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M E M O R A N D U M

TO: Code-Making Panel 5

FROM: Sarah Caldwell, *Committee Administrator*

DATE: April 15, 2021

SUBJECT: NEC® First Draft Technical Committee FINAL Ballot Results (A22)

According to the final ballot results, all ballot items received the necessary affirmative votes to pass ballot.

16 Members Eligible to Vote

1 Members Not Returned (*Feliciano*)

The attached report shows the number of affirmative, negative, and abstaining votes as well as the explanation of the vote for each revision.

To pass ballot, each revision requires: (1) a simple majority of those eligible to vote and (2) an affirmative vote of $\frac{2}{3}$ of ballots returned. See Sections 3.3.4.3.(c) and 4.3.10.1 of the ***Regulations Governing the Development of NFPA Standards***.

**First Revision No. 8280-NFPA 70-2020 [Global Input]**

Add acronyms to the following definitions:

Ground-Fault Protection of Equipment (GFPE).

Grounding Electrode Conductor (GEC).

Bonding Jumper, Equipment (EBJ).

Bonding Jumper, Supply-Side (SSBJ).

Bonding Jumper, Main (MBJ).

Bonding Jumper, System (SBJ).

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Wed Dec 23 10:26:28 EST 2020

Committee Statement

Committee Statement: To comply with the 2020 NEC Style Manual to include acronyms for definitions to aid in electronic searches and allowed to be used elsewhere in this code acronyms were added to the specified terms in Article 100.

Response Message: FR-8280-NFPA 70-2020

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8079-NFPA 70-2020 [Detail]**

See revisions to 250.64(B), 250.64(B)(1) and 250.64(B)(2).

(B) Securing and Protection Against Physical Damage.

Where exposed, a grounding electrode conductor or its enclosure shall be securely fastened to the surface on which it is carried. Grounding electrode conductors shall be permitted to be installed on or through framing members.

(1) Not Exposed to Physical Damage.

A 6 AWG or larger copper, copper-clad aluminum, or aluminum grounding electrode conductor not exposed to physical damage shall be permitted to be run along the surface of the building construction without metal covering or protection.

(2) Exposed to Physical Damage.

A 6 AWG or larger copper, copper-clad aluminum, or aluminum grounding electrode conductor exposed to physical damage shall be protected in rigid metal conduit (RMC), intermediate metal conduit (IMC), Schedule 80 rigid polyvinyl chloride conduit (PVC), reinforced thermosetting resin conduit Type XW (RTRC-XW), electrical metallic tubing (EMT), or cable armor.

Supplemental Information

<u>File Name</u>	<u>Description Approved</u>
NEC_250.64_B_FR8079_detail.docx	For staff use

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 16:41:43 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: Copper-clad aluminum was added to the list of conductor types because it is already allowed in the NEC.
FR-8079-NFPA 70-2020 Copper-clad steel was not accepted because no technical substantiation was provided to ensure that under expected conditions of use the copper layer will not delaminate, that the steel core stiffness and strength is sufficient to prevent failure, and that it can be bent and installed without stressing terminations within equipment. The Public Input does not require 40% copper-clad steel in all cases which was used in all of the submitted testing reports. The current values used in the short time current test are less than those required in UL 467. Copper-clad steel needs to be listed in all cases to ensure acceptable performance.

[Public Input No. 2465-NFPA 70-2020 \[Section No. 250.64\(B\)\(2\)\]](#)

[Public Input No. 2463-NFPA 70-2020 \[Section No. 250.64\(B\)\(1\)\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
13 Affirmative All
0 Affirmative with Comments
2 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

Negative with Comment

Abernathy, Paul W.

Inadequate substantiation was provided to support this change.

Crawford, Carlie Rose

CDA votes negative. Inadequate substantiation was submitted to show that Copper-clad aluminum conductor is suitable for this application.

**First Revision No. 8204-NFPA 70-2020 [Detail]**

See attached Word file for changes to 250.94(A).

Supplemental Information

<u>File Name</u>	<u>Description</u> <u>Approved</u>
NEC_FR8204_250.94.docx	For staff use
NEC_FR8204_250.94_For_ballot.docx	For ballot

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 13:27:54 EST 2020

Committee Statement

Committee Statement: Editorial changes are made to the opening paragraph. "That is supplied by a feeder or branch circuit" replaces "additional" to add clarity.

A new 250.94(A)(4) simplifies the requirement that the IBT device is required to be securely mounted. "Metallic" is changed to "metal" to comply with the NEC Style Manual.

In the exception, the reference to 830.100 was deleted since the section no longer exists and additionally revisions were made for clarity.

Response Message: FR-8204-NFPA 70-2020

[Public Input No. 1445-NFPA 70-2020 \[Section No. 250.94 \[Excluding any Sub-Sections\]\]](#)

[Public Input No. 3014-NFPA 70-2020 \[Section No. 250.94\(A\)\]](#)

[Public Input No. 1446-NFPA 70-2020 \[Section No. 250.94\(A\)\]](#)

[Public Input No. 262-NFPA 70-2020 \[Section No. 250.94\(A\)\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

14 Affirmative All

1 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Affirmative with Comment

Bowmer, Trevor N.

FR-8257 and FR-8204 make conflicting revisions to 250.94A. FR-8204 should be accepted and FR-8257 rejected. FR-8204 includes the desired revision to the charging statement of 250.94 which is omitted from FR-8257. FR-8257 incorrectly deletes "electrically connected to" from Item 4a. FR-8257 omits "The IBT shall be..." from Item 5. As revised by either FR, the text could be mistakenly read to imply that IBT connections be made at BOTH 4a (service equipment) and 4b (disconnecting means) whereas only one should be made.

250.94 Bonding for Communication Systems.

Communications system bonding conductor terminations shall be connected in accordance with 250.94(A) or (B).

(A) The Intersystem Bonding Termination Device.

An intersystem bonding termination (IBT) for connecting intersystem bonding conductors shall be provided external to enclosures at the service equipment or metering equipment enclosure and at the disconnecting means for any ~~additional~~ buildings or structures that are supplied by a feeder or branch circuit. If an IBT is used, it shall comply with the following:

- (1) Be accessible for connection and inspection.
- (2) Consist of a set of terminals with the capacity for connection of not less than three intersystem bonding conductors.
- (3) Not interfere with opening the enclosure for a service, building or structure disconnecting means, or metering equipment.

(4) Be securely mounted:

~~(a)(4)~~—At the service equipment, be ~~securely mounted and~~ electrically connected to an metal enclosure for the service equipment, to the a metal meter enclosure, or to an exposed nonflexible metallie metal service raceway, or be ~~mounted at one of these enclosures and be~~ connected to the metal enclosure or to the grounding electrode conductor with a minimum 6 AWG copper conductor.

~~(b)(5)~~—At the disconnecting means for a building or structure, be ~~securely mounted and~~ electrically connected to the metallie metal enclosure for the building or structure disconnecting means, or ~~be mounted at the disconnecting means and~~ be connected to the metallie metal enclosure or to the grounding electrode conductor with a minimum 6 AWG copper conductor.

- ~~(56)~~ The IBT terminals shall be listed as grounding and bonding equipment.

Exception: In existing buildings or structures where any of the intersystem bonding and grounding electrode conductors required by 770.100(B)(2), 800.100(B)(2), 810.21(F)(2), and 820.100, and 830.100 exist, installation of an IBT the intersystem bonding termination is not required. An accessible means external to enclosures for connecting intersystem bonding and grounding electrode conductors shall be permitted at the service equipment and at the disconnecting means for any ~~additional~~ buildings or structures that are supplied by a feeder or branch circuit by at least one of the following means:

- (1) Exposed nonflexible metallie metal raceways
- (2) An exposed grounding electrode conductor
- (3) Approved means for the external connection of a copper or other corrosion-resistant bonding or grounding electrode conductor to the grounded raceway or equipment

Informational Note No. 1: A 6 AWG copper conductor with one end bonded to the grounded nonflexible metallic raceway or equipment and with 150 mm (6 in.) or more of the other end made accessible on the outside wall is an example of the approved means covered in 250.94, Exception item (3).

Informational Note No. 2: See 770.100, 800.100, 810.21, and 820.100, and 830.100 for intersystem bonding and grounding requirements for conductive optical fiber cables, communications circuits, radio and television equipment, CATV circuits and network-powered broadband communications systems, respectively.

**First Revision No. 8214-NFPA 70-2020 [Detail]****New definition to be included in Article 100.**

Grounded System, Impedance (Impedance Grounded System). An electrical system that is grounded by intentionally connecting the system neutral point to ground through an impedance device. (CMP-5)

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 15:22:10 EST 2020

Committee Statement

Committee Statement: A new definition of "impedance grounded system" has been created. Currently, no definition exists for an impedance grounded system in the NEC. The term is used but also the system is described inconsistently with multiple variations such as high impedance grounded neutral system and impedance grounded neutral system. This definition will provide consistency as well as a reference to define elements that are a part of the system.

Response Message: FR-8214-NFPA 70-2020

Ballot Results

✓ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8216-NFPA 70-2020 [Detail]****New definition to be included in Article 100.**

Grounding Conductor, Impedance (Impedance Grounding Conductor). A conductor that connects the system neutral point to the impedance device in an impedance grounded system. (CMP-5)

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 15:26:03 EST 2020

Committee Statement

Committee Statement: A new definition for “impedance grounding conductor” has been created. Currently, no proper definition exists for the conductor that connects the neutral point of an impedance grounded system to the grounding impedance device. Consequently, a description of the conductor is inconsistent, and none completely meet the definition as it is used in any application. It is not a neutral conductor because it is not intended to carry current under normal conditions. It is not a grounding electrode conductor because it is not connected to the grounding electrode nor system grounded conductor.

The conductor is an impedance grounding conductor as it is intended to carry fault current that is reduced by a designed impedance. The new term will provide accuracy, clarification, and consistency in understanding the intent and applying the code.

Response Message: FR-8216-NFPA 70-2020

[Public Input No. 743-NFPA 70-2020 \[New Section after 250.1\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumner, Darrell M.

**First Revision No. 8226-NFPA 70-2020 [Detail]**

See changes to 250.104(D)(3).

(3) Common Grounding Electrode Conductor.

If a common grounding electrode conductor is installed for multiple separately derived systems as permitted by 250.30(A)(6), and exposed structural metal that is interconnected to form the building frame or interior metal water piping exists in the area served by the separately derived system, the metal water piping and the structural metal member shall be bonded to the common grounding electrode conductor in the area served by the separately derived system.

Exception: A separate bonding jumper from each derived system to metal water piping and to structural metal members shall not be required if the metal water piping and the structural metal members in the area served by the separately derived system are bonded to the common grounding electrode conductor.

Supplemental Information

<u>File Name</u>	<u>Description</u> <u>Approved</u>
NEC_FR8226_250.104_D_3_.docx	For staff use

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 11:30:01 EST 2020

Committee Statement

Committee Statement: The word "water" is added as appropriate to clarify the type of metal piping that is to be bonded.

Response Message: FR-8226-NFPA 70-2020

Public Input No. 1259-NFPA 70-2020 [Section No. 250.104(D)(3)]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8245-NFPA 70-2020 [Detail]**

Create new definition in Article 100 as follows:

Likely to Become Energized. Conductive material that could become energized because of electrical insulation or electrical spacing failure. (CMP-5)

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 16:34:02 EST 2020

Committee Statement

Committee Statement: The new definition of "likely to become energized" addresses a term used in multiple places throughout the NEC. This will aid in the understanding of what is meant by the term.

Response Message: FR-8245-NFPA 70-2020

[Public Input No. 3113-NFPA 70-2020 \[New Part after I.\]](#)

[Public Input No. 4460-NFPA 70-2020 \[New Definition after Definition: Lighting Track \(Track Ligh...\)\]](#)

[Public Input No. 1888-NFPA 70-2020 \[New Part after I.\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8370-NFPA 70-2021 [Detail]**

Relocate 250.121 as new 250.118(B) with revisions. See attached.

Supplemental Information

<u>File Name</u>	<u>Description</u> <u>Approved</u>
NEC_FR8370_250.121.docx	For staff use
NEC_Detail_FR-8370_250.121_for_ballot.docx	For ballot

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Jan 05 08:16:07 EST 2021

Committee Statement

Committee Statement: This revision relocates the entire text as new 250.118(B) and makes appropriate format changes to comply with the NEC Style Manual.

Section 250.121 provides requirements for permitted or not permitted types of equipment grounding conductors, grounding electrode conductors, and the metal frame of a building or structure. Article 250 currently contains sections addressing each of these topics. Section 250.121 is relocated to 250.118(B) for improved usability.

Response Message: FR-8370-NFPA 70-2021

[Public Input No. 366-NFPA 70-2020 \[Section No. 250.121\(A\)\]](#)

[Public Input No. 4303-NFPA 70-2020 \[Section No. 250.118\]](#)

[Public Input No. 4330-NFPA 70-2020 \[Section No. 250.121\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
14 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Affirmative with Comment

Bowmer, Trevor N.

The action is correctly shown as "Relocate 250.121 as new 250.118(B) with revisions. See attached." however the attached WORD file (NEC_DETAIL_FR_8370_250.121_for_ballot...) incorrectly shows the text being moved to 220.18(B) which is an existing section on "Inductive and LED Lighting Loads".

220.18

(B) ~~Restricted Use of Equipment Grounding Conductors.~~Not Permitted.

The following shall not be used as equipment grounding conductors.

- (1) ~~An equipment grounding conductor shall not be used as a grounding electrode conductor.~~Grounding electrode conductors

Exception: A wire-type equipment grounding conductor installed in compliance with 250.6(A) and the applicable requirements for both the equipment grounding conductor and the grounding electrode conductor in Parts II, III, and VI of this article shall be permitted to serve as both an equipment grounding conductor and a grounding electrode conductor.

- (2) ~~The structural~~Structural metal frame of a building or structure ~~shall not be used as an equipment grounding conductor.~~

~~250.121 Restricted Use of Equipment Grounding Conductors.~~

~~(A) Grounding Electrode Conductor.~~

~~An equipment grounding conductor shall not be used as a grounding electrode conductor.~~

~~Exception: A wire-type equipment grounding conductor installed in compliance with 250.6(A) and the applicable requirements for both the equipment grounding conductor and the grounding electrode conductor in Parts II, III, and VI of this article shall be permitted to serve as both an equipment grounding conductor and a grounding electrode conductor.~~

~~(B) Metal Frame of Building or Structure.~~

~~The structural metal frame of a building or structure shall not be used as an equipment grounding conductor.~~

**First Revision No. 8242-NFPA 70-2020 [Definition: Bonding Conductor or Jumper.]****Bonding Conductor or Jumper (BJ) .**

A ~~reliable~~ conductor ~~to ensure~~ that ensures the required electrical conductivity between metal parts that are required to be electrically connected. (CMP-5)

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 16:13:20 EST 2020

Committee Statement

Committee Statement: To comply with the 2020 NEC Manual of Style terms that are vague or unenforceable are removed.

Response Message: FR-8242-NFPA 70-2020

Public Input No. 325-NFPA 70-2020 [Definition: Bonding Conductor or Jumper.]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

14 Affirmative All

1 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Affirmative with Comment

Atkins, Derrick L.

