

A means shall be installed to isolate from all sources of voltage each capacitor, capacitor bank, or capacitor installation that will be removed from service as a unit. The isolating means shall provide a visible gap in the electrical circuit adequate for the operating voltage.

(2) Isolating or Disconnecting Switches with No Interrupting Rating.

Isolating or disconnecting switches (with no interrupting rating) shall be interlocked with the load-interrupting device or shall be provided with prominently displayed caution signs in accordance with 495.22 to prevent switching load current.

(C) Additional Requirements for Series Capacitors.

The proper switching sequence shall be ensured by use of one of the following:

(1) Mechanically sequenced isolating and bypass switches

(2) Interlocks

(3) Switching procedure prominently displayed at the switching location

495.123 Overcurrent Protection.

(A) Provided to Detect and Interrupt Fault Current.

A means shall be provided to detect and interrupt fault current likely to cause dangerous pressure within an individual capacitor.

(B) Single-Pole or Multipole Devices.

Single-pole or multipole devices shall be permitted for this purpose.

(C) Protected Individually or in Groups.

Capacitors shall be permitted to be protected individually or in groups.

(D) Protective Devices Rated or Adjusted.

Protective devices for capacitors or capacitor equipment shall be rated or adjusted to operate within the limits of the safe zone for individual capacitors.

495.124 Identification.

Each capacitor shall be provided with a permanent nameplate giving the manufacturer's name, rated voltage, frequency, kilovar or amperes, number of phases, and the volume of liquid identified as flammable, if such is the case.

495.125 Grounding.

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

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

495.126 Means for Discharge.

(A) Means to Reduce the Residual Voltage.

A means shall be provided to reduce the residual voltage of a capacitor to 50 volts or less within 5 minutes after the capacitor is disconnected from the source of supply.

(B) Connection to Terminals.

A discharge circuit shall be either permanently connected to the terminals of the capacitor or provided with automatic means of connecting it to the terminals of the capacitor bank after disconnection of the capacitor from the source of supply. The windings of motors, transformers, or other equipment directly connected to capacitors without a switch or overcurrent device interposed shall meet the requirements of 495.126(A).

Part X. Resistors and Reactors

495.130 General.

~~**(A)** Protected Against Physical Damage.~~

~~Resistors and reactors shall be protected against physical damage.~~

~~**(B)** Isolated by Enclosure or Elevation.~~

~~Resistors and reactors shall be isolated by enclosure or elevation to protect personnel from accidental contact with energized parts.~~

~~**(C)** Combustible Materials.~~

~~Resistors and reactors shall not be installed in close enough proximity to combustible materials to constitute a fire hazard and shall have a clearance of not less than 305 mm (12 in.) from combustible materials.~~

~~**(D)** Clearances.~~

~~Clearances from resistors and reactors to grounded surfaces shall be adequate for the voltage involved.~~

~~**(E)** Temperature Rise from Induced Circulating Currents.~~

~~Metallic enclosures of reactors and adjacent metal parts shall be installed so that the temperature rise from induced circulating currents is not hazardous to personnel or does not constitute a fire hazard.~~

~~**495.131** Grounding.~~

~~Resistor and reactor cases or enclosures shall be connected to the equipment grounding conductor.~~

~~*Exception:* *Resistor or reactor cases or enclosures supported on a structure designed to operate at other than ground potential shall not be connected to the equipment grounding conductor.*~~

~~**495.132** Oil-Filled Reactors.~~

~~Installation of oil-filled reactors, in addition to the above requirements, shall comply with applicable requirements of Article 495, Part VII.~~

Statement of Problem and Substantiation for Public Comment

The major premise behind this reorganization was to create a commonality and ready recognition of medium voltage rules in the NEC through the creation of new articles that all would end in the digit “5”. Well, where do we stand as this comment is written? This is what the records show:

Article 115 (from Art. 110): CMP 1 resolved it.
Article 205 (from Art. 200): CMP 5 resolved it.
Article 235 (from Art. 210/215/230): CMP 10 resolved it.
Article 245 (from one section of Art. 490 and medium voltage in Art. 242): CMP 9 issued FR 7940; the Correlating Committee stripped all coverage of Art. 242 content (FCR 387). Note that the Correlating Committee referred this material to CMP 10 for comment; that comment will almost certainly be extremely negative based on closely related CMP 10 activity.
Article 255 (from Art. 250): CMP 5 resolved it
Article 305 (from Art. 300 Part II plus Art. 314-medium voltage plus Art. 368-medium voltage plus Art. 399: CMP 3 issued FR-9609; the Correlating Committee (FCR-458) stripped all coverage of content beyond what is n in current Art. 300 Part II. No other content is moving here, although Art. 399 is slated to be Art. 395.
Article 315 (from Art. 311) has moved forward
Article 495 (from Art. 490, plus Art. 450 medium voltage plus Art. 430 medium voltage plus Art. 460 medium voltage plus Art. 470 medium voltage. CMP 9 issued FR 7941, the Correlating Committee stripped all coverage of content beyond Art. 450 and 490 (CC Note 384).

Therefore, for medium voltage content in XX5 articles we have nothing in Chapter 1, one article 2X5 in Chapter 2 that likely lacks consensus, three articles in Chapter 3 (one of which, 399 to 395 was always

easily identifiable as medium voltage content regardless of numbering), and one in Chapter 4. Meanwhile, new wiring method articles are entering Chapter 3 with medium voltage components, such as Part IV of the new Article 371 on flexible bus systems. Other locations in Chapter 3 continue to have extensive coverage of medium voltage, including but not limited to cablebus (Art. 370) and cable tray (Art. 392). Nor is this activity limited to Chapter 3. Article 400 is adding an entirely new part addressing portable power feeder cables (submitted by UL!) that operate upwards of 2000 volts. And, that is not to mention other parts of the NEC as yet untouched by this effort, including the manhole part in Art. 110, a part originally created as a result of a medium voltage question in EC&M Magazine. Any further attempts to go down this road are a fool's errand.

This and comparable first revisions represent change for the sake of change, and a solution in search of a problem. The proponents freely admitted that it would take three code cycles to fully implement this reorganization, without making any technical improvements in the NEC. Every code reorganization is extremely challenging for the users, who have spent years learning where things are. It should be a last resort. This is why former CC Chair (and now Member Emeritus) Harold Ware so struggled with this problem when the current organization was put in place, and he strongly opposes this effort now. CMP 9 is now an outlier on this topic, much more so than at the first revision meetings because of subsequent Correlating Committee actions. This must stop now.

Related Item

• FR-7941

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 18 08:31:30 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: CMP 9 created Article 495 with content from Article 490. This action was accepted by the Correlating Committee (PC 1963), and CMP 9 continues to support the creation of Article 495. Regarding the “Medium Voltage Articles” at the first draft stage, it should be noted that Articles 245, 305, 315, 395, and 495 were created, and the Correlating Committee directed that CMP 2 form a Task Group to create a new Article 235 (PC 635).

