



Second Revision No. 7755-NFPA 70-2021 [Global Comment]

1) Revise 495.2 as follows:

~~**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.~~

2) Revise 495.3 as follows:

495.3 Other Articles.

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

(A) Oil-Filled Equipment.

Installation of electrical equipment containing more than 38 L (10 gal) of flammable oil per unit shall meet

the requirements of Parts II and III of Article 450.

(B) Enclosures in Damp or Wet Locations.

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

3) Revise the Table Note in Table 495.24 as follows:

Table 495.24 Minimum Clearance of Live Parts

...

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.

4) Revise 495.26 as follows:

~~**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.~~

5) Revise 495.36 as follows:

~~**495.36 Grounding:**~~

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

6) Revise 495.37 as follows:

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](#) .

7) Revise 495.48(A) as follows:

(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](#)

8) Revise Part IV as follows:

Part IV. Mobile and Portable Equipment

495.651 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 Grounding and Bonding .

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.

495.6 5 2 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.

495.6 5 3 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.

495.6 5 4 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.

495.6 5 5 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).

495.6 5 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~~.

9) Revise Part V as follows:

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 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 [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.

10) Delete Part VI, Part VII, Part VIII, Part IX, and Part X.

Supplemental Information

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Submitter Information Verification

Committee: NEC-P09

Submittal Date: Thu Oct 14 16:33:41 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7755-NFPA 70-2021

[Public Comment No. 483-NFPA 70-2021 \[Section No. 495.2\]](#)

[Public Comment No. 1963-NFPA 70-2021 \[Global Input\]](#)

[Public Comment No. 1424-NFPA 70-2021 \[Global Input\]](#)



Second Revision No. 7853-NFPA 70-2021 [Global Comment]

- (1) Delete the Part I, Part II, and Part III headings from Article 245.
- (2) Delete 245.40 through 245.56.

Supplemental Information

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Submitter Information Verification

Committee: NEC-P09

Submittal Date: Fri Oct 15 19:01:50 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7853-NFPA 70-2021

[Public Comment No. 1392-NFPA 70-2021 \[Global Input\]](#)



Second Revision No. 7851-NFPA 70-2021 [Detail]

In Article 100, revise the definition of *Switching Device* as follows:

Switching Device(**as applied to equipment rated over 1000 volts ac, 1500 volts dc, nominal**).

A device designed to close, open, or both, one or more electrical circuits.
(~~GMP-1~~CMP-9)

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Fri Oct 15 18:31:55 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7851-NFPA 70-2021

[Public Comment No. 1570-NFPA 70-2021 \[Definition: Switching Device. \[Excluding any Sub-Sections\]\]](#)



Second Revision No. 7846-NFPA 70-2021 [Definition: Disconnecting (or Isolating) Switch (Disconnect...)]

Disconnecting Switch (or Isolating) Switch (~~Disconnecter, Isolator~~).

A mechanical switching device used for isolating a circuit or equipment from a source of power.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Fri Oct 15 17:59:00 EDT 2021

Committee Statement

Committee Statement: The terms “disconnecter” 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.

Response Message: SR-7846-NFPA 70-2021

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



Second Revision No. 7847-NFPA 70-2021 [Definition: Interrupter Switch.]

Interrupter Switch.

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

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Fri Oct 15 18:09:31 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7847-NFPA 70-2021

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



Second Revision No. 7848-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.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Fri Oct 15 18:12:50 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7848-NFPA 70-2021

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



Second Revision No. 7849-NFPA 70-2021 [Definition: Oil Switch.]

Oil Switch.

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

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Fri Oct 15 18:16:00 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7849-NFPA 70-2021

[Public Comment No. 1604-NFPA 70-2021 \[Definition: Oil Switch.\]](#)



Second Revision No. 7508-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-4 9)

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 11:16:41 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7508-NFPA 70-2021

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

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



Second Revision No. 7505-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)

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 11:13:51 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7505-NFPA 70-2021

[Public Comment No. 17-NFPA 70-2021 \[Definition: Panelboard.\]](#)

[Public Comment No. 902-NFPA 70-2021 \[Definition: Panelboard.\]](#)

[Public Comment No. 1229-NFPA 70-2021 \[Definition: Panelboard.\]](#)



Second Revision No. 7850-NFPA 70-2021 [Definition: Regulator Bypass Switch.]