The acronym after the term should be (BC) as the term is a Bonding Conductor.

**First Revision No. 8244-NFPA 70-2020 [Definition: Effective Ground-Fault Current Path.]****Ground-Fault Current Path, Effective. (Effective Ground-Fault Current Path)**

An intentionally constructed, low-impedance electrically conductive path designed and intended to carry current under ground-fault conditions from the point of a ground fault on a wiring system to the electrical supply source and that facilitates the operation of the overcurrent protective device or ground-fault detectors. (CMP-5)

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 16:24:04 EST 2020

Committee Statement

Committee Statement: To comply with Sections 2.2.2.3 and 2.2.2.3.1 of the NEC Style Manual the title structure for the definition of effective ground fault path has been modified and allows for electronic searching of the term. Definitions under the purview of CMP 5 have been reviewed for compliance to the NEC Manual of Style.

Response Message: FR-8244-NFPA 70-2020

Public Input No. 940-NFPA 70-2020 [Definition: Effective Ground-Fault Current Path.]

Ballot Results

✓ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8243-NFPA 70-2020 [Definition: Ground Fault.]****Ground-Fault Condition .**

An unintentional, electrically conductive connection between an ungrounded conductor of an electrical circuit and the normally non-current-carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth. (CMP-5)

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 16:21:36 EST 2020

Committee Statement

Committee Statement: The change is made to clarify that a ground-fault is a condition and aligns with previous changes made in the 2020 edition.

Response Message: FR-8243-NFPA 70-2020

[Public Input No. 360-NFPA 70-2020 \[Definition: Ground Fault.\]](#)

Ballot Results**✔ This item has passed ballot**

16 Eligible Voters

1 Not Returned

13 Affirmative All

0 Affirmative with Comments

2 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Bowmer, Trevor N.

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumner, Darrell M.

Negative with Comment

Atkins, Derrick L.

A ground-fault is better described as an event rather than a condition. The current term is clear as written, and modify it to condition does not add any further clarity.

Crawford, Carlie Rose

CDA agrees with Derick Atkins. A ground-fault is an event, not a condition.

**First Revision No. 8246-NFPA 70-2020 [Definition: Separately Derived System.]****Separately Derived System.**

An electrical source power supply output , other than a service, having no direct connection(s) to circuit conductors of any other electrical source other than those established by grounding and bonding connections. (CMP-5)

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 16:42:01 EST 2020

Committee Statement

Committee Statement: The term more accurately describes what the separately derived system is and how the term is to be applied.

Response Message: FR-8246-NFPA 70-2020

Public Input No. 4647-NFPA 70-2020 [Definition: Separately Derived System.]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

13 Affirmative All

0 Affirmative with Comments

2 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Steinman, Gregory J.

Sumbera, Darrell M.

Negative with Comment

Crawford, Carlie Rose

The revision does not add clarity to the definition of separately derived system.

Porter, Christine T.

I do not believe that replacing the term source with the term power supply will make this clear. Using the term power supply may actually lead users to assume that separately derived systems can only be from a power supply instead of a power source.



First Revision No. 8223-NFPA 70-2020 [Section No. 200.2]

200.2 General.

Grounded conductors shall comply with 200.2(A) and (B).

(A) Insulation.

The grounded conductor, if insulated, shall have insulation that is suitable, other than color, for any ungrounded conductor of the same circuit for systems of 1000 volts or less, or impedance grounded neutral systems of over 1000 volts, or (2) is rated not less than 600 volts for solidly grounded neutral systems of over 1000 volts as described in 250.184(A).

(1) is suitable ~~is suitably rated~~, other than color, for any ungrounded conductor of the same circuit for systems of 1000 volts or less, ~~or impedance grounded neutral systems of over 1000 volts, or~~

(2) is rated not less than 600 volts for solidly grounded neutral systems of over 1000 volts as described in accordance with 250.184(A)

(B) Continuity.

The continuity of a grounded conductor shall not depend on a connection to a ~~metallic metal~~ enclosure, raceway, or cable armor.

Informational Note: See 300.13(B) for the continuity of grounded conductors used in multiwire branch circuits.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 17:42:22 EST 2020

Committee Statement

Committee Statement: The section has been revised to correlate with the new definition of impedance grounded system and impedance grounding conductor.

The section is revised to a list format for clarity and usability in accordance with the NEC Style Manual Section 2.1.5.1.

To comply with Section 4.1.3 of the 2020 NEC Manual of Style, direct references to other requirements are made using the phrase "in accordance with".

To comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC style manual "suitable" should not be used, it has been replaced to allow users a more specific understanding of what is required.

To comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC style manual "metallic" is replaced with "metal" in (B).

Response Message: FR-8223-NFPA 70-2020

[Public Input No. 753-NFPA 70-2020 \[Section No. 200.2\(A\)\]](#)

[Public Input No. 2272-NFPA 70-2020 \[Section No. 200.2\(A\)\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8274-NFPA 70-2020 [Section No. 200.4(A)]****(A) Installation.**

Neutral conductors shall not be used for more than one branch circuit, for more than one multiwire branch circuit, or for more than one set of ungrounded feeder conductors unless specifically permitted elsewhere in this *Code*.

Informational Note: See 215.4 for information on common neutrals. See 225.7(B) for information on common neutrals in lighting.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 21:40:44 EST 2020

Committee Statement

Committee Statement: A new informational note at 200.4(A) provides a better understanding of when common neutrals may be used.

Response Message: FR-8274-NFPA 70-2020

Public Input No. 2038-NFPA 70-2020 [New Definition after Definition: Neutral Conductor.]

Ballot Results**✓ This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8029-NFPA 70-2020 [Sections 200.6(A), 200.6(B)]

(A) Sizes 6 AWG or Smaller.

An ~~insulated grounded conductor~~ The insulation of grounded conductors of 6 AWG or smaller shall be identified by one of the following means:

- (1) ~~The insulated conductor shall have a~~ A continuous white outer finish.
- (2) ~~The insulated conductor shall have a~~ A continuous gray outer finish.
- (3) ~~The insulated conductor shall have three~~ Three continuous white or gray stripes along the conductor's entire length on other than green insulation.
- (4) ~~Insulated conductors that have their outer covering finished to show a~~ Conductors with white or gray color but have insulation and colored tracer threads in the braid identifying the source of manufacture. ~~-are acceptable means of identification.~~
- (5) A single-conductor, sunlight-resistant, outdoor-rated cable used as a solidly grounded conductor in photovoltaic power systems, as permitted by ~~690.44~~ 690.31(C)(1), shall be identified at the time of installation by markings at terminations in accordance with 200.6(A)(1) through (A)(4).
- (6) The grounded conductor of a mineral-insulated, metal-sheathed cable (Type MI) shall be identified at the time of installation by a distinctive white or gray marking at its terminations The marking shall encircle the conductor insulation.
- (7) Fixture wire shall comply with the requirements for grounded conductor identification ~~as specified in accordance with~~ 402.8.
- (8) For aerial cable, the identification shall comply with one of the methods in 200.6(A)(1) through (A)(5), or by means of a ridge located on the exterior of the cable so as to identify it.

(B) Sizes 4 AWG or Larger.

An insulated grounded conductor 4 AWG or larger shall be identified by one of the following means:

- (1) A continuous white outer finish.
- (2) A continuous gray outer finish.
- (3) Three continuous white or gray stripes along the ~~conductor's~~ entire length on other than green insulation.
- (4) At the time of installation, be identified by a distinctive white or gray marking at its terminations. This marking shall encircle the conductor ~~or~~ insulation.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 18:22:23 EST 2020

Committee Statement

Committee Statement: The text is revised to indicate it is the insulation that is required to be identified. The list items of 200.6(A) and (B) are simplified for clarity. The reference in 200.6(A)(5) is updated for 690.31(C)(1). Section 200.6(A)(6) is revised to indicate the grounded conductor of a mineral insulated conductor is to be identified by a white or gray marking. Section 200.6(A)(7) adds "accordance with" to be compliant with the NEC Style Manual.

Response Message: FR-8029-NFPA 70-2020

Public Input No. 2709-NFPA 70-2020 [Section No. 200.6(B)]

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
 1 Not Returned
 15 Affirmative All
 0 Affirmative with Comments
 0 Negative with Comments
 0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 7984-NFPA 70-2020 [Section No. 200.6(D)]

(D) Grounded Conductors of Different Nominal Voltage Systems.

Where ~~if~~ grounded conductors of different nominal voltage systems are installed in the same raceway, cable, box, auxiliary gutter, or other type of enclosure, each grounded conductor shall be identified by nominal voltage system. Identification that distinguishes each nominal voltage system grounded conductor shall be permitted by one of the following means:

- (1) One nominal voltage system grounded conductor shall have an outer covering conforming to 200.6(A) or (B).
- (2) The grounded conductor(s) of other nominal voltage systems shall have a different outer covering conforming to 200.6(A) or 200.6(B) or by an outer covering of white or gray with a ~~readily~~-distinguishable colored stripe other than green running along the insulation.
- (3) Other and different means of identification allowed by 200.6(A) or (B) shall distinguish each nominal voltage system grounded conductor.

The means of identification shall be documented in a manner that is readily available or shall be permanently posted where the conductors of different nominal voltage systems originate.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 12:43:47 EST 2020

Committee Statement

Committee Statement: The words "nominal voltage" were added to the section to clarify that the different marking requirements only applies when there are different voltage class systems.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

To comply with Section 3.2.1 Unenforceable Terms in the 2020 NEC Style Manual, terms that result in requirements that are unenforceable or vague shall not be used, the term "readily" is a term that should not be used.

Response Message: FR-7984-NFPA 70-2020

Public Input No. 2273-NFPA 70-2020 [Section No. 200.6(D)]

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
 1 Not Returned
 15 Affirmative All
 0 Affirmative with Comments
 0 Negative with Comments
 0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
 Andre, Joseph F.
 Atkins, Derrick L.
 Bowmer, Trevor N.
 Crawford, Carlie Rose
 Dobrowsky, Paul
 Gray, Bobby J.
 Harding, Joseph James

Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.



First Revision No. 8275-NFPA 70-2020 [Section No. 200.7]

200.7 Use of Insulation of a White or Gray Color or with Three Continuous White or Gray Stripes.

(A) General.

The following shall be used only for the grounded circuit conductor, unless otherwise permitted in 200.7(B) and (C):

- (1) A conductor with continuous white or gray covering
- (2) A conductor with three continuous white or gray stripes on other than green insulation
- (3) A marking of white or gray color at the termination

(B) Circuits of Less Than 50 Volts.

A conductor with white or gray color insulation or three continuous white stripes or having a marking of white or gray at the termination for circuits of less than 50 volts shall be required to be grounded only ~~as required by~~ in accordance with 250.20(A).

(C) Circuits of 50 Volts or More.

The use of insulation that is white or gray or that has three continuous white or gray stripes for other than a grounded conductor for circuits of 50 volts or more shall be permitted only as in ~~(1) and (2)~~ the following:

- (1) If part of a cable assembly that has the insulation permanently reidentified to indicate its use as an ungrounded conductor by marking tape, painting, or other effective means at its termination and at each location where the conductor is visible and accessible. Identification shall encircle the insulation and shall be a color other than white, gray, or green. If used for single-pole, 3-way or 4-way switch loops, the reidentified conductor with white or gray insulation or three continuous white or gray stripes shall be used only for the supply to the switch, but not as a return conductor from the switch to the outlet.
- (2) A flexible cord having one conductor identified by a white or gray outer finish or three continuous white or gray stripes, or by any other means ~~permitted by~~ in accordance with 400.22, that is used for connecting an appliance or equipment ~~permitted by~~ in accordance with 400.10. This shall apply to flexible cords connected to outlets whether or not the outlet is supplied by a circuit that has a grounded conductor.

Informational Note: The color gray may have been used in the past as an ungrounded conductor. Care should be taken when working on existing systems.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 21:47:35 EST 2020

Committee Statement

Committee Statement: To comply with Section 4.1.3 of the 2020 NEC Style Manual, direct references to other requirements in this code are made using the phrase "in accordance with".

Response Message: FR-8275-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
 1 Not Returned
 15 Affirmative All
 0 Affirmative with Comments
 0 Negative with Comments
 0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8276-NFPA 70-2020 [Section No. 200.9]****200.9 Means of Identification of Terminals.**

In devices or utilization equipment with polarized connections, identification of terminals to which a grounded conductor is to be connected shall be ~~substantially~~ white or silver in color. The identification of other terminals shall be of a ~~readily~~ distinguishable different color.

Exception: ~~Where~~ If the conditions of maintenance and supervision ensure that only qualified persons service the installations, terminals for grounded conductors shall be permitted to be permanently identified at the time of installation by a distinctive white marking or other equally effective means.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 22:15:54 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual, the words substantially and readily were removed. Having the "white or silver" description language removes the need for the vague term "substantially".

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8276-NFPA 70-2020

Ballot Results

✓ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8277-NFPA 70-2020 [Section No. 200.10]

200.10 Identification of Terminals.

(A) Device Terminals.

All devices, excluding panelboards, provided with terminals for the attachment of conductors and intended for connection to more than one side of the circuit shall have terminals ~~properly~~ marked for identification, unless the electrical connection of the terminal intended to be connected to the grounded conductor is clearly evident.

Exception: Terminal identification shall not be required for devices that have a ~~normal~~ current rating of over 30 amperes, other than polarized attachment plugs and polarized receptacles for attachment plugs ~~as required~~ in accordance with 200.10(B).

(B) Receptacles, Plugs, and Connectors.

Receptacles, polarized attachment plugs, and cord connectors for plugs and polarized plugs shall have the terminal intended for connection to the grounded conductor identified as follows:

- (1) Identification shall be by a metal or metal coating that is ~~substantially~~ white or silver in color or by the word "white" or the letter "W" located adjacent to the identified terminal.
- (2) If the terminal is not visible, the conductor entrance hole for the connection shall be colored white or marked with the word "white" or the letter "W."

Informational Note: See 250.126 for identification of wiring device equipment grounding conductor terminals.

(C) Screw Shells.

For devices with screw shells, the terminal for the grounded conductor shall be the one connected to the screw shell.

(D) Screw Shell Devices with Leads.

For screw shell devices with attached leads, the conductor attached to the screw shell shall have a white or gray finish. The outer finish of the other conductor shall be of a solid color that will not be confused with the white or gray finish used to identify the grounded conductor.

Informational Note: The color gray may have been used in the past as an ungrounded conductor. ~~Care~~ Caution should be taken when working on existing systems.

(E) Appliances.

Appliances that have a single-pole switch or a single-pole overcurrent device in the line or any line-connected screw shell lampholders, and that are to be connected by (1) a permanent wiring method or (2) field-installed attachment plugs and cords with three or more wires (including the equipment grounding conductor), shall have means to identify the terminal for the grounded circuit conductor (if any).

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 22:17:34 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC style manual, the words "normal" and "properly" were removed from (A).

In (B)(1), to comply with Section 4.1.3 of the 2020 NEC Manual of Style, direct references to other requirements in this code are made using the phrase "in accordance with". Also, to comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC style manual the word "substantially" was removed.

To comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC style manual, the word "care" is changed to caution in the exception to (D).

Response Message: FR-8277-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

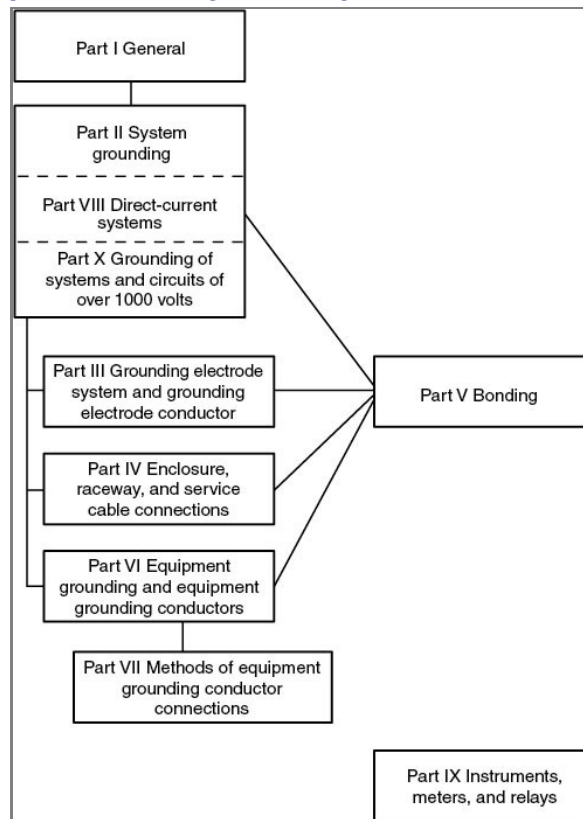
**First Revision No. 7985-NFPA 70-2020 [Section No. 250.1]****250.1 Scope.**

This article covers general requirements for grounding and bonding of electrical installations, and the following specific requirements: ~~in (1) through (6).~~

- (1) Systems, circuits, and equipment required, permitted, or not permitted to be grounded
- (2) Circuit conductor to be grounded on grounded systems
- (3) Location of grounding connections
- (4) Types and sizes of grounding and bonding conductors and electrodes
- (5) Methods of grounding and bonding
- (6) Conditions under which ~~guards, isolation, or insulation may~~ insulation, or guards are permitted to be substituted for grounding

Informational Note: See Informational Note Figure 250.1 for information on the organization of ~~Article- 250~~ this article covering grounding and bonding requirements.

Figure Informational Note Figure 250.1 Grounding and Bonding.

**Submitter Information Verification**

Committee: NEC-P05

Submittal Date: Mon Dec 14 13:35:49 EST 2020

Committee Statement

Committee Statement: The change to the informational note is made to comply with the 2020 NEC Style Manual Section 4.1.4.

To comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual “may” should not be used. Item (6) was revised for clarity.

Response Message: FR-7985-NFPA 70-2020

[Public Input No. 3805-NFPA 70-2020 \[Section No. 250.1\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8247-NFPA 70-2020 [Section No. 250.3]

250.3 ~~Application of Other Articles.~~

For other articles applying to particular cases of installation of conductors and equipment, grounding and bonding requirements are identified in Table 250.3 that are in addition to, or modifications of, those of this article.

Table 250.3 Additional Grounding and Bonding Requirements

Conductor/Equipment	Article	Section
Agricultural buildings	-	547.9 and 547.10
Audio signal processing, amplification, and reproduction equipment	-	640.7
Branch circuits	-	210.5, 210.6, 406.3
Cablebus	-	370.60
Cable trays	392	392.60
Capacitors	-	460.10, 460.27
Circuits and equipment operating at less than 50 volts	720	-
Communications circuits	800	-
Community antenna television and radio distribution systems	-	820.93, 820.100, 820.103, 800.106, 800.100
Conductors for general wiring	310	-
Medium voltage conductors and cables	311	-
Cranes and hoists	610	-
Electrically driven or controlled irrigation machines	-	675.11(C), 675.12, 675.13, 675.14, 675.15
Electric signs and outline lighting	600	-
Electrolytic cells	668	-
Elevators, dumbwaiters, escalators, moving walks, wheelchair lifts, and stairway chairlifts	620	-
Fixed electric heating equipment for pipelines and vessels	-	427.20, 427.48
Fixed outdoor electric deicing and snow melting equipment	-	426.27
Flexible cords and cables	-	400.22, 400.23
Floating buildings	-	555.54, 555.55, 555.56
Grounding-type receptacles, adapters, cord connectors, and attachment plugs	-	406.10
Hazardous (classified) locations	500-517	-
Health care facilities	517	-
Induction and dielectric heating equipment	665	-
Industrial machinery	670	-
Information technology equipment	-	645.14, 645.15
Intrinsically safe systems	-	504.50
Luminaires and lighting equipment	-	410.40, 410.42, 410.46, 410.155(B)
Luminaires, lampholders, and lamps	410	-
Marinas and boatyards	-	555.37, 555.38
Mobile homes and mobile home park	550	-
Motion picture and television studios and similar locations	-	530.20, 530.64(B)
Motors, motor circuits, and controllers	430	-
Natural and artificially made bodies of water	682	682.30, 682.31, 682.32, 682.33
Network powered broadband communications circuits	-	800.100, 800.106, 830.93
Optical fiber cables	-	770.100
Outlet, device, pull, and junction boxes; conduit bodies; and fittings	-	314.4, 314.25
Over 600 volts, nominal, underground wiring methods	-	300.50(C)
Panelboards	-	408.40
Pipe organs	650	-
Radio and television equipment	810	-
Receptacles and cord connectors	-	406.3
Recreational vehicles and recreational vehicle parks	551	-
Services	230	-
Solar photovoltaic systems	-	690.41, 690.42, 690.43, 690.45, 690.47
Swimming pools, fountains, and similar installations	680	-
Switchboards and panelboards	-	408.18(C)
Switches	-	404.12
Theaters, audience areas of motion picture and television studios, and similar locations	-	520.81

Conductor/Equipment	Article	Section
Transformers and transformer vaults	-	450.10
Use and identification of grounded conductors	200	-
X-ray equipment	660	517.78

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 18:30:38 EST 2020

Committee Statement

Committee Statement: To comply with the 2020 NEC Style Manual Section 4.1.1, 250.3 and the Table 250.3 are removed as 90.3 already states that Chapters 5, 6, and 7 may modify requirements in this article and the other references were incomplete.

Response Message: FR-8247-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8248-NFPA 70-2020 [Section No. 250.4]****250.4 General Requirements for Grounding and Bonding.**

The following general requirements identify what grounding and bonding of electrical systems are required to accomplish. The prescriptive methods contained in ~~Article 250~~ this article shall be followed to comply with the performance requirements of this section.

(A) Grounded Systems.**(1) Electrical System Grounding.**

Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operation.

Informational Note No. 1: An important consideration for limiting the imposed voltage is the routing of bonding and grounding electrode conductors so that they are not any longer than necessary to complete the connection without disturbing the permanent parts of the installation and so that unnecessary bends and loops are avoided.

Informational Note No. 2: See NFPA 780-2017 2020, *Standard for the Installation of Lightning Protection Systems*, for information on installation of grounding and bonding for lightning protection systems.

(2) Grounding of Electrical Equipment.

Normally non-current-carrying conductive materials enclosing electrical conductors or equipment, or forming part of such equipment, shall be connected to earth so as to limit the voltage to ground on these materials.

(3) Bonding of Electrical Equipment.

Normally non-current-carrying conductive materials enclosing electrical conductors or equipment, or forming part of such equipment, shall be connected together and to the electrical supply source in a manner that establishes an effective ground-fault current path.

(4) Bonding of Electrically Conductive Materials and Other Equipment.

Normally non-current-carrying electrically conductive materials that are likely to become energized shall be connected together and to the electrical supply source in a manner that establishes an effective ground-fault current path.

(5) Effective Ground-Fault Current Path.

Electrical equipment and wiring and other electrically conductive material likely to become energized shall be installed in a manner that creates a low-impedance circuit facilitating the operation of the overcurrent device or ground detector for high-impedance grounded systems. It shall be capable of safely carrying the maximum ground-fault current likely to be imposed on it from any point on the wiring system where a ground fault ~~may occur~~ occurs to the electrical supply source. The earth shall not be considered as an effective ground-fault current path.

(B) Ungrounded Systems.**(1) Grounding Electrical Equipment.**

Non-current-carrying conductive materials enclosing electrical conductors or equipment, or forming part of such equipment, shall be connected to earth in a manner that will limit the voltage imposed by lightning or unintentional contact with higher-voltage lines and limit the voltage to ground on these materials.

Informational Note: See NFPA 780-2017 2020, *Standard for the Installation of Lightning Protection Systems*, for information on installation of grounding and bonding for lightning protection systems.

(2) Bonding of Electrical Equipment.

Non-current-carrying conductive materials enclosing electrical conductors or equipment, or forming part of such equipment, shall be connected together and to the supply system grounded equipment in a manner that creates a low-impedance path for ground-fault current that is capable of carrying the maximum fault current likely to be imposed on it.

(3) Bonding of Electrically Conductive Materials and Other Equipment.

Electrically conductive materials that are likely to become energized shall be connected together and to the supply system grounded equipment in a manner that creates a low-impedance path for ground-fault current that is capable of carrying the maximum fault current likely to be imposed on it.

(4) Path for Fault Current.

Electrical equipment, wiring, and other electrically conductive material likely to become energized shall be installed in a manner that creates a low-impedance circuit from any point on the wiring system to the electrical supply source to facilitate the operation of overcurrent devices should a second ground fault from a different phase occur on the wiring system. The earth shall not be considered as an effective fault-current path.

Submitter Information Verification

Committee: NEC-P05

Submission Date: Fri Dec 18 18:35:43 EST 2020

Committee Statement

Committee Statement:

To comply with Section 4.1.3 of the 2020 NEC Style Manual , the reference structure was changed.

To comply with Section 4.2 of the 2020 NEC Style Manual, the references to the NFPA 780 standard were updated.

The word “high” was deleted to correlate with the new definition of impedance grounded system.

To add clarity and comply with the 2020 NEC Style Manual, the term “may” was removed.

To comply with Section 4.2 of the 2020 NEC Style Manual, the references to the NFPA 780 standard were updated.

Response Message: FR-8248-NFPA 70-2020

[Public Input No. 3807-NFPA 70-2020 \[Section No. 250.4 \[Excluding any Sub-Sections\]\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 7990-NFPA 70-2020 [Sections 250.6(A), 250.6(B), 250.6(C)]

(A) Arrangement to Prevent Objectionable Current.

The grounding and bonding of electrical systems, circuit conductors, surge arresters, surge-protective devices, and conductive normally non-current-carrying metal parts of equipment shall be installed and arranged in a manner that will prevent objectionable current.

(B) Alterations to Stop Objectionable Current.

If the use of multiple grounding or bonding connections results in objectionable current and the requirements of 250.4(A)(5) or (B)(4) are met, one or more of the following alterations shall be permitted:

- (1) Discontinue one or more but not all of such grounding or bonding connections.
- (2) Change the locations of the grounding or bonding connections.
- (3) Interrupt the continuity of the conductor or conductive path causing the objectionable current.
- (4) Take other suitable remedial and approved action.

(C) ~~Temporary~~ Currents Not Classified as Objectionable Currents.

~~Temporary currents~~ Currents resulting from abnormal conditions, such as ground faults, and currents resulting from required grounding and bonding connections shall not be classified as objectionable current for the purposes specified in 250.6(A) and (B).

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 15:00:25 EST 2020

Committee Statement

Committee Statement:

The proposed revision clarifies that bonding connections can create objectionable current.

To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual "suitable" should not be used in Item (B)(4).

In (C), the word temporary is removed to clarify that non-objectionable currents can be caused by conditions that may not be temporary.

Response Message:

FR-7990-NFPA 70-2020

[Public Input No. 1064-NFPA 70-2020 \[Section No. 250.6\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
 1 Not Returned
 14 Affirmative All
 0 Affirmative with Comments
 1 Negative with Comments
 0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
 Andre, Joseph F.
 Bowmer, Trevor N.
 Crawford, Carlie Rose
 Dobrowsky, Paul

Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

Negative with Comment

Atkins, Derrick L.

It is not appropriate to state that all required grounding and bonding connections are not considered to create an objectionable current. There maybe some grounding and bonding connections that do create an objectionable current.

**First Revision No. 7992-NFPA 70-2020 [Section No. 250.6(E)]**

(E) Isolation of Objectionable Direct-Current Ground Currents from Cathodic Protection Systems .

Where ~~If~~ isolation of objectionable ~~dc ground direct~~ currents from a cathodic protection ~~systems~~ system is required, a listed ~~ac coupling/dc isolating isolator~~ device shall be permitted in the equipment grounding conductor path to provide an effective return path for ac ground-fault current while blocking ~~dc current~~ the flow of direct currents .

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 15:08:31 EST 2020

Committee Statement

Committee Statement: The revision clarifies the intent of the section and aligns the language with industry standards.

To comply with Section 3.3.4 Word Clarity in the 2020 NEC Style Manual, when stating a condition, the word “where” was changed to “if”.

Response Message: FR-7992-NFPA 70-2020

Public Input No. 297-NFPA 70-2020 [Section No. 250.6(E)]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8249-NFPA 70-2020 [Section No. 250.12]****250.12** Clean Surfaces.

Nonconductive coatings (such as paint, lacquer, and enamel) on equipment to be grounded or bonded shall be removed from threads and other contact surfaces to ensure good electrical continuity or shall be connected by means of fittings designed so as to make such removal unnecessary.

Submitter Information Verification**Committee:** NEC-P05**Submittal Date:** Fri Dec 18 18:45:52 EST 2020**Committee Statement**

Committee Statement: To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual "good" should not be used.

Response Message: FR-8249-NFPA 70-2020**Ballot Results**

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8159-NFPA 70-2020 [Section No. 250.20]

250.20 Alternating-Current Systems to Be Grounded.

Alternating-current systems shall be grounded ~~as provided for~~ in accordance with 250.20(A), (B), (C), or (D), ~~unless prohibited elsewhere in this Code~~. Other systems shall be permitted to be grounded. If such systems are grounded, they shall comply with the applicable provisions of this article.

Informational Note No. 1: An example of a system permitted to be grounded is a corner-grounded delta transformer connection. See 250.26(4) for conductor to be grounded.

Informational Note No. 2: See 503.155, 517.61, 517.160, 668.10, and 680.23(A)(2) for examples of circuits prohibited to be grounded.

(A) Alternating-Current Systems of Less Than 50 Volts.

Alternating-current systems of less than 50 volts shall be grounded under any of the following conditions:

- (1) ~~Where~~ If supplied by transformers, if the transformer supply system exceeds 150 volts to ground
- (2) ~~Where~~ If supplied by transformers, if the transformer supply system is ungrounded
- (3) ~~Where~~ If installed outside as overhead conductors

(B) Alternating-Current Systems of 50 Volts to 1000 Volts.