Public Comment No. 1885-NFPA 70-2021 [Article 495]

Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal

Part I. General

495.1 Scope.

This article covers the general requirements for equipment operating at more than 1000 volts ac, 1500 volts dc, nominal.

Informational Note No. 1: See NFPA *70E* 2021 , *Standard for Electrical Safety in the Workplace* , for electrical safety requirements for employee workplaces.

Informational Note No. 2: See ANSI Z535.4-2011, *Product Signs and Safety Labels,* for further information on hazard signs and labels.

Informational Note No. 3: See IEEE 3001.5-2013, *Recommended Practice for the Application of Power Distribution Apparatus in Industrial and Commercial Power Systems* , for information regarding power distribution apparatus.

495.2 Definition.

The definition in this section shall apply only within this article.

High Voltage.

A potential difference of more than 1000 volts, nominal.

495.3 Other Articles.

Enclosures in damp or wet locations shall meet the requirements of 312.2 .

495.4 Flexible Cords and Flexible Cable Types.

Flexible cords and flexible cables over 1000 volts shall conform to the description in Table 495.4. The use of flexible cords and flexible cables other than those in Table 495.4 shall require permission by the authority having jurisdiction.

Table 495.4 Flexible Cords and Flexible Cables

------- Nominal Insulation Thickness ---- Trade Name Type Letter Voltage AWG or kcmil Number of Conductors Insulation AWG or kcmil mm mils Braid on Each Conductor Outer Covering Use Portable power cable G 2000 12–500 2–6 plus equipment grounding conductor(s) Thermoset 12–2

1–4/0

250–

500 1.52

2.03

2.41 60

80

95 — Oil-resistant thermoset Portable and extra-hard usage - G-GC* 2000 12–500 3–6 plus equipment grounding conductors and 1 ground check conductor Thermoset 12–2

1–4/0

250–

500 1.52

2.03

2.41 60

80

95 — Oil-resistant thermoset Portable and extra-hard usage Portable power cable PPE* 2000 12–500 1–6 plus optional equipment grounding conductor(s) Thermoplastic elastomer 12–2

1–4/0

250–

500 1.52

2.03

2.41 60

80

95 — Oil-resistant thermo-plastic elastomer Portable and extra-hard usage Portable power cable W* 2000 12–500

501–1000 1–6

1 Thermoset 12–2

1–4/0

250–500

501–

1000 1.52

2.03

2.41

2.80 60

80

95

110 — Oil-resistant thermoset Portable and extra-hard usage

*Types G, G-GC, S, SC, SCE, SCT, SE, SEO, SEOO, SEW, SEOW, SEOOW, SO, SOO, SOW, SOOW, ST, STO, STOO, STW, STOW, STOOW, PPE, and W shall be permitted for use on

theater stages, in garages, and elsewhere where flexible cords are permitted by this *Code*.

Part II. Equipment — Specific Provisions

495.22 Isolating Means.

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

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

An identified fuseholder and fuse shall be permitted as an isolating switch.

495.23 Voltage Regulators.

Proper switching sequence for regulators shall be ensured by use of one of the following:

(1) Mechanically sequenced regulator bypass switch(es)

(2) Mechanical interlocks

(3) Switching procedure prominently displayed at the switching location

495.24 Minimum Space Separation.

In field-fabricated installations, the minimum air separation between bare live conductors and between such conductors and adjacent grounded surfaces shall not be less than the values given in Table 495.24. These values shall not apply to interior portions or exterior terminals of equipment designed, manufactured, and tested in accordance with accepted national standards.

Table 495.24 **Minimum Clearance of Live Parts**

Nominal Voltage Rating (kV) Impulse Withstand, Basic Impulse Level (BIL) (kV) Minimum Clearance of Live Parts Phase-to-Phase Phase-to-Ground Indoors Outdoors Indoors Outdoors Indoors Outdoors mm in. mm in. mm in. mm in. 2

245

9.5 255 10 200 200

460

18.0 460 18 335 13.0 335 13 46 — 200 — — 460 18 — — 335 13 — 250 — — 535 21 — -

17

69 — 250 — — -

535

21 — — 435 17 — 350 — — 790 31 — — 635 25 115 — 550 — — 1350 53 — — 1070 42

Note: The values given are the minimum clearance for rigid parts and bare conductors under favorable service conditions. They shall be increased for conductor movement or under unfavorable service conditions or wherever space limitations permit. The selection of the associated impulse withstand voltage for a particular system voltage is determined by the characteristics of the surge protective equipment.

495.25 Backfeed.

Installations where the possibility of backfeed exists shall comply with 495.25(A) and (B).

(A) Sign.

A permanent sign in accordance with 110.21(B) shall be installed on the disconnecting means enclosure or immediately adjacent to open disconnecting means with the following words or equivalent:

DANGER — CONTACTS ON EITHER SIDE OF THIS DEVICE MAY BE ENERGIZED BY BACKFEED.

(B) Diagram.

A permanent and legible single-line diagram of the local switching arrangement, clearly identifying each point of connection to the high-voltage section, shall be provided within sight of each point of connection.

495.26 Oil-Filled Equipment.

Installation of electrical equipment, other than transformers covered in Part VII containing more than 38 L (10 gal) of flammable oil per unit, shall meet the requirements of Part VII.

Informational Note: The same requirements for oil used in oil-filled transformers are also applicable to other oil-filled equipment.

Part III. Equipment — Switchgear and Industrial Control Assemblies

495.30 General.

Part III covers assemblies of switchgear and industrial control equipment, including, but not limited to, switches and interrupting devices and their control, metering, protection, and regulating equipment where they are an integral part of the assembly, with associated interconnections and supporting structures.

495.31 Arrangement of Devices in Assemblies.

Arrangement of devices in assemblies shall be such that individual components can safely perform their intended function without adversely affecting the safe operation of other components in the assembly.

495.32 Guarding of High-Voltage Energized Parts Within a Compartment.

Where access for other than visual inspection is required to a compartment that contains energized high-voltage parts, barriers shall be provided to prevent accidental contact by persons, tools, or other equipment with energized parts. Exposed live parts shall only be permitted in compartments accessible to qualified persons. Fuses and fuseholders designed to enable future replacement without de-energizing the fuseholder shall only be permitted for use by qualified persons.

495.33 Guarding of Energized Parts Operating at 1000 Volts, Nominal, or Less Within Compartments.

Energized bare parts mounted on doors shall be guarded where the door must be opened for maintenance of equipment or removal of draw-out equipment.

495.34 Clearance for Cable Conductors Entering Enclosure.

The unobstructed space opposite terminals or opposite raceways or cables entering a switchgear or control assembly shall be approved for the type of conductor and method of termination.

495.35 Accessibility of Energized Parts.

(A) High-Voltage Equipment.