Regulator Bypass Switch.

A specific switching device or combination of switching devices designed to bypass a regulator equipment used to control voltage levels or related circuit characteristics .

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Fri Oct 15 18:19:22 EDT 2021

Committee Statement

Committee 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".

Response Message: SR-7850-NFPA 70-2021

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



Second Revision No. 7509-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.

~~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)

Informational Note: These assemblies ~~are generally~~ can be accessible from the rear or side as well as from the front and are not intended to be installed in cabinets.

Supplemental Information

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Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 11:19:42 EDT 2021

Committee Statement

Committee 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).

Response Message: SR-7509-NFPA 70-2021

[Public Comment No. 1557-NFPA 70-2021 \[Definition: Switchboard.\]](#)



Second Revision No. 7520-NFPA 70-2021 [Definition: Transformer.]

Transformer.

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

Submitter Information Verification

Committee: NEC-P09

Submission Date: Wed Oct 13 11:47:40 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7520-NFPA 70-2021

[Public Comment No. 28-NFPA 70-2021 \[Definition: Transformer.\]](#)

[Public Comment No. 1588-NFPA 70-2021 \[Definition: Transformer.\]](#)



Second Revision No. 7548-NFPA 70-2021 [Definitions (100): Dead Front.... to Dead Front ...]

Dead-Front.

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

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 14:30:14 EDT 2021

Committee Statement

Committee 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).

Response Message: SR-7548-NFPA 70-2021

[Public Comment No. 1967-NFPA 70-2021 \[Definition: Dead Front.\]](#)



Second Revision No. 7729-NFPA 70-2021 [Section No. 245.15]

245.2 Reconditioned Equipment.

Reconditioned equipment shall be listed as ~~reconditioned~~ and the original listing mark removed. permitted as follows:

- (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.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Thu Oct 14 15:22:14 EDT 2021

Committee Statement

Committee 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”.

Response Message: SR-7729-NFPA 70-2021

[Public Comment No. 2078-NFPA 70-2021 \[Section No. 245.15\]](#)

[Public Comment No. 1930-NFPA 70-2021 \[Section No. 245.15\]](#)



Second Revision No. 7525-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 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 ($\frac{1}{4}$ 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 ($\frac{7}{16}$ in.) if located within 10 mm ($\frac{3}{8}$ in.) of an enclosure wall.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 12:28:02 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7525-NFPA 70-2021

[Public Comment No. 752-NFPA 70-2021 \[Section No. 312.10\]](#)

[Public Comment No. 842-NFPA 70-2021 \[New Section after 312.9\]](#)

[Public Comment No. 1606-NFPA 70-2021 \[Section No. 312.10\]](#)

[Public Comment No. 1248-NFPA 70-2021 \[Section No. 312.10\]](#)

[Public Comment No. 1551-NFPA 70-2021 \[Section No. 312.10\]](#)



Second Revision No. 7527-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 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 attaching a cover shall extend no more than 10 mm ($\frac{3}{8}$ in.).
- (4) Screws or other fasteners, other than in (4.3), 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 cm³ (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 cm³ (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 to (3) through (6): A screw shall be permitted to be longer if the end of the screw is protected with an approved means.

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.

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Submitter Information Verification

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Committee Statement

Committee 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.

Response SR-7527-NFPA 70-2021

Message:

[Public Comment No. 1552-NFPA 70-2021 \[Section No. 314.5\]](#)

[Public Comment No. 1491-NFPA 70-2021 \[Section No. 314.5\]](#)

[Public Comment No. 843-NFPA 70-2021 \[New Section after 314.4\]](#)

[Public Comment No. 1249-NFPA 70-2021 \[Section No. 314.5\]](#)

[Public Comment No. 1609-NFPA 70-2021 \[Section No. 314.5\]](#)



Second Revision No. 7528-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 $\frac{1}{4}$ 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.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 12:40:15 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7528-NFPA 70-2021

[Public Comment No. 940-NFPA 70-2021 \[Section No. 314.16\(B\)\(5\)\]](#)



Second Revision No. 7529-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)(1) shall be made for each terminal block assembly based on the largest conductor(s) terminated within to it.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 12:42:29 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7529-NFPA 70-2021

[Public Comment No. 1062-NFPA 70-2021 \[Section No. 314.16\(B\)\(6\)\]](#)



Second Revision No. 7531-NFPA 70-2021 [Section No. 314.24(C)]

(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 ($\frac{1}{2}$ in.). Where devices or equipment are mounted in boxes having side-wiring entries, the conductors entering from the side shall be protected from abrasion as covered in (1) or (2), as follows. The term *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 ($\frac{1}{2}$ in.).