Alternating-current systems of 50 volts to 1000 volts that supply premises wiring and premises wiring systems shall be grounded under any of the following conditions:

- (1) ~~Where~~ If the system can be grounded so that the maximum voltage to ground on the ungrounded conductors does not exceed 150 volts
- (2) ~~Where~~ If the system is 3-phase, 4-wire, wye connected in which the neutral conductor is used as a circuit conductor
- (3) ~~Where~~ If the system is 3-phase, 4-wire, delta connected in which the midpoint of one phase winding is used as a circuit conductor

Informational Note: According to Annex O of *NFPA 70E-2018 2021*, *Standard for Electrical Safety in the Workplace*, high impedance grounding is an effective tool to reduce arc-flash hazards.

(C) Alternating-Current Systems of over 1000 Volts.

Alternating-current systems supplying mobile or portable equipment shall be grounded ~~as specified~~ in accordance with 250.188. ~~Where~~ If supplying other than mobile or portable equipment, such systems shall be permitted to be grounded.

(D) Impedance Grounded ~~Neutral~~ Systems.

Impedance grounded ~~neutral~~ systems shall be grounded in accordance with 250.36 or 250.187, as applicable.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Wed Dec 16 15:02:09 EST 2020

Committee Statement

Committee Statement: The phrase "unless prohibited elsewhere in this Code" is added to 250.20 to allow permission of requirements in other articles of the Code to allow circuits to be ungrounded. Informational Note 2 is added with the contents previously in 250.22 to reference other requirements for circuits which are prohibited to be grounded.

To comply with Section 4.1.3 in the 2020 NEC Style Manual, the reference structure was changed.

To comply with Section 3.3.4 Word Clarity in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

To comply with Section 4.2 in the 2020 NEC Style Manual, the reference to the NFPA 70E standard was updated.

In Section 250.20(D), the word "neutral" was deleted to make the term consistent with the new definition.

Response Message: FR-8159-NFPA 70-2020

Public Input No. 3809-NFPA 70-2020 [Section No. 250.22]

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 7993-NFPA 70-2020 [Section No. 250.21(A)]****(A) General.**

The following ac systems of 50 volts to 1000 volts shall be permitted to be grounded but shall not be required to be grounded:

- (1) Electrical systems used exclusively to supply industrial electric furnaces used for applications such as melting, refining, or tempering, ~~and the like~~
- (2) Separately derived systems used exclusively for rectifiers that supply only adjustable-speed industrial drives
- (3) Separately derived systems supplied by transformers that have a primary voltage rating of 1000 volts or less if all the following conditions are met:
 - a. The system is used exclusively for control circuits.
 - b. The conditions of maintenance and supervision ensure that only qualified persons service the installation.
 - c. Continuity of control power is required.
- (4) Other systems that are not required to be grounded in accordance with ~~the requirements of~~ 250.20(B)

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
CMP_5_-250.21_A_.docx	Staff Use Only	

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 15:23:50 EST 2020

Committee Statement

Committee Statement: In Item (1), to add clarity and comply with Section 3.3.4 Word Clarity in the 2020 NEC Style Manual the sentence was revised to remove the phrase "and the like". To comply with Section 4.1.3 in the 2020 NEC Style Manual, the reference structure was changed.

The words "the requirements of" are deleted as they are unnecessary in Item (4).

Response Message: FR-7993-NFPA 70-2020

[Public Input No. 4058-NFPA 70-2020 \[Section No. 250.21\(A\)\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8158-NFPA 70-2020 [Section No. 250.22]****~~250.22~~ Circuits Not to Be Grounded.**

~~The following circuits shall not be grounded:~~

- ~~(0) Circuits for electric cranes operating over combustible fibers in Class III locations, as provided in 503.155~~
- ~~(0) Circuits in health care facilities as provided in 517.61 and 517.160~~
- ~~(0) Circuits for equipment within electrolytic cell line working zones as provided in Article 668~~
- ~~(0) Secondary circuits of lighting systems as provided in 411.6(A)~~
- ~~(0) Secondary circuits of lighting systems as provided in 680.23(A)(2)~~
- ~~(0) Class 2 load side circuits for suspended ceiling low-voltage power grid distribution systems as provided in 393.60(B)~~

Submitter Information Verification

Committee: NEC-P05

Submission Date: Wed Dec 16 15:00:35 EST 2020

Committee Statement

Committee Statement: Section 250.22 is removed to comply with Section 4.1.1 of the NEC Style Manual which requires general requirements not to be duplicated as specified in the structure of the Code in 90.3 as the requirements are located in their respective Articles. The contents of 250.22 are relocated to an informational note in 250.20.

Response Message: FR-8158-NFPA 70-2020

[Public Input No. 1040-NFPA 70-2020 \[Section No. 250.22\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8232-NFPA 70-2020 [Section No. 250.24]

250.24 Grounding of Service-Supplied Alternating-Current Systems.

(A) System Grounding Connections.

A premises wiring system supplied by a grounded ac service shall have a grounding electrode conductor connected to the grounded service conductor, at each service, in accordance with 250.24(A)(1) through (A)(5) ~~(4)~~.

(1) General.

The grounding electrode conductor connection shall be made at any accessible point from the load end of the overhead service conductors, service drop, underground service conductors, or service lateral to, ~~including the terminal or bus to which the~~ grounded service conductor is connected at the service disconnecting means.

Informational Note: See definitions of *Service Conductors, Overhead*; *Service Conductors, Underground*; *Service Drop*; and *Service Lateral* in Article 100.

(2) Outdoor Transformer.

~~Where~~ If the transformer supplying the service is located outside the building, at least one additional grounding connection shall be made from the grounded service conductor to a grounding electrode, either at the transformer or elsewhere outside the building.

Exception: The additional grounding electrode conductor connection shall not be made on high-impedance grounded neutral systems. The system shall meet the requirements of 250.36 or 250.187, as applicable.

(3) Dual-Fed Services.

For services that are dual fed (double ended) in a common enclosure or grouped together in separate enclosures and employing a secondary tie, a single grounding electrode conductor connection to the tie point of the grounded conductor(s) from each power source shall be permitted.

(4) Main Bonding Jumper as Wire or Busbar.

~~Where~~ If the main bonding jumper specified in 250.28 is a wire or busbar and is installed from the grounded conductor terminal bar or bus to the equipment grounding terminal bar or bus in the service equipment, the grounding electrode conductor shall be permitted to be connected to the equipment grounding terminal, bar, or bus to which the main bonding jumper is connected.

~~(5) Load-Side Grounding Connections.~~

~~A grounded conductor shall not be connected to normally non-current-carrying metal parts of equipment, to equipment grounding conductor(s), or be reconnected to ground on the load side of the service disconnecting means except as otherwise permitted in this article.~~

~~Informational Note: See 250.30 for separately derived systems, 250.32 for connections at separate buildings or structures, and 250.142 for use of the grounded circuit conductor for grounding equipment.~~

(B) Load-Side Grounding Connections.

A grounded conductor shall not be connected to normally non-current-carrying metal parts of equipment, to equipment grounding conductor(s), or be reconnected to ground on the load side of the service disconnecting means except as otherwise permitted in this article.

Informational Note: See 250.30 for separately derived systems, 250.32 for connections at separate buildings or structures, and 250.142 for use of the grounded circuit conductor for grounding equipment.

(C) Main Bonding Jumper.

For a grounded system, an unspliced main bonding jumper shall be used to connect the equipment grounding conductor(s) and the service-disconnect enclosure to the grounded conductor within the enclosure for each service disconnect in accordance with 250.28.

Exception No. 1: ~~Where~~ If more than one service disconnecting means is located in an assembly listed for use as service equipment, an unspliced main bonding jumper shall bond the grounded conductor(s) to the assembly enclosure.

Exception No. 2: Impedance grounded ~~neutral~~ systems shall be permitted to be connected as provided in in accordance with 250.36 and 250.187.

(D) Grounded Conductor Brought to Service Equipment.

~~Where~~ If an ac system operating at 1000 volts or less is grounded at any point, the grounded conductor(s) shall be routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means grounded conductor(s) terminal or bus. A main bonding jumper shall connect the grounded conductor(s) to each service disconnecting means enclosure. The grounded conductor(s) shall be installed in accordance with ~~250.24(C)(1) 250.24(D)(1)~~ through ~~(C)(4) (D)(4)~~.

Exception: ~~Where~~ If two or more service disconnecting means are located in a single assembly listed for use as service equipment, it shall be permitted to connect the grounded conductor(s) to the assembly common grounded conductor(s) terminal or bus. The assembly shall include a main bonding jumper for connecting the grounded conductor(s) to the assembly enclosure.

(1) Sizing for a Single Raceway or Cable.

The grounded conductor shall not be smaller than specified in Table 250.102(C)(1).

(2) Parallel- Conductors in Two or More Raceways or Cables Connected in Parallel .

If the ungrounded service-entrance conductors are ~~installed connected~~ in parallel in two or more raceways or cables, the grounded conductors shall also be installed in each raceway or cable and shall be connected in parallel. The size of the grounded conductor ~~conductor(s)~~ in each raceway or cable shall be based on the ~~total largest ungrounded conductor in each raceway or cable, or the sum of the~~ circular mil areas of the ~~parallel largest~~ ungrounded conductors ~~in the from each set connected in parallel in each raceway or cable, as indicated~~ cable in accordance with 250.24(C)(1) ~~250.24(D)(1)~~ , but not smaller than 1/0 AWG.

Informational Note: See 310.10(G) for grounded conductors connected in parallel.

(3) Delta-Connected Service.

The grounded conductor of a 3-phase, 3-wire delta service shall have an ampacity not less than that of the ungrounded conductors.

(4) ~~High-Impedance.~~ Impedance Grounded Service.

The ~~grounded impedance grounding~~ conductor on a ~~high-impedance an impedance~~ grounded neutral system shall be ~~grounded connected~~ in accordance with 250.36 ~~or 250.187, as applicable.~~

(E) Grounding Electrode Conductor.

A grounding electrode conductor shall be used to connect the equipment grounding conductors, the service-equipment enclosures, and, ~~where if~~ the system is grounded, the grounded service conductor to the grounding electrode(s) required by Part III of this article. This conductor shall be sized in accordance with 250.66.

~~High-impedance Impedance~~ grounded neutral system connections shall be made ~~as covered in 250.36 – in accordance with 250.36 or 250.187, as applicable.~~

(F) Ungrounded System Grounding Connections.

A premises wiring system that is supplied by an ac service that is ungrounded shall have, at each service, a grounding electrode conductor connected to the grounding electrode(s) required by Part III of this article. The grounding electrode conductor shall be connected to a metal enclosure of the service conductors at any accessible point from the load end of the overhead service conductors, service drop, underground service conductors, or service lateral to the service disconnecting means.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 13:12:29 EST 2020

Committee Statement

Committee Statement: The conductor that connects the neutral point of an impedance grounded system to ground through an impedance grounding device is an impedance grounding conductor. The term "grounded conductor" as used in the existing language does not meet the definition in Article 100. A reference to 250.187 is added in the text to be consistent with 250.30(A)(3)(d). The word "high" in the title is deleted because the term "high impedance" is not defined.

Editorial revisions were made for the section to be grammatically correct. Subsection 250.24(A)(5) is relocated to 250.24(B) as it is not a permitted connection of the grounded conductor and should not be included in the list of 250.24(A).

Section 250.24(D) is revised to indicate to clarify for technical accuracy that paralleled grounded service conductors in both raceways and cables are to be connected in parallel and the size is to be based upon the ungrounded conductor in the raceway or cable.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" in (A)(2), (A)(4), (C) Exception No. 1, (D), Exception to (D), and (E). The phrase "in accordance with" is added for compliance with the NEC Style Manual Section 4.1.3 in (D).

Response Message: FR-8232-NFPA 70-2020

Public Input No. 1463-NFPA 70-2020 [Section No. 250.24]

Public Input No. 744-NFPA 70-2020 [Section No. 250.24(C)(4)]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 7999-NFPA 70-2020 [Section No. 250.25]****250.25** Grounding Systems Permitted to Be Connected on the Supply Side of the Service Disconnect.

The grounding of systems connected on the supply side of the service disconnect, ~~as permitted in accordance with~~ 230.82, that are in enclosures separate from the service equipment enclosure shall comply with 250.25(A) or (B).

(A) Grounded System.

If the utility supply system is grounded, the grounding of systems permitted to be connected on the supply side of the service disconnect and are installed in one or more separate enclosures from the service equipment enclosure shall comply with the requirements of 250.24(A) through (D).

(B) Ungrounded Systems.

If the utility supply system is ungrounded, the grounding of systems permitted to be connected on the supply side of the service disconnect and are installed in one or more separate enclosures from the service equipment enclosure shall comply with the requirements of 250.24(F).

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 16:00:11 EST 2020

Committee Statement

Committee Statement: The word "service" was added to the title of the section to improve clarity for the application of the requirements.

To comply with 2020 NEC Style Manual Section 4.1.3 the reference structure was changed.

Response Message: FR-7999-NFPA 70-2020

Public Input No. 1464-NFPA 70-2020 [Section No. 250.25]

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8010-NFPA 70-2020 [Section No. 250.26]****250.26** Conductor to Be Grounded — Alternating-Current Systems.

For grounded ~~if an~~ ac premises wiring ~~systems~~ system is grounded , the conductor to be grounded shall be ~~as specified in one of~~ the following:

- (1) Single-phase, 2-wire — one conductor
- (2) Single-phase, 3-wire — the neutral conductor
- (3) Multiphase systems having one wire common to all phases — the neutral conductor
- (4) Multiphase systems ~~where if~~ one phase is grounded — that phase conductor
- (5) Multiphase systems in which one phase is used as in (2) — the neutral conductor

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 17:02:12 EST 2020

Committee Statement

Committee Statement: The word "if" corrects the usage to the NEC Style Manual and makes it clear that the requirements in this section apply if the system is grounded, whether it is required to be grounded or is done so voluntarily. In addition, the phrase "as specified in the following" is unnecessary for proper application and enforcement.

Response Message: FR-8010-NFPA 70-2020

[Public Input No. 2660-NFPA 70-2020 \[Section No. 250.26\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8250-NFPA 70-2020 [Section No. 250.28(B)]**

(B) Construction.

Where If a main bonding jumper or a system bonding jumper is a screw only, the screw shall be identified with a green finish that shall be visible with the screw installed.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 18:53:52 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8250-NFPA 70-2020

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8018-NFPA 70-2020 [Section No. 250.28(C)]**

(C) Attachment.

Main bonding jumpers and system bonding jumpers shall be connected ~~in the manner specified by one or more of the methods~~ in 250.8 that is suitable for the material of the bonding jumper and enclosure .

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 17:38:38 EST 2020

Committee Statement

Committee Statement: Since not all of the connection methods that are included in 250.8 are suitable for all types of main or system bonding jumpers, the revision will ensure the NEC requires that a suitable method be used.