Doors that would provide unqualified persons access to high-voltage energized parts shall be locked. Permanent signs in accordance with 110.21(B) shall be installed on panels or doors that provide access to live parts over 1000 volts and shall read DANGER — HIGH VOLTAGE — KEEP OUT.

(B) Control Equipment.

Where operating at 1000 volts, nominal, or less, control equipment, relays, motors, and the like shall not be installed in compartments with high-voltage parts or high-voltage wiring, unless both of the following apply:

(1) The access means is interlocked with the high-voltage switch or disconnecting means to prevent the access means from being opened or removed when the high-voltage switch is in the closed position or a withdrawable disconnecting means is in the connected position.

(2) All high-voltage parts or high-voltage wiring in the compartment that remains energized when a fixed mounted high-voltage switch is in the open position or a withdrawable disconnecting means is in the isolating (fully withdrawn) position are protected by insulating or grounded metal barriers to prevent accidental contact with energized high-voltage parts or wiring.

(C) High-Voltage Instruments or Control Transformers and Space Heaters.

High-voltage instrument or control transformers and space heaters shall be permitted to be installed in the high-voltage compartment without access restrictions beyond those that apply to the high-voltage compartment generally.

495.36 Grounding.

Frames of switchgear and control assemblies shall be connected to an equipment grounding conductor or, where permitted, the grounded conductor.

495.37 Grounding of Devices.

The metal cases or frames, or both, such as those of instruments, relays, meters, and instrument and control transformers, located in or on switchgear or control assemblies, shall be connected to an equipment grounding conductor or, where permitted, the grounded conductor.

496.38 Door Stops and Cover Plates.

External hinged doors or covers shall be provided with stops to hold them in the open position. Cover plates intended to be removed for inspection of energized parts or wiring shall be equipped with lifting handles and shall not exceed 1.1 m^2 (12 ft^2) in area or 27 kg (60 lb) in weight, unless they are hinged and bolted or locked.

495.39 Gas Discharge from Interrupting Devices.

Gas discharged during operating of interrupting devices shall be directed so as not to endanger personnel.

495.40 Visual Inspection Windows.

Windows intended for visual inspection of disconnecting switches or other devices shall be of suitable transparent material.

495.41 Location of Industrial Control Equipment.

Routinely operated industrial control equipment shall meet the requirements of 495.41(A) unless infrequently operated, as covered in 495.41(B).

(A) Control and Instrument Transfer Switch Handles or Push Buttons.

Control and instrument transfer switch handles or push buttons shall be in a readily accessible location at an elevation of not over 2.0 m (6 ft 7 in.).

Exception: Operating handles requiring more than 23 kg (50 lb) of force shall be located no higher than 1.7 m (66 in.) in either the open or closed position.

(B) Infrequently Operated Devices.

Where operating handles for such devices as draw-out fuses, fused potential or control transformers and their primary disconnects, and bus transfer and isolating switches are only operated infrequently, the handles shall be permitted to be located where they are safely operable and serviceable from a portable platform.

495.42 Interlocks — Interrupter Switches.

Interrupter switches equipped with stored energy mechanisms shall have mechanical interlocks to prevent access to the switch compartment unless the stored energy mechanism is in the discharged or blocked position.

495.43 Stored Energy for Opening.

The stored energy operator shall be permitted to be left in the uncharged position after the switch has been closed if a single movement of the operating handle charges the operator and opens the switch.

495.44 Fused Interrupter Switches.

(A) Supply Terminals.

The supply terminals of fused interrupter switches shall be installed at the top of the switch enclosure or, if the terminals are located elsewhere, the equipment shall have barriers installed to prevent persons from accidentally contacting energized parts or dropping tools or fuses into energized parts.

(B) Backfeed.

Where fuses can be energized by backfeed, a sign shall be placed on the enclosure door identifying this hazard.

(C) Switching Mechanism.

The switching mechanism shall be arranged to be operated from a location outside the enclosure where the operator is not exposed to energized parts and shall be arranged to open all ungrounded conductors of the circuit simultaneously with one operation. Switches shall be lockable open in accordance with 110.25 .

495.45 Circuit Breakers — Interlocks.

(A) Circuit Breakers.

Circuit breakers equipped with stored energy mechanisms shall be designed to prevent the release of the stored energy unless the mechanism has been fully charged.

(B) Mechanical Interlocks.

Mechanical interlocks shall be provided in the housing to prevent the complete withdrawal of the circuit breaker from the housing when the stored energy mechanism is in the fully charged position, unless a suitable device is provided to block the closing function of the circuit breaker before complete withdrawal.

495.46 Circuit Breaker Locking.

Circuit breakers shall be capable of being locked in the open position or, if they are installed in a draw-out mechanism, that mechanism shall be capable of being locked in such a position that the mechanism cannot be moved into the connected position. In either case, the provision for locking shall be lockable open in accordance with 110.25 .

495.47 Switchgear Used as Service Equipment.

Switchgear installed as high-voltage service equipment shall include a ground bus for the connection of service cable shields and to facilitate the attachment of safety grounds for personnel protection. This bus shall be extended into the compartment where the service conductors are terminated. Where the compartment door or panel provides access to parts that can only be de-energized and visibly isolated by the serving utility, the warning sign required by 495.35(A) shall include a notice that access is limited to the serving utility or is permitted only following an authorization of the serving utility.

495.48 Substation Design, Documentation, and Required Diagram.

(A) Design and Documentation.

Substations shall be designed by a qualified licensed professional engineer. Where components or the entirety of the substation is listed by a qualified electrical testing laboratory, documentation of internal design features subject to the listing investigation shall not be required. The design shall address but not be limited to the following topics, and the documentation of this design shall be made available to the authority having jurisdiction:

(1) Clearances and exits

(2) Electrical enclosures

(3) Securing and support of electrical equipment

(4) Fire protection

(5) Safety ground connection provisions

(6) Guarding live parts

(7) Transformers and voltage regulation equipment

(8) Conductor insulation, electrical and mechanical protection, isolation, and terminations

(9) Application, arrangement, and disconnection of circuit breakers, switches, and fuses

(10) Provisions for oil-filled equipment

(11) Switchgea

(12) Surge arresters

(B) Diagram.

A permanent, single-line diagram of the switchgear shall be provided in a readily visible location within the same room or enclosed area with the switchgear and shall clearly identify the following:

(1) Interlocks

(2) Isolation means

(3) All possible sources of voltage to the installation under normal or emergency conditions

The marking on the switchgear shall cross-reference the diagram.

Exception: Where the equipment consists solely of a single cubicle or metal-enclosed substation containing only one high-voltage switching device, diagrams shall not be required.

495.49 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.

Part IV. Mobile and Portable Equipment

495.51 General.

(A) Covered.

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

(1) Substations and switch houses mounted on skids

(2) Trailers or cars

(3) Mobile shovels

(4) Draglines

(5) Cranes

(6) Hoists

(7) Drills

(8) Dredges

(9) Compressors

(10) Pumps

(11) Conveyors

(12) Underground excavators

(B) Other Requirements.