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NEC_CMP-09_SR7531_314.24_C_.docx	staff use	

Submitter Information Verification

Committee: NEC-P09

Submission Date: Wed Oct 13 12:46:28 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7531-NFPA 70-2021

[Public Comment No. 1612-NFPA 70-2021 \[Section No. 314.24\(C\)\]](#)

[Public Comment No. 867-NFPA 70-2021 \[Section No. 314.24\]](#)



Second Revision No. 7535-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). A 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 ceiling-suspended (paddle) fans, in accordance with 314.27(C).

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.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 13:10:40 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7535-NFPA 70-2021

Public Comment No. 2179-NFPA 70-2021 [Section No. 314.27(E)]



Second Revision No. 7551-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 listed wall-mounted control devices.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 14:49:29 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7551-NFPA 70-2021

[Public Comment No. 872-NFPA 70-2021 \[Section No. 404.1\]](#)

[Public Comment No. 950-NFPA 70-2021 \[Section No. 404.1\]](#)

[Public Comment No. 1882-NFPA 70-2021 \[Section No. 404.1\]](#)



Second Revision No. 7858-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.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Fri Oct 15 23:30:13 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7858-NFPA 70-2021

[Public Comment No. 1710-NFPA 70-2021 \[Section No. 404.2\(C\)\]](#)



Second Revision No. 7645-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~~ can be operated from a readily accessible place. They shall be installed such that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 2.0 m (6 ft 7 in.) above the floor or working platform, except as follows:

- (1) On busway installations, fused switches and circuit breakers shall be permitted to be located at the same level as the busway. Suitable means shall be provided to operate the handle of the device from the floor.
- (2) Switches and circuit breakers installed adjacent to motors, appliances, or other equipment that they supply shall be permitted to be located higher than 2.0 m (6 ft 7 in.) and to be accessible by portable means.
- (3) Hookstick operable isolating switches shall be permitted at greater heights.

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.

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NEC_CMP-09_SR7645_404.8.docx	staff use	

Submitter Information Verification

Committee: NEC-P09

Submission Date: Thu Oct 14 10:24:52 EDT 2021

Committee Statement

Committee Statement:	CMP 9 revises the text in 404.8(A) to convert the exceptions to positive text and in 404.8(C) to eliminate the unnecessary words, "permitted to be".
Response Message:	SR-7645-NFPA 70-2021



Second Revision No. 7562-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 for requirements for circuit breakers relative to indication of state and required markings .

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 15:21:46 EDT 2021

Committee Statement

Committee Statement: CMP 9 added explanatory text in the note regarding the purpose of the referenced code sections.

Response Message: SR-7562-NFPA 70-2021

[Public Comment No. 874-NFPA 70-2021 \[Section No. 404.11\]](#)

[Public Comment No. 1614-NFPA 70-2021 \[Section No. 404.11\]](#)



Second Revision No. 7859-NFPA 70-2021 [Section No. 404.14(D)]

(D) Snap Switches with Push-in Terminals 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. Snap switch terminations shall be in accordance with the following:

- (1) Terminals of 15-ampere and 20-ampere snap switches not marked CO/ALR shall be used with copper and copper-clad aluminum conductors only.
- (2) Terminals marked CO/ALR shall be permitted to be used with copper, aluminum, and copper-clad aluminum conductors.
- (3) Snap switches connected using screwless terminals of the conductor push-in type construction (also known as conductor push-in terminals) shall be installed on not greater than 15-ampere branch circuits and shall be connected with 14 AWG solid copper wire only unless listed and marked for other types of conductors.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Fri Oct 15 23:51:40 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7859-NFPA 70-2021

Public Comment No. 1460-NFPA 70-2021 [Section No. 404.14(D)]



Second Revision No. 7560-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 only to control permanently connected loads, such as incandescent luminaires, unless listed for the control of other loads and installed accordingly . They shall be marked by their manufacturer with their current and voltage ratings and used for loads that do not exceed their ampere rating at the voltage applied.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 15:17:37 EDT 2021

Committee Statement

Committee Statement: The text is revised to remove redundant requirements.