Response Message: FR-8018-NFPA 70-2020

Public Input No. 1469-NFPA 70-2020 [Section No. 250.28(C)]

Ballot Results

✓ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8251-NFPA 70-2020 [Section No. 250.28(D)(3)]****(3) Separately Derived System with More Than One Enclosure.**

Where If a separately derived system supplies more than a single enclosure, the system bonding jumper for each enclosure shall be sized in accordance with 250.28(D)(1) based on the largest ungrounded feeder conductor serving that enclosure, or a single system bonding jumper shall be installed at the source and sized in accordance with 250.28(D)(1) based on the equivalent size of the largest supply conductor determined by the largest sum of the areas of the corresponding conductors of each set.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 18:54:44 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8251-NFPA 70-2020

Ballot Results**✓ This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8233-NFPA 70-2020 [Section No. 250.30]****250.30 Grounding Separately Derived Alternating-Current Systems.**

In addition to complying with 250.30(A) for grounded systems, or as provided in 250.30(B) for ungrounded systems, separately derived systems shall comply with 250.20, 250.21, 250.22, or 250.26, as applicable. Multiple power sources of the same type that are connected in parallel to form one system that supplies premises wiring shall be considered treated as a single separately derived system and shall be installed in accordance with 250.30.

Informational Note No. 1: An alternate ac power source, such as an on-site generator, is not a separately derived system if the grounded conductor is solidly interconnected to a service-supplied system grounded conductor. An example of such a situation is where if the alternate source transfer equipment does not include a switching action in the grounded conductor and allows it to remain solidly connected to the service-supplied grounded conductor when the alternate source is operational and supplying the load served.

Informational Note No. 2: See 445.13 for the minimum size of conductors that carry fault current.

(A) Grounded Systems.

A separately derived ac system that is grounded shall comply with 250.30(A)(1) through (A)(8). Except as otherwise permitted in this article, a grounded conductor shall not be connected to normally non-current-carrying metal parts of equipment, be connected to equipment grounding conductors, or be reconnected to ground on the load side of the system bonding jumper.

Informational Note: See 250.32 for connections at separate buildings or structures and 250.142 for use of the grounded circuit conductor for grounding equipment.

Exception: Impedance grounded ~~neutral~~ system grounding connections shall be made as specified in accordance with 250.36 or 250.187, as applicable.

(1) System Bonding Jumper.

An unspliced system bonding jumper shall comply with 250.28(A) through (D). This connection shall be made at any single point on the separately derived system from the source to the first system disconnecting means or overcurrent device, or it shall be made at the source of a separately derived system that has no disconnecting means or overcurrent devices, in accordance with 250.30(A)(1)(a) or (A)(1)(b). The system bonding jumper shall remain within the enclosure where it originates. If the source is located outside the building or structure supplied, a system bonding jumper shall be installed at the grounding electrode connection in compliance with 250.30(C).

Exception No. 1: For systems installed in accordance with 450.6, a single system bonding jumper connection to the tie point of the grounded circuit conductors from each power source shall be permitted.

Exception No. 2: If a building or structure is supplied by a feeder from an outdoor separately derived system, a system bonding jumper at both the source and the first disconnecting means shall be permitted if doing so does not establish a parallel path for the grounded conductor. If a grounded conductor is used in this manner, it shall not be smaller than the size specified for the system bonding jumper but shall not be required to be larger than the ungrounded conductor(s). For the purposes of this exception, connection through the earth shall not be considered as providing a parallel path.

Exception No. 3: The size of the system bonding jumper for a system that supplies a Class 1, Class 2, or Class 3 circuit, and is derived from a transformer rated not more than 1000 volt-amperes, shall not be smaller than the derived ungrounded conductors and shall not be smaller than 14 AWG copper or 12 AWG aluminum.

(a) *Installed at the Source.* The system bonding jumper shall connect the grounded conductor to the supply-side bonding jumper and the normally non-current-carrying metal enclosure.

(b) *Installed at the First Disconnecting Means.* The system bonding jumper shall connect the grounded conductor to the supply-side bonding jumper, the disconnecting means enclosure, and the equipment grounding conductor(s).

Exception: Separately derived systems consisting of multiple sources of the same type that are connected in parallel shall be permitted to have the system bonding jumper installed at the paralleling switchgear, switchboard, or other paralleling connection point instead of at the disconnecting means located at each separate source.

(2) Supply-Side Bonding Jumper.

If the source of a separately derived system and the first disconnecting means are located in separate enclosures, a supply-side bonding jumper shall be installed with the circuit conductors from the source enclosure to the first disconnecting means enclosure. A supply-side bonding jumper shall not be required to be larger than the derived ungrounded conductors. The supply-side bonding jumper shall be permitted to be of nonflexible metal raceway type or of the wire or bus type as follows:

- (1) A supply-side bonding jumper of the wire type shall comply with 250.102(C), based on the size of the derived ungrounded conductors.
- (2) A supply-side bonding jumper of the bus type shall have a cross-sectional area not smaller than a supply-side bonding jumper of the wire type as determined in 250.102(C).

Exception: A supply-side bonding jumper shall not be required between enclosures for installations made in compliance with 250.30(A)(1), Exception No. 2.

(3) Grounded Conductor.

If a grounded conductor is installed and the system bonding jumper connection is not located at the source, 250.30(A)(3)(a) through (A)(3)(d) shall apply. The grounded conductor shall not be required to be larger than the derived ungrounded conductors.

(a) *Sizing for a Single Raceway.* The grounded conductor shall not be smaller than specified in Table 250.102(C)(1).

(b) ~~*Parallel Conductors Connected in Parallel in Two or More Raceways or Cables.*~~ If the ungrounded conductors are installed connected in parallel in two or more raceways or cables, the grounded conductors shall also be installed in each raceway or cable and shall be connected in parallel. The size of the grounded conductor(s) in each raceway or cable shall be based on the total circular mil area of the parallel-derived ungrounded conductors in the raceway as indicated largest derived ungrounded conductor in each raceway or cable, or the sum of the circular mil areas of the largest derived ungrounded conductors from each set connected in parallel in each raceway or cable, in accordance with 250.30(A)(3)(a), but not smaller than 1/0 AWG.

Informational Note: See 310.10(G) for grounded conductors connected in parallel.

(c) *Delta-Connected System.* The grounded conductor of a 3-phase, 3-wire delta system shall have an ampacity not less than that of the ungrounded conductors.

(d) *Impedance Grounded System.* The grounded impedance grounding conductor of an impedance grounded ~~neutral~~ system shall be installed in accordance with 250.36 or 250.187, as applicable.

(4) Grounding Electrode.

The building or structure grounding electrode system shall be used as the grounding electrode for the separately derived system. If located outdoors, the grounding electrode shall be in accordance with 250.30(C).

Exception: If a separately derived system originates in equipment that is listed and identified as suitable for use as service equipment, the grounding electrode used for the service or feeder equipment shall be permitted to be used as the grounding electrode for the separately derived system.

Informational Note No. 1: See 250.104(D) for bonding requirements for interior metal water piping in the area served by separately derived systems.

Informational Note No. 2: See 250.50 and 250.58 for requirements for bonding all electrodes together if located at the same building or structure.

(5) Grounding Electrode Conductor, Single Separately Derived System.

A grounding electrode conductor for a single separately derived system shall be sized in accordance with 250.66 for the derived ungrounded conductors. It shall be used to connect the grounded conductor of the derived system to the grounding electrode in accordance with 250.30(A)(4), or as permitted in 250.68(C)(1) and (C)(2). This connection shall be made at the same point on the separately derived system where the system bonding jumper is connected.

Exception No. 1: If the system bonding jumper specified in 250.30(A)(1) is a wire or busbar, it shall be permitted to connect the grounding electrode conductor to the equipment grounding terminal, bar, or bus if the equipment grounding terminal, bar, or bus is of sufficient size for the separately derived system.

Exception No. 2: If the source of a separately derived system is located within equipment listed and identified as suitable for use as service equipment, the grounding electrode conductor from the service or feeder equipment to the grounding electrode shall be permitted as the grounding electrode conductor for the separately derived system, if the grounding electrode conductor is of sufficient size for the separately derived system. If the equipment grounding bus internal to the equipment is not smaller than the required grounding electrode conductor for the separately derived system, the grounding electrode connection for the separately derived system shall be permitted to be made to the bus.

Exception No. 3: A grounding electrode conductor shall not be required for a system that supplies a Class 1, Class 2, or Class 3 circuit and is derived from a transformer rated not more than 1000 volt-amperes, provided the grounded conductor is bonded to the transformer frame or enclosure by a jumper sized in accordance with 250.30(A)(1), Exception No. 3, and the transformer frame or enclosure is grounded by one of the means specified in 250.134.

(6) Grounding Electrode Conductor, Multiple Separately Derived Systems.

A common grounding electrode conductor for multiple separately derived systems shall be permitted. If installed, the common grounding electrode conductor shall be used to connect the grounded conductor of each separately derived system to the grounding electrode as specified in 250.30(A)(4). A grounding electrode conductor tap shall then be installed from each separately derived system to the common grounding electrode conductor. Each tap conductor shall connect the grounded conductor of the separately derived system to the common grounding electrode conductor. This connection shall be made at the same point on the separately derived system where the system bonding jumper is connected.

Exception No. 1: If the system bonding jumper specified in 250.30(A)(1) is a wire or busbar, it shall be permitted to connect the grounding electrode conductor tap to the equipment grounding terminal, bar, or bus, provided the equipment grounding terminal, bar, or bus is of sufficient size for the separately derived system.

Exception No. 2: A grounding electrode conductor shall not be required for a system that supplies a Class 1, Class 2, or Class 3 circuit and is derived from a transformer rated not more than 1000 volt-amperes, provided the system grounded conductor is bonded to the transformer frame or enclosure by a jumper sized in accordance with 250.30(A)(1), Exception No. 3, and the transformer frame or enclosure is grounded by one of the means specified in 250.134.

Exception No. 3: If the source of a separately derived system is located within equipment listed and identified as suitable for use as service equipment, the grounding electrode conductor from the service or feeder equipment to the grounding electrode shall be permitted as the grounding electrode conductor for the separately derived system, if the grounding electrode conductor is of sufficient size for the separately derived system. If the equipment grounding bus internal to the equipment is not smaller than the required grounding electrode conductor for the separately derived system, the grounding electrode connection for the separately derived system shall be permitted to be made to the bus.

(a) **Common Grounding Electrode Conductor.** The common grounding electrode conductor shall be permitted to be one of the following:

- (1) A conductor of the wire type not smaller than 3/0 AWG copper or 250 kcmil aluminum
- (2) A metal water pipe ~~that complies in accordance~~ with 250.68(C)(1)
- (3) The metal structural frame of the building or structure ~~that complies in accordance~~ with 250.68(C)(2) or is connected to the grounding electrode system by a conductor not smaller than 3/0 AWG copper or 250 kcmil aluminum

(b) **Tap Conductor Size.** Each tap conductor shall be sized in accordance with 250.66 based on the derived ungrounded conductors of the separately derived system it serves.

Exception to (a)(1) and (b): If the only electrodes that are present are of the types in 250.66(A), (B), or (C), the size of the common grounding electrode conductor shall not be required to be larger than the largest conductor required by 250.66(A), (B), or (C) for the type of electrode that is present.

(c) **Connections.** All tap connections to the common grounding electrode conductor shall be made at an accessible location by one of the following methods:

- (1) A connector listed as grounding and bonding equipment.
- (2) Listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide (¼ in. thick × 2 in. wide) and of sufficient ~~a~~ length to accommodate the number of terminations necessary for the installation. If aluminum busbars are used, the installation shall also ~~empty be in accordance~~ with 250.64(A).
- (3) The exothermic welding process.

Tap conductors shall be connected to the common grounding electrode conductor in such a manner that the common grounding electrode conductor remains without a splice or joint.

(7) Installation.

The installation of all grounding electrode conductors shall comply with 250.64(A), (B), (C), and (E).

(8) Bonding.

Structural steel and metal piping shall be connected to the grounded conductor of a separately derived system in accordance with 250.104(D).

(B) Ungrounded Systems.

The equipment of an ungrounded separately derived system shall be grounded and bonded as specified in 250.30(B)(1) through (B)(3).

(1) Grounding Electrode Conductor.

A grounding electrode conductor, sized in accordance with 250.66 for the largest derived ungrounded conductor(s) or set of derived ungrounded conductors, shall be used to connect the metal enclosures of the derived system to the grounding electrode as specified in 250.30(A)(5) or (A)(6), as applicable. This connection shall be made at any point on the separately derived system from the source to the first system disconnecting means. If the source is located outside the building or structure supplied, a grounding electrode connection shall be made in compliance with 250.30(C).

(2) Grounding Electrode.

Except as permitted by 250.34 for portable and vehicle-mounted generators, the grounding electrode shall comply with 250.30(A)(4).

(3) Bonding Path and Conductor.

A supply-side bonding jumper shall be installed from the source of a separately derived system to the first disconnecting means in compliance with 250.30(A)(2).

(C) Outdoor Source.

If the source of the separately derived system is located outside the building or structure supplied, a grounding electrode connection shall be made at the source location to one or more grounding electrodes in compliance accordance with 250.50. In addition, the installation shall comply be in accordance with 250.30(A) for grounded systems or with 250.30(B) for ungrounded systems.

Exception: The grounding electrode conductor connection for impedance grounded neutral systems shall comply be in accordance with 250.36 or 250.187, as applicable.

Supplemental Information

<u>File Name</u>	<u>Description</u> <u>Approved</u>
NEC_FR8233_250.30.docx	For staff use

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 13:44:56 EST 2020

Committee Statement

Committee Statement: To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC style manual "considered" was changed to "treated".

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

In the exception "neutral" was deleted to correlate with the new definition of impedance grounding system. As specified was changed to in accordance with to comply with the NEC Style Manual

A new definition of "impedance grounding conductor" has been created to properly define the conductor that connects the neutral point of an impedance grounded system to the impedance grounding device.

Section 250.30(A)(3)(b) was revised to be consistent with 250.24(D)(1). The phrase "in accordance with" is added for compliance with the NEC Style Manual Section 4.1.3 throughout 250.30.

Response Message: FR-8233-NFPA 70-2020

[Public Input No. 745-NFPA 70-2020 \[Section No. 250.30\(A\)\(3\)\]](#)

[Public Input No. 1472-NFPA 70-2020 \[Section No. 250.30\(A\)\(3\)\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8020-NFPA 70-2020 [Section No. 250.32(A)]****(A) Grounding Electrode System and Grounding Electrode Conductor .**

A building(s) or structure(s) supplied by a feeder(s) or branch circuit(s) shall have a grounding electrode system and grounding electrode conductor installed in accordance with Part III of Article 250. ~~Where there is no existing grounding electrode, the grounding electrode(s) required in 250.50 shall be installed.~~

Exception: A grounding electrode system and grounding electrode conductor shall not be required ~~where~~ if only a single branch circuit, including a multiwire branch circuit, supplies the building or structure and the branch circuit includes an equipment grounding conductor for grounding the normally non-current-carrying metal parts of equipment.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 17:43:24 EST 2020

Committee Statement

Committee Statement: The title of the subdivision and language in the exception are revised to add "grounding electrode system and grounding electrode conductor" for clarity and usability and consistency with the general requirement.

The second sentence of 250.32(A) is removed as the requirement is already covered in Part III of Article 250 and is redundant.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" in the exception.