The requirements of this part shall be additional to, or amendatory of, those prescribed in Articles 100 through 725 of this *Code* . Special attention shall be paid to Article 250.

(C) Protection.

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

(D) Disconnecting Means.

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

495.52 Overcurrent Protection.

Motors driving single or multiple dc generators supplying a system operating on a cyclic load basis shall not require overload protection if the thermal rating of the ac drive motor cannot be exceeded under any operating condition. The branch-circuit protective device(s) shall provide short-circuit and locked-rotor protection and shall be permitted to be external to the equipment.

495.53 Enclosures.

All energized switching and control parts shall be enclosed in grounded metal cabinets or enclosures. These cabinets or enclosures shall be marked DANGER — HIGH VOLTAGE — KEEP OUT and shall be locked so that only authorized and qualified persons can enter. The danger marking(s) or label(s) shall comply with 110.21(B) . Circuit breakers and protective equipment shall have the operating means projecting through the metal cabinet or enclosure so these units can be reset without opening locked doors. With doors closed, safe access for normal operation of these units shall be provided.

495.54 Collector Rings.

The collector ring assemblies on revolving-type machines (shovels, draglines, etc.) shall be guarded to prevent accidental contact with energized parts by personnel on or off the machine.

495.55 Power Cable Connections to Mobile Machines.

A metallic enclosure shall be provided on the mobile machine for enclosing the terminals of the power cable. The enclosure shall include terminal connections to the machine frame for the equipment grounding conductor. Ungrounded conductors shall be attached to insulators or be terminated in approved high-voltage cable couplers (which include equipment grounding conductor connectors) of proper voltage and ampere rating. The method of cable termination used shall prevent any strain or pull on the cable from stressing the electrical connections. The enclosure shall have provision for locking so that only authorized and qualified persons can open it and shall be marked as follows:

DANGER — HIGH VOLTAGE — KEEP OUT.

The danger marking(s) or label(s) shall comply with 110.21(B) .

495.56 High-Voltage Portable Cable for Main Power Supply.

Flexible high-voltage cable supplying power to portable or mobile equipment shall comply with Article 250 and Article 400, Part III.

Part V. Electrode-Type Boilers

495.70 General.

The provisions of Part V shall apply to boilers operating over 1000 volts, nominal, in which heat is generated by the passage of current between electrodes through the liquid being heated.

495.71 Electrical Supply System.

Electrode-type boilers shall be supplied only from a 3-phase, 4-wire solidly grounded wye system, or from isolating transformers arranged to provide such a system. Control circuit voltages shall not exceed 150 volts, shall be supplied from a grounded system, and shall have the controls in the ungrounded conductor.

495.72 Branch-Circuit Requirements.

(A) Rating.

Each boiler shall be supplied from an individual branch circuit rated not less than 100 percent of the total load.

(B) Common-Trip Fault-Interrupting Device.

The circuit shall be protected by a 3-phase, common-trip fault-interrupting device, which shall be permitted to automatically reclose the circuit upon removal of an overload condition but shall not reclose after a fault condition.

(C) Phase-Fault Protection.

Phase-fault protection shall be provided in each phase, consisting of a separate phase-overcurrent relay connected to a separate current transformer in the phase.

(D) Ground Current Detection.

Means shall be provided for detection of the sum of the neutral conductor and equipment grounding conductor currents and shall trip the circuit-interrupting device if the sum of those currents exceeds the greater of 5 amperes or 7 **1**/**2** percent of the boiler full-load current for 10 seconds or exceeds an instantaneous value of 25 percent of the boiler full-load current.

(E) Grounded Neutral Conductor.

The grounded neutral conductor shall be as follows:

(1) Connected to the pressure vessel containing the electrodes

(2) Insulated for not less than 1000 volts

(3) Have not less than the ampacity of the largest ungrounded branch-circuit conductor

(4) Installed with the ungrounded conductors in the same raceway, cable, or cable tray, or, where installed as open conductors, in close proximity to the ungrounded conductors

(5) Not used for any other circuit

495.73 Pressure and Temperature Limit Control.

Each boiler shall be equipped with a means to limit the maximum temperature, pressure, or both, by directly or indirectly interrupting all current flow through the electrodes. Such means shall be in addition to the temperature, pressure, or both, regulating systems and pressure relief or safety valves.

495.74 Bonding.

All exposed non-current-carrying metal parts of the boiler and associated exposed metal structures or equipment shall be bonded to the pressure vessel or to the neutral conductor to which the vessel is connected in accordance with 250.102 , except the ampacity of the bonding jumper shall not be less than the ampacity of the neutral conductor.

Part VI. Motors, Motor Circuits, and Controllers

495.80 General.

Part VI recognizes the additional hazard due to the use of higher voltages. It adds to or amends the other revisions of Article 430.

495.81 Marking on Controllers.

In addition to the marking required by 430.8 , a controller shall be marked with the control voltage.

495.82 Raceway Connection to Motors.

Flexible metal conduit or liquidtight flexible metal conduit not exceeding 1.8 m (6 ft) in length shall be permitted to be employed for raceway connection to a motor terminal enclosure.

495.83 Size of Conductors.

Conductors supplying motors shall have an ampacity not less than the current at which the motor overload protective device(s) is selected to trip.

495.84 Motor-Circuit Overcurrent Protection.

(A) General.

Each motor circuit shall include coordinated protection to automatically interrupt overload and fault currents in the motor, the motor-circuit conductors, and the motor control apparatus.

Exception: Where a motor is critical to an operation and the motor should operate to failure if necessary to prevent a greater hazard to persons, the sensing device(s) shall be permitted to be connected to a supervised annunciator or alarm instead of interrupting the motor circuit.

(B) Overload Protection.

(1) Type of Overload Device.

Each motor shall be protected against dangerous heating due to motor overloads and failure to start by a thermal protector integral with the motor or external current-sensing devices, or both. Protective device settings for each motor circuit shall be determined under engineering supervision.

(2) Wound-Rotor Alternating-Current Motors.

The secondary circuits of wound-rotor ac motors, including conductors, controllers, and resistors rated for the application, shall be considered as protected against overcurrent by the motor overload protection means.

(3) Operation.

Operation of the overload interrupting device shall simultaneously disconnect all ungrounded conductors.

(4) Automatic Reset.

Overload sensing devices shall not automatically reset after trip unless resetting of the overload sensing device does not cause automatic restarting of the motor or there is no hazard to persons created by automatic restarting of the motor and its connected machinery.

(C) Fault-Current Protection.

(1) Type of Protection.

Fault-current protection shall be provided in each motor circuit as specified by either 495.84(C)(1)(a) or (C)(1)(b).