Response Message: SR-7560-NFPA 70-2021

[Public Comment No. 898-NFPA 70-2021 \[Section No. 404.14\(F\)\]](#)



Second Revision No. 7860-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 reconditioned.

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NEC_CMP-09_SR7860_404.16.docx	staff use	

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Sat Oct 16 00:08:08 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7860-NFPA 70-2021

[Public Comment No. 1626-NFPA 70-2021 \[Section No. 404.16\(B\)\]](#)

[Public Comment No. 1622-NFPA 70-2021 \[Section No. 404.16\(A\)\]](#)

[Public Comment No. 1231-NFPA 70-2021 \[Section No. 404.16\]](#)



Committee Comment No. 7566-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 .

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 15:44:05 EDT 2021

Committee Statement

Committee Statement: CMP 9 changed the text to improve clarity of the requirement.

Response Message: CC-7566-NFPA 70-2021

[Public Comment No. 1671-NFPA 70-2021 \[Section No. 404.30\]](#)

[Public Comment No. 876-NFPA 70-2021 \[New Section after 404.28\]](#)

[Public Comment No. 1514-NFPA 70-2021 \[Section No. 404.30\]](#)

[Public Comment No. 1617-NFPA 70-2021 \[Section No. 404.30\]](#)



Second Revision No. 7861-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, provided with a legible and permanent description that complies with all of the following conditions as applicable:

- (1) Located at each switch or circuit breaker in a switchboard or switchgear
- (2) 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
- (3) Clear, evident, and specific to the purpose or use of each circuit including spare positions with an unused overcurrent device
- (4) Described with a degree of detail and clarity that is unlikely to result in confusion between circuits
- (5) Not dependent on transient conditions of occupancy
- (6) Clear in explaining abbreviations and symbols when used

(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, in accordance with the following:

- (1) With the identification and physical location of where the power originates
- (2) With a label that is permanently affixed and of sufficient durability to withstand the environment involved
- (3) Using a method that is not handwritten

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NEC_CMP-09_SR7861_408.4.docx	staff use	

Submitter Information Verification

Committee: NEC-P09

Submission Date: Sat Oct 16 00:32:06 EDT 2021

Committee Statement

**Committee
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.

**Response
Message:**

SR-7861-NFPA 70-2021

[Public Comment No. 879-NFPA 70-2021 \[Section No. 408.4\]](#)

[Public Comment No. 1645-NFPA 70-2021 \[Section No. 408.4\(A\)\]](#)



Second Revision No. 7583-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.~~ 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.~~

408.9 Replacement Panelboards.

Replacement panelboards shall be permitted to be installed in existing enclosures in accordance with 408.9(A) or (B).

(A) Panelboards Listed for the Specific Enclosure.

If the replacement panelboard is listed for the specific enclosure identified by either catalog number or dimensional information, the panelboard shall be permitted to maintain its short-circuit current rating.

(B) Panelboards Not Listed for the Specific Enclosure.

If the available fault current is greater than 10,000 amperes, the completed work shall be field labeled. If the available fault current is 10,000 amperes or less, the replacement panelboard shall be identified for the application. Any previously applied listing marks on the cabinet that pertain to the panelboard shall be removed.

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NEC_CMP-09_SR7583_408.8.docx	staff use	

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Wed Oct 13 16:47:15 EDT 2021

Committee Statement

Committee The changes separate the requirements for replacement panelboards, which are now

Statement: 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.

Response SR-7583-NFPA 70-2021
Message:

[Public Comment No. 1646-NFPA 70-2021 \[Section No. 408.8\]](#)

[Public Comment No. 1553-NFPA 70-2021 \[Section No. 408.8\]](#)

[Public Comment No. 184-NFPA 70-2021 \[Section No. 408.8\(A\)\]](#)

[Public Comment No. 183-NFPA 70-2021 \[Section No. 408.8 \[Excluding any Sub-Sections\]\]](#)

[Public Comment No. 899-NFPA 70-2021 \[Section No. 404.8\]](#)



Second Revision No. 7862-NFPA 70-2021 [New Section after 450.1]

450.2 Interconnection of Transformers.

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

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Sat Oct 16 01:07:55 EDT 2021

Committee Statement

Committee Statement: Section 450.2 was not really a definition of a transformer, even though Section 450.2 was titled as such. That is why the word “transformer” is used in the body of the rule, provoking the specific Correlating Committee objection to the violation of the Style Manual at 2.2.2.2. Section 450.2 is actually a rule governing how the provisions in the article are to be applied to transformers connections in multiple.