Response Message: FR-8020-NFPA 70-2020

[Public Input No. 1633-NFPA 70-2020 \[Section No. 250.32\(A\)\]](#)

[Public Input No. 2345-NFPA 70-2020 \[Section No. 250.32\(A\)\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.



First Revision No. 8252-NFPA 70-2020 [Section No. 250.32(B)]

(B) Grounded Systems.

(1) Supplied by a Feeder or Branch Circuit.

An equipment grounding conductor, as described in 250.118, shall be run with the supply conductors and be connected to the building or structure disconnecting means and to the grounding electrode(s). The equipment grounding conductor shall be used for grounding or bonding of equipment, structures, or frames required to be grounded or bonded. The equipment grounding conductor shall be sized in accordance with 250.122. Any installed grounded conductor shall not be connected to the equipment grounding conductor or to the grounding electrode(s).

Exception No. 1: For installations made in compliance with previous editions of this Code that permitted such connection, the grounded conductor run with the supply to the building or structure shall be permitted to serve as the ground-fault return path if all of the following requirements continue to be met:

- (1) *An equipment grounding conductor is not run with the supply to the building or structure.*
- (2) *There are no continuous metallic paths bonded to the grounding system in each building or structure involved.*
- (3) *Ground-fault protection of equipment has not been installed on the supply side of the feeder(s).*

If the grounded conductor is used for grounding in accordance with the provision of this exception, the size of the grounded conductor shall not be smaller than the larger of either of the following:

- (1) *~~That required by~~ The calculated neutral load in accordance with 220.61*
- (2) *~~That required by~~ The minimum equipment grounding conductor sized in accordance with 250.122*

Exception No. 2: If system bonding jumpers are installed in accordance with 250.30(A)(1), Exception No. 2, the feeder grounded circuit conductor at the building or structure served shall be connected to the equipment grounding conductors, grounding electrode conductor, and the enclosure for the first disconnecting means.

(2) Supplied by Separately Derived System.

(a) *With Overcurrent Protection.* If overcurrent protection is provided where the conductors originate, the installation shall comply with 250.32(B)(1).

(b) *Without Overcurrent Protection.* If overcurrent protection is not provided where the conductors originate, the installation shall comply with 250.30(A). If installed, the supply-side bonding jumper shall be connected to the building or structure disconnecting means and to the grounding electrode(s).

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 18:56:46 EST 2020

Committee Statement

Committee Statement: To add clarity to (B) exception and comply with the 2020 NEC Style Manual, Sections 3.1.4.1 and 4.1.3 the exception has been written in complete sentences, and to use the phrase "in accordance with" when referencing other parts of this code.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" in (D).

Response Message: FR-8252-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
 1 Not Returned
 15 Affirmative All
 0 Affirmative with Comments
 0 Negative with Comments
 0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8253-NFPA 70-2020 [Section No. 250.32(D)]

(D) Disconnecting Means Located in Separate Building or Structure on the Same Premises.

Where If one or more disconnecting means supply one or more additional buildings or structures under single management, and where these disconnecting means are located remote from those buildings or structures in accordance with ~~225.32~~ 225.31(B), Exception No. 1 and No. 2, 700.12(D)(4), 701.12(D)(3), or 702.12, all of the following conditions shall be met:

- (1) The connection of the grounded conductor to the grounding electrode, to normally non-current-carrying metal parts of equipment, or to the equipment grounding conductor at a separate building or structure shall not be made.
- (2) An equipment grounding conductor for grounding and bonding any normally non-current-carrying metal parts of equipment, interior metal piping systems, and building or structural metal frames is run with the circuit conductors to a separate building or structure and connected to existing grounding electrode(s) required in Part III of this article, or, ~~where if~~ there are no existing electrodes, the grounding electrode(s) required in Part III of this article shall be installed ~~where if~~ a separate building or structure is supplied by more than one branch circuit.
- (3) The connection between the equipment grounding conductor and the grounding electrode at a separate building or structure shall be made in a junction box, panelboard, or similar enclosure located immediately inside or outside the separate building or structure.

Submitter Information Verification

Committee: NEC-P05

Submission Date: Fri Dec 18 18:58:45 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" in (D).

Response Message: FR-8253-NFPA 70-2020

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8022-NFPA 70-2020 [Section No. 250.34(C)]****(C) Grounded Conductor Bonding.**

A ~~system~~ conductor that is required to be grounded by 250.26 shall be connected to the generator frame ~~where~~ if the generator is a component of a separately derived system.

Informational Note: For See 250.30 for grounding portable generators supplying fixed wiring systems, ~~see 250.30~~.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 17:51:31 EST 2020

Committee Statement

Committee Statement: The word "system" is removed to make the language consistent with the language in 250.26.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

The informational note was revised to comply with the NEC Style Manual.

Response Message: FR-8022-NFPA 70-2020

Public Input No. 1905-NFPA 70-2020 [Section No. 250.34(C)]

Ballot Results**✔ This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumner, Darrell M.



First Revision No. 8235-NFPA 70-2020 [Section No. 250.36]

250.36 ~~High-Impedance Grounded-Neutral~~ Systems — 480 Volts to 1000 Volts .

~~High-impedance~~ Impedance grounded ~~neutral~~ systems in which a grounding impedance, ~~usually device, typically~~ a resistor, limits the ground-fault current to a low value shall be permitted for 3-phase ac systems of 480 volts to 1000 volts if all the following conditions are met:

- (1) The conditions of maintenance and supervision ensure that only qualified persons service the installation.
- (2) Ground detectors are installed on the system.
- (3) Line-to-neutral loads are not served.

~~High-impedance~~ Impedance grounded ~~neutral~~ systems shall comply with 250.36(A) through (G).

Informational Note: According to Annex O of NFPA 70E-2018 2021 , *Standard for Electrical Safety in the Workplace*, ~~high-~~ impedance grounding is an effective tool to reduce arc-flash hazards.

(A) Location.

The grounding impedance ~~device~~ shall be installed between the grounding electrode conductor and the impedance grounding conductor connected to the system neutral point. If a neutral point is not available, the grounding impedance shall be installed between the grounding electrode conductor and the impedance grounding conductor connected to the neutral point derived from a grounding transformer.

(B) Impedance Grounding Conductor Insulation and Ampacity.

The ~~grounded-system impedance grounding~~ conductor from the neutral point of the transformer or generator to its connection point to the grounding impedance shall be fully insulated.

The ~~grounded-system impedance grounding~~ conductor shall have an ampacity of not less than the maximum current rating of the grounding impedance but in no case shall the ~~grounded-system impedance grounding~~ conductor be smaller than 8 AWG copper or 6 AWG aluminum or copper-clad aluminum.

(C) System Grounding Connection.

The system shall not be connected to ground except through the grounding impedance ~~device~~ .

Informational Note: The impedance is normally selected to limit the ground-fault current to a value slightly greater than or equal to the capacitive charging current of the system. This value of impedance will also limit transient overvoltages to safe values. For guidance, refer to criteria for limiting transient overvoltages in ANSI/ IEEE 142-2007 3003.1-2019 , *Recommended Practice for System Grounding of Industrial and Commercial Power Systems*.

(D) Impedance Grounding Conductor Routing.

The ~~conductor connecting the neutral point of the transformer or generator to the grounding impedance~~ impedance grounding conductor shall be permitted to be installed in a separate raceway from the ungrounded conductors. It shall not be required to run this conductor with the phase conductors to the first system disconnecting means or overcurrent device.

(E) Equipment Bonding Jumper.

The equipment bonding jumper (the connection between the equipment grounding conductors and the grounding impedance ~~device~~) shall be an unsplined conductor run from the first system disconnecting means or overcurrent device to the grounded side of the grounding impedance ~~device~~ .

(F) Grounding Electrode Conductor Connection Location.

For services or separately derived systems, the grounding electrode conductor shall be connected at any point from the grounded side of the grounding impedance ~~device~~ to the equipment grounding connection at the service equipment or the first system disconnecting means of a separately derived system.

(G) Equipment Bonding Jumper Size.

The equipment bonding jumper shall be sized in accordance with (1) or (2) as follows either of the following :

- (1) If the grounding electrode conductor connection is made at the grounding impedance ~~device~~ , the equipment bonding jumper shall be sized in accordance with 250.66, based on the size of the service entrance conductors for a service or the derived phase conductors for a separately derived system.
- (2) If the grounding electrode conductor is connected at the first system disconnecting means or overcurrent device, the equipment bonding jumper shall be sized the same as the ~~neutral impedance grounding~~ conductor in 250.36(B).

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 14:45:52 EST 2020

Committee Statement

Committee Statement: The conductor that connects the neutral point to the impedance of an impedance grounded system does not meet the definition of a grounded conductor in Article 100. The newly defined term "impedance grounding conductor" has replaced

“grounded system conductor” throughout the section.

To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual “usually” was changed to “typically” in the lead paragraph.

The referenced standard was updated in the informational note to 250.36 and in (C).

The word “device” is added after “impedance” throughout the section to clarify the subject is a physical object, not a value. This provides consistency with other parts of the code, such as within the definition of “grounded, solidly” in Article 100.

In (D), the conductor is described to be consistent with other locations in the code. The definition of “impedance grounding conductor” includes the connection points and does not need to be repeated in the text.

**Response
Message:**

FR-8235-NFPA 70-2020

[Public Input No. 2620-NFPA 70-2020 \[Section No. 250.36\(C\)\]](#)

[Public Input No. 750-NFPA 70-2020 \[Section No. 250.36\(D\)\]](#)

[Public Input No. 752-NFPA 70-2020 \[Section No. 250.36\(G\)\]](#)

[Public Input No. 3309-NFPA 70-2020 \[Section No. 250.36\(C\)\]](#)

[Public Input No. 749-NFPA 70-2020 \[Section No. 250.36\(B\)\]](#)

Ballot Results

 This item has passed ballot

16 Eligible Voters

1 Not Returned

14 Affirmative All

1 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Affirmative with Comment

Mohla, Daleep C.

See Document CMP5 FR8235 Affirmative Comment- Mohla sent separately to Sarah Caldwell and Patrick Foley.

CMP 5 -First Revision 8235 Affirmative Comment – Daleep Mohla

Affirmative Comment to First Revision No. 8235- [Section No. 250.36 (E) and 250.36 (G)

- a. 250.36 (E)- Equipment Bonding Jumper
Change the term Equipment Bonding Jumper in 250.36 (E) to Impedance grounding bonding jumper in the title and text to be consistent with title and text in 250.36 (B) and (D). This will eliminate the incompatibility with term bonding jumper used elsewhere in the code. See proposed revised text below

(E) ~~Equipment~~ Impedance grounding Bonding Jumper.

The ~~equipment~~ impedance grounding bonding jumper (the connection between the equipment grounding conductors and the grounding impedance device) shall be an unspliced conductor run from the first system disconnecting means or overcurrent device to the grounded side of the grounding impedance device.

- b. 250.36 (G) Equipment Bonding Jumper Size
Change the term Equipment bonding jumper to Impedance grounding bonding jumper size in the title and text to be consistent with the title and text in 250.36 (B) and (D) and new proposed change to 250.36 (E). See proposed revised text below

(G) ~~Equipment~~ Impedance grounding Bonding Jumper Size.

The ~~equipment~~ impedance grounding bonding jumper shall be sized in accordance with (1) or (2) as follows:

(1) If the grounding electrode conductor connection is made at the grounding impedance device, the ~~equipment~~ impedance grounding bonding jumper shall be sized in accordance with 250.66, based on the size of the service entrance conductors for a service or the derived phase conductors for a separately derived system.

(2) If the grounding electrode conductor is connected at the first system disconnecting means or overcurrent device, the ~~equipment-impedance grounding~~ bonding jumper shall be sized the same as the neutral impedance grounding conductor in 250.36(B)

**First Revision No. 8254-NFPA 70-2020 [Section No. 250.50]****250.50** Grounding Electrode System.

All grounding electrodes as described in 250.52(A)(1) through (A)(7) that are present at each building or structure served shall be bonded together to form the grounding electrode system. ~~Where~~ If none of these grounding electrodes exist, one or more of the grounding electrodes specified in 250.52(A)(4) through (A)(8) shall be installed and used.

Exception: Concrete-encased electrodes of existing buildings or structures shall not be required to be part of the grounding electrode system ~~where~~ if the steel reinforcing bars or rods are not accessible for use without disturbing the concrete.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:01:20 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8254-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.



First Revision No. 8066-NFPA 70-2020 [Section No. 250.52(A)(3)]

(3) Concrete-Encased Electrode.

A concrete-encased electrode shall consist of at least 6.0 m (20 ft) of either (1) or (2) of the following :

- (1) One or more bare or zinc galvanized or other electrically conductive coated steel reinforcing bars or rods of not less than 13 mm (½ in.) in diameter, installed in one continuous 6.0 m (20 ft) length, or if in multiple pieces connected together by the usual steel tie wires, exothermic welding, welding, or other effective means to create a 6.0 m (20 ft) or greater length; or
- (2) Bare copper conductor not smaller than 4 AWG

Metallic Metal components shall be encased by at least 50 mm (2 in.) of concrete and shall be located horizontally within that portion of a concrete foundation or footing that is in direct contact with the earth or within vertical foundations or structural components or members that are in direct contact with the earth. If multiple concrete-encased electrodes are present at a building or structure, it shall be permissible to bond only one into the grounding electrode system.

Informational Note: Concrete installed with insulation, vapor barriers, films, or similar items separating the concrete from the earth is not considered to be in "direct contact" with the earth.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 15:59:45 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual "usual" should not be used in (3)(1). The word "or" was removed as editorial.

The word "metallic" was changed to "metal" to comply with Annex A of the NEC Style Manual.

Response Message: FR-8066-NFPA 70-2020

Public Input No. 261-NFPA 70-2020 [Section No. 250.52(A)(3)]

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
 1 Not Returned
 15 Affirmative All
 0 Affirmative with Comments
 0 Negative with Comments
 0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
 Andre, Joseph F.
 Atkins, Derrick L.
 Bowmer, Trevor N.
 Crawford, Carlie Rose
 Dobrowsky, Paul
 Gray, Bobby J.
 Harding, Joseph James
 Harding, G. Scott
 Jensen, Christopher M.
 Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8068-NFPA 70-2020 [Section No. 250.53(A)]

(A) Rod, Pipe, and Plate Electrodes.

Rod, pipe, and plate electrodes shall meet the requirements of 250.53(A)(1) through (A)(3). Rod, pipe, and plate electrodes shall be free from nonconductive coatings such as paint or enamel.

(1) Below Permanent Moisture Level.

If practicable, rod, pipe, and plate electrodes shall be embedded below permanent moisture level. ~~Rod, pipe, and plate electrodes shall be free from nonconductive coatings such as paint or enamel.~~

(2) Supplemental Electrode Required.

A single rod, pipe, or plate electrode shall be supplemented by an additional electrode of a type specified in 250.52(A)(2) through (A)(8). The supplemental electrode shall be permitted to be bonded to one of the following:

- (1) Rod, pipe, or plate electrode
- (2) Grounding electrode conductor
- (3) Grounded service-entrance conductor
- (4) Nonflexible grounded service raceway
- (5) Any grounded service enclosure

Exception: If a single rod, pipe, or plate grounding electrode has a resistance to earth of 25 ohms or less, the supplemental electrode shall not be required.