(1) A circuit breaker of suitable type and rating shall be arranged so that it can be serviced without hazard. The circuit breaker shall simultaneously disconnect all ungrounded conductors. The circuit breaker shall be permitted to sense the fault current by means of integral or external sensing elements.

(2) Fuses of a suitable type and rating shall be placed in each ungrounded conductor. Fuses shall be used with suitable disconnecting means, or they shall be of a type that can also serve as the disconnecting means. They shall be arranged so that they cannot be serviced while they are energized.

(2) Reclosing.

Fault-current interrupting devices shall not automatically reclose the circuit.

Exception: *Automatic reclosing of a circuit shall be permitted where the circuit is exposed to transient faults and where such automatic reclosing does not create a hazard to persons.*

(3) Combination Protection.

Overload protection and fault-current protection shall be permitted to be provided by the same device.

495.85 Rating of Motor Control Apparatus.

The ultimate trip current of overcurrent (overload) relays or other motor-protective devices used shall not exceed 115 percent of the controller's continuous current rating. Where the motor branch-circuit disconnecting means is separate from the controller, the disconnecting means current rating shall not be less than the ultimate trip setting of the overcurrent relays in the circuit.

495.86 Disconnecting Means.

The controller disconnecting means shall be lockable in accordance with 110.25 .

495.87 Tables for Part VI.

The full load currents for two-phase and three-phase alternating-current motors shall be as specified in Table 495.87(a) and Table 495.87(b).

Table 495.87(a) Full-Load Current, Two-Phase Alternating-Current Motors (4-Wire)

The values of full-load current are for motors running at speeds usual for belted motors and motors with normal torque characteristics. Current in the common conductor of a 2-phase, 3-wire system will be 1.41 times the value given. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 2300 volts to 2400 volts.

Horsepower Induction-Type Squirrel Cage and Wound Rotor (Amperes) 2300

Volts 60 14 75 18 100 23 125 27 150 32 200 43

Table 495.87(b) Full-Load Current, Three-Phase Alternating-Current Motors

The values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 2300 volts to 2400 volts.

Horsepower Induction-Type Squirrel Cage and Wound Rotor (Amperes) Synchronous-Type Unity Power - - Factor * (Amperes) - 2300 Volts 2300
Volts 60 16 12 100 26 20 125 31 25 150 37 30 200 49 40

*For 90 and 80 percent power factor, the figures shall be multiplied by 1.1 and 1.25, respectively.

Part VII. Transformers

495.100 General Provisions.

This part covers the installation of all transformers over 1000 volts on either the primary or secondary. Part VII supplements or amends the other provisions of Article 450. This part does not cover the following:

(1) Current transformers

(2) Dry-type transformers that constitute a component part of other apparatus and comply with the requirements for such apparatus

(3) Transformers that are an integral part of an X-ray, high-frequency, or electrostatic-coating apparatus

(4) Transformers for sign and outline lighting

(5) Transformers for electric-discharge lighting

(6) Transformers used for research, development, or testing, where effective arrangements are provided to safeguard persons from contacting energized parts

495.102 Exposed Energized Parts.

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

495.103 Overcurrent Protection.

Overcurrent protection of transformers shall comply with Table 495.103. As used in this section, the word *transformer* shall mean a transformer or polyphase bank of two or more single-phase transformers operating as a unit.

Informational Note No. 1: See 240.4 , 240.21 , 240.100 , and 240.101 for overcurrent protection of conductors.

Informational Note No. 2: Nonlinear loads can increase heat in a transformer without operating its overcurrent protective device.

Table 495.103 Maximum Rating or Setting of Overcurrent Protection for Transformers Over 1000 Volts (as a Percentage of Transformer-Rated Current)

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

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

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

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

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

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

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

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

495.104 Dry-Type Transformers Installed Indoors.

(A) Not Over 112 **1/2** kVA.

Dry-type transformers installed indoors and rated 112 **1/2** kVA or less shall have a separation of at least 300 mm (12 in.) from combustible material unless separated from the combustible material by a fire-resistant, heat-insulated barrier.

(B) Over 112 **1/2** kVA.

Individual dry-type transformers of more than 112 **1/2** kVA rating shall be installed in a transformer room of fire-resistant construction having a minimum fire rating of 1 hour.

Exception No. 1: Transformers with Class 155 or higher insulation systems and separated from combustible material by a fire-resistant, heat-insulating barrier or by not less than 1.83 m (6 ft) horizontally and 3.7 m (12 ft) vertically shall not be required to be installed in a transformer room.

Exception No. 2: Transformers with Class 155 or higher insulation systems and completely enclosed except for ventilating openings shall not be required to be installed in a transformer room.

Informational Note: See ASTM E119-18a, *Standard Test Methods for Fire Tests of Building Construction and Materials*, for additional information on fire-resistance ratings.

(C) Over 35,000 Volts.

Dry-type transformers rated over 35,000 volts shall be installed in a vault complying with the provisions of this article.

495.105 Dry-Type Transformers Installed Outdoors.

Dry-type transformers installed outdoors shall have a weatherproof enclosure.

Transformers exceeding 112 **1/2** kVA shall not be located within 300 mm (12 in.) of combustible materials of buildings unless the transformer has Class 155 insulation systems or higher and is completely enclosed except for ventilating openings.

495.106 Less-Flammable Liquid-Insulated Transformers.

Transformers insulated with listed less-flammable liquids that have a fire point of not less than 300°C shall be permitted to be installed in accordance with 495.106(A) or 495.106(B).

(A) Indoor Installations.

Indoor installations shall be permitted in accordance with one of the following:

(1) In Type I or Type II buildings, in areas where all of the following requirements are met:

(2) The transformer is rated 35,000 volts or less.

(3) No combustible materials are stored.

(4) A liquid confinement area is provided.

(5) The installation complies with all the restrictions provided for in the listing of the liquid.

Informational Note: Such restrictions can include, but are not limited to, maximum pressure of the tank, use of a pressure relief valve, appropriate fuse types, and proper sizing of overcurrent protection.

(6) If an automatic fire extinguishing system and a liquid confinement area are present, provided the transformer is rated 35,000 volts or less

(7) If the installation complies with 495.109

(B) Outdoor Installations.

Less-flammable liquid-filled transformers shall be permitted to be installed outdoors, attached to, adjacent to, or on the roof of buildings, if installed in accordance with the following:

(1) For Type I and Type II buildings, the installation shall comply with all the restrictions provided for in the listing of the liquid.

Informational Note No. 1: See 495.110 for information about installations adjacent to combustible material, fire escapes, or door and window openings that might require additional safeguards .

Informational Note No. 2: Such restrictions can include, but are not limited to, maximum pressure of the tank, use of a pressure relief valve, appropriate fuse types, and proper sizing of overcurrent protection.

(2) In accordance with 495.110.

Informational Note No. 3: See NFPA 220-2021, *Standard on Types of Building Construction* , for definitions of Type I and Type II building constructions.