The history of this particular section provides important insight that supports this position. The section originated as a CMP 13 proposal framed as an additional sentence in the scope section, not as a definition (Proposal 13-6, 1987 cycle). The Correlating Committee rejected the proposal and instructed that the rejection be treated as a public comment because it violated the Style Manual. Prior to that time, the location section of the article was placed as Section 2. As a result of the Correlating Committee action, CMP 13 moved what had been Section 2 (as noted, it was then titled “Location”) to what is now Section 13 (now titled “Accessibility”) in the comment period (Comment 13-2). This vacated Section 2, which was then repurposed at the location of the new sentence, but unfortunately titled as a definition. This history makes quite clear the title was an afterthought; CMP 13 was focused on getting the clarifying language about plural transformer connections into the beginning of the article. This second revision now fully refines that process. Fortunately, Section 2 of articles is no longer reserved for definitions, simplifying this change to keep Section 450.2 and rewrite the section as a requirement and not a definition.

Response Message: SR-7862-NFPA 70-2021



Second Revision No. 7682-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~~ See NFPA 220 -2021, Standard on Types of Building Construction, for definitions of Type I and Type II building construction .

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 See 450.27 for examples of additional safeguards that can be required for installations adjacent to combustible material, fire escapes, or door and window openings .

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

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NEC_CMP-09_SR7682_450.23_B_.docx	staff use	

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Thu Oct 14 11:30:50 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7682-NFPA 70-2021

[Public Comment No. 1648-NFPA 70-2021 \[Section No. 450.23\(B\)\]](#)

[Public Comment No. 886-NFPA 70-2021 \[Section No. 450.23\(B\)\]](#)



Second Revision No. 7686-NFPA 70-2021 [Article 490]

~~Article 490~~— Equipment Over 1000 Volts, Nominal

~~Part I.~~— General

~~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.~~

~~490.3~~— Other Articles.

~~(A)~~— Oil-Filled Equipment.

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

~~(B)~~— Enclosures in Damp or Wet Locations.

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

~~Part II.~~— Equipment — Specific Provisions

~~490.21~~— Circuit-Interrupting Devices.

~~(A)~~— Circuit Breakers.

~~(1)~~— Location.

~~(0) 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.~~

~~(0) 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.~~

~~(0) 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:

- (0) ~~An accessible mechanical or other identified means for manual tripping, independent of control power~~
- (0) ~~Be release free (trip free)~~
- (0) ~~If capable of being opened or closed manually while energized, main contacts that operate independently of the speed of the manual operation~~
- (0) ~~A mechanical position indicator at the circuit breaker to show the open or closed position of the main contacts~~
- (0) ~~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 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:~~

- (0) ~~The continuous current rating of a circuit breaker shall not be less than the maximum continuous current through the circuit breaker.~~
- (0) ~~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.~~
- (0) ~~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.~~
- (0) ~~The momentary rating of a circuit breaker shall not be less than the maximum asymmetrical fault current at the point of installation.~~
- (0) ~~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 utilize 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 so as to prevent persons from accidentally contacting energized parts or dropping tools or fuses into energized parts.~~

~~490.22 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 410.21(B).~~

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

~~490.23 Voltage Regulators.~~

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

- ~~(0) Mechanically sequenced regulator bypass switch(es)~~
- ~~(0) Mechanical interlocks~~
- ~~(0) Switching procedure prominently displayed at the switching location~~

490.24 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 490.24(a). These values shall not apply to interior portions or exterior terminals of equipment designed, manufactured, and tested in accordance with accepted national standards.

Table 490.24(a) Minimum Clearance of Live Parts

Nominal Voltage Rating (kV)	Impulse Withstand, Basic Impulse Level B.I.L. (kV)		Minimum Clearance of Live Parts							
			Phase-to-Phase				Phase-to-Ground			
			Indoors		Outdoors		Indoors		Outdoors	
			Indoors	Outdoors	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
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.