(3) Supplemental Electrode.

If multiple rod, pipe, or plate electrodes are installed to meet the requirements of this section, they shall not be less than 1.8 m (6 ft) apart.

Informational Note: The paralleling efficiency of rods is increased by spacing them twice the length of the longest rod.

(4) Rod and Pipe Electrodes.

The electrode shall be installed such that at least 2.44 m (8 ft) of length is in contact with the soil. It shall be driven to a depth of not less than 2.44 m (8 ft) except that, where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from the vertical or, where rock bottom is encountered at an angle up to 45 degrees, the electrode shall be permitted to be buried in a trench that is at least 750 mm (30 in.) deep. The upper end of the electrode shall be flush with or below ground level unless the aboveground end and the grounding electrode conductor attachment are protected against physical damage as specified in 250.10.

(5) Plate Electrode.

Plate electrodes shall be installed not less than 750 mm (30 in.) below the surface of the earth.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 16:11:17 EST 2020

Committee Statement

Committee Statement: The second sentence was relocated from 250.53(A)(1) to 250.53(A) because it does not relate to the moisture level.

Response Message: FR-8068-NFPA 70-2020

Public Input No. 2667-NFPA 70-2020 [Section No. 250.53(A)(1)]

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8069-NFPA 70-2020 [Section No. 250.53(B)]****(B) Electrode Spacing.**

Where If more than one of the electrodes of the type specified in 250.52(A)(5) or (A)(7) are used, each electrode of one grounding system (including that used for strike termination devices) shall not be less than 1.83 m (6 ft) from any other electrode of another grounding system. ~~Two or more grounding electrodes that are bonded together shall be considered a single grounding electrode system.~~

Submitter Information Verification**Committee:** NEC-P05**Submittal Date:** Tue Dec 15 16:14:06 EST 2020**Committee Statement**

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

The second sentence of 250.53(B) was deleted because the requirement already exists in 250.50.

Response Message: FR-8069-NFPA 70-2020Public Input No. 2672-NFPA 70-2020 [Section No. 250.53(B)]**Ballot Results****✔ This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumner, Darrell M.

**First Revision No. 8072-NFPA 70-2020 [Section No. 250.53(E)]**

(E) Supplemental Grounding Electrode Bonding Connection Jumper Size.

Where If the supplemental electrode is a rod, pipe, or plate electrode, that portion of the bonding jumper that is the sole connection to the supplemental grounding electrode shall not be required to be larger than 6 AWG copper wire or 4 AWG aluminum or copper-clad aluminum wire.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 16:18:13 EST 2020

Committee Statement

Committee Statement: The title of this section is changed because it is consistent with the use of defined terms. Copper-clad aluminum was added because it is already allowed in the NEC.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8072-NFPA 70-2020 Repeating a portion of the requirements of 250.64(A) here could cause confusion and is not necessary.

[Public Input No. 135-NFPA 70-2019 \[Section No. 250.53\(E\)\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
1 Not Returned
13 Affirmative All
0 Affirmative with Comments
2 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumner, Darrell M.

Negative with Comment

Abernathy, Paul W.

Inadequate substantiation was provided to support this change.

Crawford, Carlie Rose

CDA votes negative. Inadequate substantiation was submitted to show that Copper-clad aluminum conductor is suitable for this application.

**First Revision No. 8073-NFPA 70-2020 [Section No. 250.58]****250.58** Common Grounding Electrode.

Where ~~If~~ an ac system is connected to a grounding electrode in or at a building or structure, the same electrode shall be used to ground conductor enclosures and equipment in or on that building or structure. ~~Where If~~ separate services, feeders, or branch circuits supply a building and are required to be connected to a grounding electrode(s), the same grounding electrode(s) shall be used.

~~Two or more grounding electrodes that are bonded together shall be considered as a single grounding electrode system in this sense.~~

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 16:20:43 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

The last sentence of 250.58 was deleted because the requirement already exists in 250.50.

Response Message: FR-8073-NFPA 70-2020

Ballot Results

✓ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8090-NFPA 70-2020 [Section No. 250.64(B)(4)]**

(4) In Contact with the Earth.

Grounding electrode conductors and grounding electrode bonding jumpers in contact with the earth shall not be required to comply with 300.5 or 305.15 , but shall be buried or otherwise protected if subject to physical damage.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 17:08:58 EST 2020

Committee Statement

Committee Statement: The reference to 300.50 was added to clarify that it does not apply to grounding electrode conductors for circuits over 1000 volts.

Response Message: FR-8090-NFPA 70-2020

Public Input No. 1017-NFPA 70-2020 [Section No. 250.64(B)(4)]

Ballot Results

✓ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

12 Affirmative All

3 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Dobrowsky, Paul

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Affirmative with Comment

Bowmer, Trevor N.

The revised text incorrectly shows references to "...300.5 or 305.15" whereas it should read "300.5 or 300.50". There is no current Section 305.15. The correct references are 300.5 and 300.50 that both refer to underground and buried applications.

Crawford, Carlie Rose

Revise Panel Statement from 300.50 to 305.15 because a new Article 305 is created.

Gray, Bobby J.

There is an editorial error in the proposed revision. The cited section should be 300.50 as noted in the committee statement.



First Revision No. 8094-NFPA 70-2020 [Section No. 250.64(D)]

(D) Building or Structure with Multiple Disconnecting Means in Separate Enclosures.

If a building or structure is supplied by a service or feeder with two or more disconnecting means in separate enclosures, the grounding electrode connections shall be made in accordance with 250.64(D)(1), 250.64(D)(2), or 250.64(D)(3).

(1) Common Grounding Electrode Conductor and Taps.

A common grounding electrode conductor and grounding electrode conductor taps shall be installed. The common grounding electrode conductor shall be sized in accordance with 250.66, based on the sum of the circular mil area of the largest ungrounded conductor(s) of each set of conductors that supplies the disconnecting means. If the service-entrance conductors connect directly to the overhead service conductors, service drop, underground service conductors, or service lateral, the common grounding electrode conductor shall be sized in accordance with Table 250.66, note 1.

A grounding electrode conductor tap shall extend to the inside of each disconnecting means enclosure. The grounding electrode conductor taps shall be sized in accordance with 250.66 for the largest service-entrance or feeder conductor serving the individual enclosure. The tap conductors shall be connected to the common grounding electrode conductor by one of the following methods in such a manner that the common grounding electrode conductor remains without a splice or joint:

- (1) Exothermic welding.
- (2) Connectors listed as grounding and bonding equipment.
- (3) Connections to an aluminum or copper busbar not less than 6 mm thick × 50 mm wide (¼ in. thick × 2 in. wide) and of sufficient length to accommodate the number of terminations necessary for the installation. The busbar shall be securely fastened and shall be installed in an accessible location. Connections shall be made by a listed connector or by the exothermic welding process. If aluminum busbars are used, the installation shall comply with 250.64(A).

(2) Individual Grounding Electrode Conductors.

A grounding electrode conductor shall be connected between the grounding electrode system and one or more of the following, as applicable:

- (1) Grounded conductor in each service equipment disconnecting means enclosure
- (2) Equipment grounding conductor installed with the feeder(s) or branch circuit(s) for other than services
- (3) Supply-side bonding jumper

Each grounding electrode conductor shall be sized in accordance with 250.66 based on the service-entrance or feeder conductor(s) supplying the individual disconnecting means.

(3) Common Location.

A grounding electrode conductor shall be connected in a wireway or other accessible enclosure on the supply side of the disconnecting means to one or more of the following, as applicable:

- (1) Grounded service conductor(s)
- (2) Equipment grounding conductor installed with the feeder
- (3) Supply-side bonding jumper

The connection shall be made with exothermic welding or a connector listed as grounding and bonding equipment. The grounding electrode conductor shall be sized in accordance with 250.66 based on the service-entrance or feeder conductor(s) at the common location where the connection is made.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 17:13:22 EST 2020

Committee Statement

Committee Statement: The text is added to remove a conflict with 250.24(A)(1). Section 250.64(D)(2)(2) specifically applies to buildings and structures supplied by other than services.

To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual "sufficient" should not be used in (D)(1)(3).

Response Message: FR-8094-NFPA 70-2020

Ballot Results

✓ This item has passed ballot

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8096-NFPA 70-2020 [Section No. 250.64(E)]**

(E) Raceways, Cable Armor, and Enclosures for Grounding Electrode Conductors.

(1) General.

Ferrous metal raceways, enclosures, and cable armor for grounding electrode conductors shall be electrically continuous from the point of attachment to cabinets or equipment to the grounding electrode and shall be securely fastened to the ground clamp or fitting. Ferrous metal raceways, enclosures, and cable armor shall be bonded at each end of the raceway or enclosure to the grounding electrode or grounding electrode conductor to create an electrically parallel path. Nonferrous metal raceways, enclosures, and cable armor shall not be required to be electrically continuous.

(2) Methods.

Bonding shall be in compliance with 250.92(B) and ensured by one of the methods in 250.92(B)(2) through (B)(4).

(3) Size.

The bonding jumper for a grounding electrode conductor(s), raceway(s), enclosure(s), or cable armor shall be the same size as, or larger than, the largest enclosed grounding electrode conductor.

(4) Wiring Methods.

If a raceway is used as protection for a grounding electrode conductor, the installation shall comply with the requirements of the appropriate applicable raceway article.

Supplemental Information

<u>File Name</u>	<u>Description</u> <u>Approved</u>
NEC_250.64_E_FR8096.docx	For staff use

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 17:18:43 EST 2020

Committee Statement

Committee Statement:	The term "cable armor" is added to the title to be consistent with the text of this section. To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC style manual, "appropriate" was replaced with applicable in (E)(4).
Response Message:	FR-8096-NFPA 70-2020

Public Input No. 592-NFPA 70-2020 [Section No. 250.64(E)]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.

Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8075-NFPA 70-2020 [New Section after 250.64(F)]**

(G) _ Enclosures with Ventilation Openings.

Grounding electrode conductors shall not be installed through a ventilation opening of an enclosure.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 16:24:04 EST 2020

Committee Statement

Committee Statement: Routing grounding electrode conductors through a ventilation opening of an enclosure can result in reduced air flow and overheating of the associated equipment.

Response Message: FR-8075-NFPA 70-2020

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8074-NFPA 70-2020 [Section No. 250.64 [Excluding any Sub-Sections]]**

Grounding electrode conductors at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system shall be installed as specified in 250.64(A) through (F) (G).

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 16:22:49 EST 2020

Committee Statement

Committee Statement: Add new section reference to (G).

Response Message: FR-8074-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumner, Darrell M.

**First Revision No. 8098-NFPA 70-2020 [Section No. 250.66(A)]****(A)** Connections to a Rod, Pipe, or Plate Electrode(s).

If the grounding electrode conductor or bonding jumper connected to a single or multiple rod, pipe, or plate electrode(s), or any combination thereof, as described in 250.52(A)(5) or (A)(7), does not extend on to other types of electrodes that require a larger size conductor, the grounding electrode conductor shall not be required to be larger than 6 AWG copper wire or 4 AWG aluminum or copper-clad aluminum wire.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 17:23:13 EST 2020

Committee Statement

Committee Statement: Copper-clad aluminum was added to 250.66(A) because it is recognized in the NEC as an acceptable conductor material.

Response Message: No technical substantiation was provided to ensure that under expected conditions of use the copper layer will not delaminate, the steel core stiffness and strength is sufficient to prevent failure, and that it can be bent and installed without stressing terminations within equipment. The series of Public Inputs do not require 40% copper-clad steel in all cases which was used in all of the submitted testing reports. The current values used in the short time current test are less than those required in UL 467. Copper-clad steel needs to be listed in all cases to ensure acceptable performance.

Public Input No. 2468-NFPA 70-2020 [Section No. 250.66(A)]

Ballot Results**✔ This item has passed ballot**

16 Eligible Voters
1 Not Returned
13 Affirmative All
0 Affirmative with Comments
2 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumner, Darrell M.

Negative with Comment

Abernathy, Paul W.

Inadequate substantiation was provided to support this change.

Crawford, Carlie Rose

CDA votes negative. Inadequate substantiation was submitted to show that Copper-clad aluminum conductor is suitable for this application.



First Revision No. 8163-NFPA 70-2020 [Section No. 250.66 [Excluding any Sub-Sections]]

The size of the grounding electrode conductor at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system of a grounded or ungrounded ac system shall not be less conductor and bonding jumper(s) for connection of grounding electrodes shall not be smaller than given in Table 250.66, except as permitted in 250.66(A) through (C).

Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

<u>Size of Largest Ungrounded Conductor or Equivalent Area for Parallel Conductors (AWG/kcmil)</u>		<u>Size of Grounding Electrode Conductor (AWG/kcmil)</u>	
<u>Copper</u>	<u>Aluminum or Copper-Clad Aluminum</u>	<u>Copper</u>	<u>Aluminum or Copper-Clad Aluminum</u>
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	4
2/0 or 3/0	4/0 or 250	4	2
Over 3/0 through 350	Over 250 through 500	2	1/0
Over 350 through 600	Over 500 through 900	1/0	3/0
Over 600 through 1100	Over 900 through 1750	2/0	4/0
Over 1100	Over 1750	3/0	250

Notes:

1. If multiple sets of service-entrance conductors connect directly to a service drop, set of overhead service conductors, set of underground service conductors, or service lateral, the equivalent size of the largest service-entrance conductor shall be determined by the largest sum of the areas of the corresponding conductors of each set.
2. ~~Where~~ If there are no service-entrance conductors, the grounding electrode conductor size shall be determined by the equivalent size of the largest service-entrance conductor required for the load to be served.
3. See installation restrictions in 250.64.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Wed Dec 16 17:12:58 EST 2020

Committee Statement

Committee Statement: Examples of where this section or table applies are removed from the opening paragraph because direct references to this section or table are made from other sections in Article 250 and from other articles as appropriate. The bonding jumper was added to recognize that other than grounding electrode conductors are sized by reference to this section or table.

Revision is made to Note 2 to comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8163-NFPA 70-2020

Public Input No. 4598-NFPA 70-2020 [Section No. 250.66]

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8157-NFPA 70-2020 [Section No. 250.68(C)]

(C) Grounding Electrode Conductor Connections.

Grounding electrode conductors and bonding jumpers shall be permitted to be connected at the following locations and used to extend the connection to an electrode(s):

- (1) Interior metal water piping that is electrically continuous with a metal underground water pipe electrode and is located not more than 1.52 m (5 ft) from the point of entrance to the building, as measured along the water piping, shall be permitted to extend the connection to an electrode(s). Interior metal water piping located more than 1.52 m (5 ft) from the point of entrance to the building, as measured along the water piping, shall not be used as a conductor to interconnect electrodes of the grounding electrode system.