Informational Note No. 4: See Article 100 for the definition of *Listed* .

495.107 Nonflammable Fluid-Insulated Transformers.

Transformers insulated with a dielectric fluid identified as nonflammable shall be permitted to be installed indoors or outdoors. Such transformers installed indoors and rated over 35,000 volts shall be installed in a vault. Such transformers installed indoors shall be furnished with a liquid confinement area and a pressure-relief vent. The transformers shall be furnished with a means for absorbing any gases generated by arcing inside the tank, or the pressure-relief vent shall be connected to a chimney or flue that will carry such gases to an environmentally safe area.

Informational Note: Safety can be increased if fire hazard analyses are performed for such transformer installations.

For the purposes of this section, a nonflammable dielectric fluid is one that does not have a flash point or fire point and is not flammable in air.

495.108 Askarel-Insulated Transformers Installed Indoors.

Askarel-insulated transformers installed indoors and rated over 25 kVA shall be furnished with a pressure-relief vent. Where installed in a poorly ventilated place, they shall be furnished with a means for absorbing any gases generated by arcing inside the case, or the pressure-relief vent shall be connected to a chimney or flue that carries such gases outside the building. Askarel-insulated transformers rated over 35,000 volts shall be installed in a vault.

495.109 Oil-Insulated Transformers Installed Indoors.

Oil-insulated transformers installed indoors shall be installed in a vault constructed as specified in Part VII of this article.

Exception No. 1: Where the total capacity does not exceed 112 1/2 kVA, the vault specified in Part VII of this article shall be permitted to be constructed of reinforced concrete that is not less than 100 mm (4 in.) thick.

Exception No. 2: Where the nominal voltage does not exceed 1000, a vault shall not be required if suitable arrangements are made to prevent a transformer oil fire from igniting other materials and the total capacity in one location does not exceed 10 kVA in a section of the building classified as combustible or 75 kVA where the surrounding structure is classified as fire-resistant construction.

Exception No. 3: Electric furnace transformers that have a total rating not exceeding 75 kVA shall be permitted to be installed without a vault in a building or room of fire-resistant construction if suitable arrangements are made to prevent a transformer oil fire from spreading to other combustible material.

Exception No. 4: A transformer that has a total rating not exceeding 75 kVA and a supply voltage of 1000 volts or less that is an integral part of charged-particle-accelerating equipment shall be permitted to be installed without a vault in a building or room of noncombustible or fire-resistant construction if suitable arrangements are made to prevent a transformer oil fire from spreading to other combustible material.

Exception No. 5: Transformers shall be permitted to be installed in a detached building that does not comply with Part III of this article if neither the building nor its contents present a fire hazard to any other building or property, and if the building is used only in supplying electric service and the interior is accessible only to qualified persons.

Exception No. 6: Oil-insulated transformers shall be permitted to be used without a vault in portable and mobile surface mining equipment (such as electric excavators) if each of the following conditions is met:

(1) Provision is made for draining leaking fluid to the ground.

(2) Safe egress is provided for personnel.

(3) A minimum 6-mm (1/4 -in.) steel barrier is provided for personnel protection.

495.110 Oil-Insulated Transformers Installed Outdoors.

Combustible material, combustible buildings, and parts of buildings, fire escapes, and door and window openings shall be safeguarded from fires originating in oil-insulated transformers installed on roofs, attached to or adjacent to a building or combustible material.

In cases where the transformer installation presents a fire hazard, one or more of the following safeguards shall be applied according to the degree of hazard involved:

(1) Space separations

(2) Fire-resistant barriers

(3) Automatic fire suppression systems

(4) Enclosures that confine the oil of a ruptured transformer tank

Oil enclosures shall be permitted to consist of fire-resistant dikes, curbed areas or basins, or trenches filled with coarse, crushed stone. Oil enclosures shall be provided with trapped drains where the exposure and the quantity of oil involved are such that removal of oil is important.

Informational Note: See ANSI/IEEE C2-2017, *National Electrical Safety Code* , for additional information on transformers installed on poles or structures or underground.

495.111 Modification of Transformers.

When modifications are made to a transformer in an existing installation that change the type of the transformer with respect to Part VII of this article, such transformer shall be marked to show the type of insulating liquid installed, and the modified transformer installation shall comply with the applicable requirements for that type of transformer.

495.112 Transformer Vaults

Vaults shall be located where they can be ventilated to the outside air without using flues or ducts wherever such an arrangement is practicable.

495.113 Accessibility.

All transformer vaults shall be readily accessible to qualified personnel for inspection and maintenance or shall meet the requirements of 450.13(A) or (B).

495.114 Walls, Roofs, and Floors.

The walls and roofs of vaults shall be constructed of materials that have approved structural strength for the conditions with a minimum fire resistance of 3 hours. The floors of vaults in contact with the earth shall be of concrete that is not less than 100 mm (4 in.) thick, but, where the vault is constructed with a vacant space or other stories below it, the floor shall have approved structural strength for the load imposed thereon and a minimum fire resistance of 3 hours. For the purposes of this section, studs and wallboard construction shall not be permitted.

Exception: Where transformers are protected with automatic sprinkler, water spray, carbon dioxide, or halon, construction of 1-hour rating shall be permitted.

Informational Note No. 1: See ASTM E119-18a, *Methods for Fire Tests of Building Construction and Materials* , for additional information.

Informational Note No. 2: A typical 3-hour construction is 150 mm (6 in.) thick reinforced concrete.

495.115 Doorways.

Vault doorways shall be protected in accordance with 495.115(A) through (C).

(A) Type of Door.

Each doorway leading into a vault from the building interior shall be provided with a tight-fitting door that has a minimum fire rating of 3 hours. The authority having jurisdiction shall be permitted to require such a door for an exterior wall opening where conditions warrant.

Exception: *Where transformers are protected with automatic sprinkler, water spray, carbon dioxide, or halon, construction of 1-hour rating shall be permitted.*

Informational Note: See NFPA 80-2022, *Standard for Fire Doors and Other Opening Protectives* , for additional information.

(B) Sills.

A door sill or curb that is of an approved height that will confine the oil from the largest transformer within the vault shall be provided, and in no case shall the height be less than 100 mm (4 in.).

(C) Accessibility.

Doors shall be equipped with locks, and doors shall be kept locked, with access being allowed only to qualified persons. Personnel doors shall be capable of opening not less than 90 degrees in the direction of egress and be equipped with listed fire exit hardware.

495.116 Ventilation Openings.

Where required by 450.9 , openings for ventilation shall be provided in accordance with 495.116(A) through (F).

(A) Location.

Ventilation openings shall be located as far as possible from doors, windows, fire escapes, and combustible material.

(B) Arrangement.

A vault ventilated by natural circulation of air shall be permitted to have roughly half of the total area of openings required for ventilation in one or more openings near the floor and the remainder in one or more openings in the roof or in the sidewalls near the roof, or all of the area required for ventilation shall be permitted in one or more openings in or near the roof.