490.25 Backfeed.

Installations where the possibility of backfeed exists shall comply with 490.25(A) and (B), which follow.

(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.~~

~~Part III. Equipment — Switchgear and Industrial Control Assemblies~~

~~490.30 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.~~

~~490.31 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.~~

~~490.32 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.~~

~~490.33 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.~~

~~490.34 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.~~

~~490.35 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:~~

- ~~(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, and~~
- ~~(2) All high-voltage parts or high-voltage wiring in the compartment that remain 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.~~

~~490.37 Equipment Grounding Connections.~~

~~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 .~~

~~490.38 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 m² (12 ft²) in area or 27 kg (60 lb) in weight, unless they are hinged and bolted or locked.~~

~~490.39 Gas Discharge from Interrupting Devices.~~

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

~~490.40 Visual Inspection Windows.~~

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

~~490.41 Location of Industrial Control Equipment.~~

~~Routinely operated industrial control equipment shall meet the requirements of 490.41(A) unless infrequently operated, as covered in 490.41(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.~~

~~490.42 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.~~

~~490.43 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.~~

~~490.44 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 so as 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 .~~

~~490.45 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.~~

~~490.46 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 .~~

~~490.47 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 490.35(A) shall include a notice that access is limited to the serving utility or is permitted only following an authorization of the serving utility.~~

~~490.48 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:~~

- ~~(0) Clearances and exits~~
- ~~(0) Electrical enclosures~~
- ~~(0) Securing and support of electrical equipment~~
- ~~(0) Fire protection~~
- ~~(0) Safety ground connection provisions~~
- ~~(0) Guarding live parts~~
- ~~(0) Transformers and voltage regulation equipment~~
- ~~(0) Conductor insulation, electrical and mechanical protection, isolation, and terminations~~
- ~~(0) Application, arrangement, and disconnection of circuit breakers, switches, and fuses~~
- ~~(0) Provisions for oil-filled equipment~~
- ~~(0) Switchgear~~
- ~~(0) 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 this diagram shall clearly identify interlocks, isolation means, and all possible sources of voltage to the installation under normal or emergency conditions, and 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.*~~

~~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.~~

~~Part IV. Mobile and Portable Equipment~~

~~490.61 General.~~

~~(A) Covered.~~

~~The provisions of this part shall apply to installations and use of high-voltage power distribution and utilization equipment that is portable, mobile, or both, such as substations and switch houses mounted on skids, trailers, or cars; mobile shovels; draglines; cranes; hoists; drills; dredges; compressors; pumps; conveyors; underground excavators; and the like.~~

~~(B) Grounding and Bonding.~~

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

~~490.62 Overcurrent Protection.~~

~~Motors driving single or multiple dc generators supplying a system operating on a cyclic load basis do not require overload protection, provided that 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.~~

~~490.63 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.~~

~~490.64 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.~~

~~490.65 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 may 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).~~

~~490.66 High-Voltage Portable Cable for Main Power Supply.~~

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

~~Part V. Boilers~~

~~490.70 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.~~

~~490.71 Electrical Supply System.~~

~~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.~~

490.72 ~~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 $7\frac{1}{2}$ 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:

- (0) ~~Connected to the pressure vessel containing the heating elements~~
- (0) ~~Insulated for not less than 1000 volts~~
- (0) ~~Have not less than the ampacity of the largest ungrounded branch-circuit conductor~~
- (0) ~~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~~
- (0) ~~Not used for any other circuit~~

490.73 ~~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. Such means shall be in addition to the temperature, pressure, or both, regulating systems and pressure relief or safety valves.

490.74 ~~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.

Submitter Information Verification

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Committee Statement

Committee 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.

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Second Revision No. 7752-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.

Submitter Information Verification

Committee: NEC-P09

Submittal Date: Thu Oct 14 16:28:08 EDT 2021

Committee Statement

Committee 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.

Response Message: SR-7752-NFPA 70-2021

[Public Comment No. 1932-NFPA 70-2021 \[Section No. 495.49\]](#)

[Public Comment No. 1650-NFPA 70-2021 \[Section No. 490.49\]](#)

[Public Comment No. 900-NFPA 70-2021 \[Section No. 490.49\]](#)