(C) Size.

For a vault ventilated by natural circulation of air to an outdoor area, the combined net area of all ventilating openings, after deducting the area occupied by screens, gratings, or louvers, shall not be less than 1900 mm^2 (3 $in.^2$) per kVA of transformer capacity in service, and in no case shall the net area be less than 0.1 m^2 (1 ft^2) for any capacity under 50 kVA.

(D) Covering.

Ventilation openings shall be covered with durable gratings, screens, or louvers, according to the treatment required in order to avoid unsafe conditions.

(E) Dampers.

All ventilation openings to the indoors shall be provided with automatic closing fire dampers that operate in response to a vault fire. Such dampers shall possess a standard fire rating of not less than 1 **1** ⁄ **2** hours.

Informational Note: See ANSI/UL 555-2016, *Standard for Fire Dampers* , for additional information on fire dampers.

(F) Ducts.

Ventilating ducts shall be constructed of fire-resistant material.

495.117 Drainage.

Where practicable, vaults containing more than 100 kVA transformer capacity shall be provided with a drain or other means that will carry off any accumulation of oil or water in the vault unless local conditions make this impracticable. The floor shall be pitched to the drain where provided.

495.118 Water Pipes and Accessories.

Any pipe or duct system foreign to the electrical installation shall not enter or pass through a transformer vault. Piping or other facilities provided for vault fire protection, or for transformer cooling, shall not be considered foreign to the electrical installation.

495.119 Storage in Vaults.

Materials shall not be stored in transformer vaults.

Part IX. Capacitors

495.120 Enclosing and Guarding.

(A) Containing More Than 11 L (3 gal) of Flammable Liquid.

Capacitors containing more than 11 L (3 gal) of flammable liquid shall be enclosed in vaults or outdoor fenced enclosures complying with Article 110, Part III. This limit shall apply to any single unit in an installation of capacitors.

(B) Accidental Contact.

Where capacitors are accessible to unauthorized and unqualified persons, they shall be enclosed, located, or guarded so that persons cannot come into accidental contact or bring conducting materials into accidental contact with exposed energized parts, terminals, or buses associated with them. However, no additional guarding is required for enclosures accessible only to authorized and qualified persons.

495.121 Not Covered.

Surge capacitors or capacitors included as a component part of other apparatus and conforming with the requirements of such apparatus are excluded from these requirements.

This part also covers the installation of capacitors in hazardous (classified) locations as modified by Articles 501 through 503 .

495.122 Switching.

(A) Load Current.

(1)

Group-operated switches shall be used for capacitor switching and shall be capable of the following:

(1) Carrying continuously not less than 135 percent of the rated current of the capacitor installation

(2) Interrupting the maximum continuous load current of each capacitor, capacitor bank, or capacitor installation that will be switched as a unit

(3) Withstanding the maximum inrush current, including contributions from adjacent capacitor installations

(4) Carrying currents due to faults on capacitor side of switch

(B) Isolation.

(1) General.

A means shall be installed to isolate from all sources of voltage each capacitor, capacitor bank, or capacitor installation that will be removed from service as a unit. The isolating means shall provide a visible gap in the electrical circuit adequate for the operating voltage.

(2) Isolating or Disconnecting Switches with No Interrupting Rating.

Isolating or disconnecting switches (with no interrupting rating) shall be interlocked with the load-interrupting device or shall be provided with prominently displayed caution signs in accordance with 495.22 to prevent switching load current.

(C) Additional Requirements for Series Capacitors.

The proper switching sequence shall be ensured by use of one of the following:

(1) Mechanically sequenced isolating and bypass switches

(2) Interlocks

(3) Switching procedure prominently displayed at the switching location

495.123 Overcurrent Protection.

(A) Provided to Detect and Interrupt Fault Current.

A means shall be provided to detect and interrupt fault current likely to cause dangerous pressure within an individual capacitor.

(B) Single-Pole or Multipole Devices.

Single-pole or multipole devices shall be permitted for this purpose.

(C) Protected Individually or in Groups.

Capacitors shall be permitted to be protected individually or in groups.

(D) Protective Devices Rated or Adjusted.

Protective devices for capacitors or capacitor equipment shall be rated or adjusted to operate within the limits of the safe zone for individual capacitors.

495.124 Identification.

Each capacitor shall be provided with a permanent nameplate giving the manufacturer's name, rated voltage, frequency, kilovar or amperes, number of phases, and the volume of liquid identified as flammable, if such is the case.

495.125 Grounding.

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

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

495.126 Means for Discharge.

(A) Means to Reduce the Residual Voltage.

A means shall be provided to reduce the residual voltage of a capacitor to 50 volts or less within 5 minutes after the capacitor is disconnected from the source of supply.

(B) Connection to Terminals.

A discharge circuit shall be either permanently connected to the terminals of the capacitor or provided with automatic means of connecting it to the terminals of the capacitor bank after disconnection of the capacitor from the source of supply. The windings of motors, transformers, or other equipment directly connected to capacitors without a switch or overcurrent device interposed shall meet the requirements of 495.126(A).

Part X. Resistors and Reactors

495.130 General.

~~**(A)** Protected Against Physical Damage.~~

~~Resistors and reactors shall be protected against physical damage.~~

~~**(B)** Isolated by Enclosure or Elevation.~~

~~Resistors and reactors shall be isolated by enclosure or elevation to protect personnel from accidental contact with energized parts.~~

~~**(C)** Combustible Materials.~~

~~Resistors and reactors shall not be installed in close enough proximity to combustible materials to constitute a fire hazard and shall have a clearance of not less than 305 mm (12 in.) from combustible materials.~~

~~**(D)** Clearances.~~

~~Clearances from resistors and reactors to grounded surfaces shall be adequate for the voltage involved.~~

~~**(E)** Temperature Rise from Induced Circulating Currents.~~

~~Metallic enclosures of reactors and adjacent metal parts shall be installed so that the temperature rise from induced circulating currents is not hazardous to personnel or does not constitute a fire hazard.~~

~~**495.131** Grounding.~~

~~Resistor and reactor cases or enclosures shall be connected to the equipment grounding conductor.~~

~~*Exception:* *Resistor or reactor cases or enclosures supported on a structure designed to operate at other than ground potential shall not be connected to the equipment grounding conductor.*~~

~~**495.132** Oil-Filled Reactors.~~

~~Installation of oil-filled reactors, in addition to the above requirements, shall comply with applicable requirements of Article 495, Part VII.~~

Statement of Problem and Substantiation for Public Comment

After attempting to bring this proposed article into compliance with the NEC Style Manual, which requires articles to be developed on a “specific topic” most of the later parts had to be restored to their original articles. For example, Parts V through X were the over 1000-volt provisions derived from other articles covering those specific topics. This clearly violated the NEC Style Manual. The Correlating Committee took appropriate action and directed that all those parts be restored to their respective locations within the articles covering those specific topics. What is left is essentially a duplication of Article 490, so this new proposed article is unnecessary. It was also not technically substantiated. There were no externally developed public inputs over the last several cycles indicating there was a problem. These changes resulted from an internally formed task group, but the evidence of a problem is missing and the disposition of the NEC Committees on related Public Inputs clearly shows that majority of the Code Making panels resolved these efforts. The disposition of the associated Code Panels should not be ignored.

Related Item

• FR 7941

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz
Organization: NECA
Street Address:
City:

State:
Zip:
Submittal Date: Wed Aug 18 13:39:16 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected

Resolution: CMP 9 created Article 495 with content from Article 490. This action was accepted by the Correlating Committee (PC 1963), and CMP 9 continues to support the creation of Article 495. CMP-9 has deleted Article 490 to eliminate the duplication. (See SR-7686.)

Public Comment No. 483-NFPA 70-2021 [Section No. 495.2]

~~**495.2** Definition.~~

~~The definition in this section shall apply only within this article.~~

~~**High Voltage.**~~

~~A potential difference of more than 1000 volts, nominal.~~

Statement of Problem and Substantiation for Public Comment

Definitions should be moved to Article 100

Related Item

• FR 9276

Submitter Information Verification

Submitter Full Name: Dennis Querry
Organization: Trinity River Authority
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 28 11:57:14 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-7755-NFPA 70-2021

Statement: This revision addresses comments in Correlating Committee Note No. 384. In that Note, the Correlating

Committee directed that that requirements in Articles 430, 460, and 470 for Motors, Capacitors, Resistors and Reactors, be removed from Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal, and remain in their respective articles. While this revision removes requirements found in Articles 430, 460, and 470.

Also, the Correlating Committee directed CMP 9 to revise requirements in Article 495 to include revisions that were made to Article 490 that were unrelated to the restructuring. These revisions incorporate those changes from 490 into Article 495, which includes the relocation of the definition to Article 100.

Lastly, recognizing that not all equipment requirements for equipment over 1000 volts were relocated to Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal, this revision deletes requirements for transformers in favor of maintaining those requirements in Article 450 Transformers and Transformer Vaults (Including Secondary Ties). While relocating transformer requirements may be warranted in the future, the fact

that many transformers may have one winding rated under 1000 volts, with another winding over 1000 volts, makes transformers unique with respect to a clear delineation of the topic.

Public Comment No. 485-NFPA 70-2021 [Section No. 495.22]

495.22 Isolating Means.

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

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

Load break isolating switches shall be interlocked with an approved circuit interrupting device.

An identified fuseholder and fuse shall be permitted as an isolating switch.

Statement of Problem and Substantiation for Public Comment

Isolating switches can be load break or non-load break. The term isolating switch is used somewhat generically here.

Related Item

• FR 7491

Submitter Information Verification

Submitter Full Name: Dennis Querry
Organization: Trinity River Authority
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 28 12:10:14 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but held

Resolution: The Public Comment introduces material that was not included at the First Draft stage of the process. The change from “Isolating” to “Non-load break isolating” seems to have merit; however, it should be noted that non-load break isolating switches are not always required to be interlocked with an interrupting device.

Public Comment No. 1932-NFPA 70-2021 [Section No. 495.49]

495.49 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.

Additional Proposed Changes

File Name	Description	Approved
CN_257.pdf	70_CN257	

Statement of Problem and Substantiation for Public Comment

NOTE: The following CC Note No. 257 appeared in the First Draft Report.

The Correlating Committee directs the panel to reconsider the text in this section to remove redundant requirements in accordance with 4.1.1 of the NEC Style Manual and correlate with FR 8663 and FR 8577.

Related Item

• Correlating Note No. 257 • First Revision No. 8663 • First Revision No. 8577

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NEC Correlating Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 18 16:56:00 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7752-NFPA 70-2021
Statement: Section 110.21 requires the original listing mark be removed. Section 110.20 addresses other aspects of reconditioning, and the listing or field labeling of reconditioned equipment. In response to the Correlating Committee Public Comment (PC 1932) reference to removal of the listing mark and other conditions of reconditioning are unnecessary, and therefore removed from the statement. In addition, the requirement only applies to equipment within Article 495, therefore, the statement “within the scope

of this article" is unnecessary.

CMP 9 is also aware of Correlating Committee Note 259 that suggests sections covering reconditioning be placed very near the beginning of the applicable article. In this case, that would be user unfriendly, because the applicability of the reconditioning provisions is confined to switchgear covered in Part III of the article. Therefore, CMP 9 leaves the reconditioning requirement in its present location in 495.49.

Lastly, CMP 9 has retained the last sentence which includes requirements not found in the newly created Section 110.20. This additional requirement addresses equipment damaged by fire, products of combustion, or water, and may be information worth considering as a "general requirement" in future editions of the Code.

Correlating Committee Note No. 257-NFPA 70-2021 [Section No. 495.49]

Submitter Information Verification

Committee: NEC-AAC
Submittal Date: Thu May 06 09:46:15 EDT 2021

Committee Statement

Committee Statement: The Correlating Committee directs the panel to reconsider the text in this section to remove redundant requirements in accordance with 4.1.1 of the NEC Style Manual and correlate with FR 8663 and FR 8577.

Ballot Results

This item has passed ballot

12 Eligible Voters
0 Not Returned
12 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Affirmative All

Ayer, Lawrence S.
Gallo, Ernest J.
Hickman, Palmer L.
Holub, Richard A.
Hunter, Dean C.
Johnston, Michael J.
Kendall, David H.
Kovacik, John R.
Manche, Alan
McDaniel, Roger D.
Porter, Christine T.
Williams, David A.

Public Comment No. 1570-NFPA 70-2021 [Definition: Switching Device. [Excluding any Sub-Sections]]

~~A device~~ **Switching Device.** Equipment that is designed to ~~close~~ make , ~~open, or both,~~ carry, and interrupt specified currents, as applied to one or more electrical circuits. (CMP-~~1~~ 9)

Statement of Problem and Substantiation for Public Comment

This comment incorporates the definition of "Interrupter Switch" that is being deleted in a related comment because that term is not used in the NEC. The rewording melds the concepts in that definition with the parent language for "Switching Device" in the 2020 NEC. The definition is being reassigned to CMP 9.

Related Item

• CC Note 358

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 14:24:37 EDT 2021
Committee: NEC-P09

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7851-NFPA 70-2021
Statement: CMP 9 is changing the title text to clarify that both the parent language and all subsidiary definitions apply exclusively to equipment with ratings over 1000 V ac, 1500 V dc. CMP 9 is also adding "(CMP-9)" at the end of the parent text, because the responsibility for all definitions in this group have been reassigned accordingly. CMP 9 is not changing the wording of this definition because the changes suggested in the comment were insufficiently substantiated.