Exception: In industrial, commercial, and institutional buildings or structures, if conditions of maintenance and supervision ensure that only qualified persons service the installation, interior metal water piping located more than 1.52 m (5 ft) from the point of entrance to the building, as measured along the water piping, shall be permitted as a bonding conductor to interconnect electrodes that are part of the grounding electrode system, or as a grounding electrode conductor, if the entire length, other than short sections passing perpendicularly through walls, floors, or ceilings, of the interior metal water pipe that is being used for the conductor is exposed.

- (2) The metal structural frame of a building shall be permitted to be used as a conductor to interconnect electrodes that are part of the grounding electrode system, or as a grounding electrode conductor. Hold-down bolts securing the structural steel column that are connected to a concrete-encased electrode complying with 250.52(A)(3) and located in the support footing or foundation shall be permitted to connect the metal structural frame of a building or structure to the concrete-encased grounding electrode. The hold-down bolts shall be connected to the concrete-encased electrode by welding, exothermic welding, ~~the usual~~ steel tie wires, or other approved means.
- (3) A rebar-type concrete-encased electrode installed in accordance with 250.52(A)(3) with an additional rebar section extended from its location within the concrete foundation or footing to an accessible location that is not subject to corrosion shall be permitted for connection of grounding electrode conductors and bonding jumpers in accordance with the following:
 - a. The additional rebar section shall be continuous with the grounding electrode rebar or shall be connected to the grounding electrode rebar and connected together by ~~the usual~~ steel tie wires, exothermic welding, welding, or other effective means.
 - b. The rebar extension shall not be exposed to contact with the earth without corrosion protection.
 - c. Rebar shall not be used as a conductor to interconnect the electrodes of grounding electrode systems.

Supplemental Information

File Name	Description Approved
NEC_250.68_C_FR8157.docx	For staff use

Submitter Information Verification

Committee: NEC-P05

Submission Date: Wed Dec 16 14:54:41 EST 2020

Committee Statement

Committee Statement: Text is added to clarify that the 5' distance applies to the length of water piping, not the distance from the building entry to the connection on the water piping.

To comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC style manual "usual" should not be used in (C)(2) and (C)(3).

Response Message: FR-8157-NFPA 70-2020

[Public Input No. 1018-NFPA 70-2020 \[Section No. 250.68\(C\)\]](#)

[Public Input No. 1413-NFPA 70-2020 \[Section No. 250.68\(C\)\]](#)

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8164-NFPA 70-2020 [Section No. 250.70]****250.70** Methods of Grounding and Bonding Conductor Connection to Electrodes.**(A)** General.

The grounding or bonding conductor shall be connected to the grounding electrode by exothermic welding, listed lugs, listed pressure connectors, listed clamps, or other listed means. Connections depending on solder shall not be used. Ground clamps shall be listed for the materials of the grounding electrode and the grounding electrode conductor and, ~~where if~~ used on pipe, rod, or other buried electrodes, shall also be listed for direct soil burial or concrete encasement. Not more than one conductor shall be connected to the grounding electrode by a single clamp or fitting unless the clamp or fitting is listed for multiple conductors. ~~One of the following methods shall be used:~~

- ~~(0) A pipe fitting, pipe plug, or other approved device screwed into a pipe or pipe fitting~~
- ~~(0) A listed bolted clamp of cast bronze or brass, or plain or malleable iron~~
- ~~(0) For indoor communications purposes only, a listed sheet metal strap-type ground clamp having a rigid metal base that seats on the electrode and having a strap of such material and dimensions that it is not likely to stretch during or after installation~~
- ~~(0) An equally substantial approved means~~

(B) Indoor Communications Systems.

For indoor communications purposes only, a listed sheet metal strap-type ground clamp having a rigid metal base that seats on the electrode and having a strap of such material and dimensions that it is not likely to stretch during or after installation shall be permitted.

Informational Note: Listed ground clamps that are identified for direct burial are also suitable for concrete encasement.

Supplemental Information

<u>File Name</u>	<u>Description</u> <u>Approved</u>
NEC_250.70_FR8164.docx	For staff use

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Wed Dec 16 17:15:44 EST 2020

Committee Statement

Committee Statement: The section is revised to create an (A) General and (B) Indoor Communications Systems for clarity. For other than item (3), the examples in the list are not necessary.

The first sentence is inclusive of the examples of permitted connection methods and is more exhaustive. To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

The informational note adds helpful information.

Response Message: FR-8164-NFPA 70-2020

[Public Input No. 127-NFPA 70-2019 \[Section No. 250.70\]](#)

[Public Input No. 4543-NFPA 70-2020 \[Section No. 250.70\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8025-NFPA 70-2020 [Section No. 250.80]****250.80** Service Raceways and Enclosures.

Metal enclosures and raceways for service conductors and equipment shall be connected to the grounded-system conductor if the electrical system is grounded or to the grounding electrode conductor for electrical systems that are not grounded.

Exception: Metal components that are installed in a run of underground nonmetallic raceway(s) and are isolated from possible contact by a minimum cover of 450 mm (18 in.) to all parts of the metal components shall not be required to be connected to the grounded-system conductor, supply-side bonding jumper, or grounding electrode conductor.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 17:56:15 EST 2020

Committee Statement

Committee Statement: The word "system" is removed to use the defined term grounded conductor.

Response Message: FR-8025-NFPA 70-2020

[Public Input No. 1892-NFPA 70-2020 \[Section No. 250.80\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8027-NFPA 70-2020 [Section No. 250.84]****250.84** Underground Service Cable or Raceway.**(A)** Underground Service Cable.

The sheath or armor of a continuous underground metal-sheathed or armored service cable system that is connected to the grounded-~~system~~ conductor on the supply side shall not be required to be connected to the grounded-~~system~~ conductor at the building or structure. The sheath or armor shall be permitted to be insulated from the interior metal raceway or piping.

(B) Underground Service Raceway Containing Cable.

An underground metal service raceway that contains a metal-sheathed or armored cable connected to the grounded-~~system~~ conductor shall not be required to be connected to the grounded-~~system~~ conductor at the building or structure. The sheath or armor shall be permitted to be insulated from the interior metal raceway or piping.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Mon Dec 14 17:58:24 EST 2020

Committee Statement

Committee Statement: The word "system" is removed to use the defined term grounded conductor.

Response Message: FR-8027-NFPA 70-2020

Public Input No. 1893-NFPA 70-2020 [Section No. 250.84]

Ballot Results**✔ This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8255-NFPA 70-2020 [Section No. 250.86]****250.86** Other Conductor Enclosures and Raceways.

Except as permitted by 250.112(I), metal enclosures and raceways for other than service conductors shall be connected to the equipment grounding conductor.

Exception No. 1: Metal enclosures and raceways for conductors added to existing installations of open wire, knob-and-tube wiring, and nonmetallic-sheathed cable shall not be required to be connected to the equipment grounding conductor ~~where~~ if these enclosures or wiring methods comply with (1) through (4) as follows all the following :

- (1) *Do not provide an equipment ground*
- (2) *Are in runs of less than 7.5 m (25 ft)*
- (3) *Are free from probable contact with ground, grounded metal, metal lath, or other conductive material*
- (4) *Are guarded against contact by persons*

Exception No. 2: Short sections of metal enclosures or raceways used to provide support or protection of cable assemblies from physical damage shall not be required to be connected to the equipment grounding conductor.

Exception No. 3: Metal components shall not be required to be connected to the equipment grounding conductor or supply-side bonding jumper ~~where~~ if either of the following conditions exist:

- (1) *The metal components are installed in a run of nonmetallic raceway(s) and isolated from possible contact by a minimum cover of 450 mm (18 in.) to any part of the metal components.*
- (2) *The metal components are part of an installation of nonmetallic raceway(s) and are isolated from possible contact to any part of the metal components by being encased in not less than 50 mm (2 in.) of concrete.*

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:08:27 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" in Exception No. 1 and 3.

Response Message: FR-8255-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8256-NFPA 70-2020 [Section No. 250.90]****250.90** General.

Bonding shall be provided where if necessary to ensure electrical continuity and the capacity to conduct safely any fault current likely to be imposed.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:10:44 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8256-NFPA 70-2020

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8165-NFPA 70-2020 [Section No. 250.92(B)]****(B) Method of Bonding at the Service.**

Bonding jumpers meeting the requirements of this article shall be used around impaired connections, such as reducing washers or oversized, concentric, or eccentric knockouts. Standard locknuts or bushings shall not be the only means for the bonding required by this section but shall be permitted to be installed to make a mechanical connection of the raceway(s).

Electrical continuity at service equipment, service raceways, and service conductor enclosures shall be ensured by one or more of the following methods:

- (1) Bonding equipment to the grounded service conductor ~~in a manner provided in~~ by an applicable method in 250.8(A)
- (2) Connections made up wrenchtight using threaded couplings, threaded entries, or listed threaded hubs on enclosures ~~if made up wrenchtight~~
- (3) Threadless couplings and connectors if made up tight for metal raceways and metal-clad cables
- (4) Other listed devices, such as bonding-type locknuts, bushings, or bushings with bonding jumpers

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Wed Dec 16 17:36:34 EST 2020

Committee Statement

Committee Statement: Changes are made to (B)(1) because some of the connection methods provided in 250.8(A) may not be suitable for making the connection that is required. The revision to item (2) recognizes that many enclosures have threaded entries rather than threaded hubs. The order of the words was also rearranged for clarity.

Response Message: FR-8165-NFPA 70-2020

Public Input No. 1086-NFPA 70-2020 [Section No. 250.92(B)]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.

Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.



First Revision No. 8257-NFPA 70-2020 [Section No. 250.94(A)]

(A) The Intersystem Bonding Termination Device.

An intersystem bonding termination (IBT) for connecting intersystem bonding conductors shall be provided external to enclosures at the service equipment or metering equipment enclosure and at the disconnecting means for any ~~additional~~ buildings or structures that are supplied by a feeder or branch circuit. If an IBT is used, it shall comply with the following:

- (1) Be accessible for connection and inspection.
- (2) Consist of a set of terminals with the capacity for connection of not less than three intersystem bonding conductors.
- (3) Not interfere with opening the enclosure for a service, building or structure disconnecting means, or metering equipment.
- (4) Be securely mounted as follows:

(a) At the service equipment, be ~~securely mounted and electrically connected to an a metal~~ enclosure for the service equipment, to ~~the a metal~~ meter enclosure, or to an exposed nonflexible ~~metallic metal~~ service raceway, or be ~~mounted at one of these enclosures and be~~ connected to the metal enclosure or to the grounding electrode conductor with a minimum 6 AWG copper conductor.

(b) At the disconnecting means for a building or structure, be ~~securely mounted and~~ electrically connected to the ~~metallic metal~~ enclosure for the building or structure disconnecting means, or ~~be mounted at the disconnecting means and~~ be connected to the ~~metallic~~ metal enclosure or to the grounding electrode conductor with a minimum 6 AWG copper conductor.

- (5) ~~The terminals shall be~~ Be listed as grounding and bonding equipment.

Exception: In existing buildings or structures ~~where~~, if any of the intersystem bonding and grounding electrode conductors required by 770.100(B)(2), 800.100(B)(2), 810.21(F)(2), and 820.100, and 830.100 exist, installation of the intersystem bonding termination is an IBT shall not be required. An accessible means external to enclosures for connecting intersystem bonding and grounding electrode conductors shall be permitted at the service equipment and at the disconnecting means for any ~~additional~~ buildings or structures that are supplied by a feeder or branch circuit by at least one of the following means:

- (1) *Exposed nonflexible ~~metallic~~ metal raceways*
- (2) *An exposed grounding electrode conductor*
- (3) *Approved means for the external connection of a copper or other corrosion-resistant bonding or grounding electrode conductor to the grounded raceway or equipment*

Informational Note No. 1: A 6 AWG copper conductor with one end bonded to the grounded nonflexible metallic raceway or equipment and with 150 mm (6 in.) or more of the other end made accessible on the outside wall is an example of the approved means covered in 250.94, Exception item (3).

Informational Note No. 2: See 770.100, 800.100, 810.21, and 820.100, ~~and 830.100~~ for intersystem bonding and grounding requirements for conductive optical fiber cables, communications circuits, radio and television equipment, CATV circuits and network-powered broadband communications systems, respectively.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:12:36 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" in the exception.

Response Message: FR-8257-NFPA 70-2020

Ballot Results

✓ This item has passed ballot

16 Eligible Voters
 1 Not Returned
 14 Affirmative All
 0 Affirmative with Comments
 1 Negative with Comments
 0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Negative with Comment

Bowmer, Trevor N.

FR-8257 and FR-8204 make conflicting revisions to 250.94A. FR-8204 should be accepted and FR-8257 rejected. FR-8204 includes the desired revision to the charging statement of 250.94 which is omitted from FR-8257. FR-8257 incorrectly deletes "electrically connected to" from Item 4a. FR-8257 omits "The IBT shall be..." from Item 5. As revised by either FR, the text could be mistakenly read to imply that IBT connections be made at BOTH 4a (service equipment) and 4b (disconnecting means) whereas only one should be made.



First Revision No. 8166-NFPA 70-2020 [Section No. 250.94(B)]

(B) Other Means.

Connections to an aluminum or copper busbar not less than 6 mm thick × 50 mm wide (¼ in. thick × 2 in. wide) and of sufficient a length to accommodate at least three terminations for communication systems in addition to other connections. The busbar shall be securely fastened and shall be installed in an accessible location. Connections shall be made by a listed connector. If aluminum busbars are used, the installation shall also comply with 250.64(A). The busbar shall be connected to the grounding electrode system by a conductor that is the larger of the following:

- (1) Not smaller than the largest grounding electrode conductor that is connected to the busbar
- (2) As required or permitted in 250.94(A).

Exception to (A) and (B): Means for connecting intersystem bonding conductors are not required ~~where~~ if communications systems are not likely to be used.

Informational Note: The use of an IBT can reduce electrical noise on communication systems.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Wed Dec 16 17:50:10 EST 2020

Committee Statement

Committee Statement: Requirements are added to indicate the minimum size of the conductor that connects the busbar to the grounding electrode system.

To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual, "sufficient" should not be used.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" in the exception.

Response Message: FR-8166-NFPA 70-2020

[Public Input No. 1311-NFPA 70-2020 \[Section No. 250.94\(B\)\]](#)

[Public Input No. 1430-NFPA 70-2020 \[Section No. 250.94\(B\)\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
 1 Not Returned
 15 Affirmative All
 0 Affirmative with Comments
 0 Negative with Comments
 0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
 Andre, Joseph F.
 Atkins, Derrick L.
 Bowmer, Trevor N.
 Crawford, Carlie Rose
 Dobrowsky, Paul
 Gray, Bobby J.
 Harding, Joseph James

Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.



First Revision No. 8167-NFPA 70-2020 [Section No. 250.96]

250.96 Bonding Other Enclosures.

(A) General.

Metal raceways, cable trays, cable armor, cable sheath, enclosures, frames, fittings, and other metal non-current-carrying parts that are to serve as equipment grounding conductors, with or without the use of wire-type supplementary equipment grounding conductors, shall be bonded ~~where~~ if necessary to ensure electrical continuity and the capacity to conduct ~~safely any~~ fault current likely to be imposed on them. Any nonconductive paint, enamel, or similar coating shall be removed at threads, contact points, and contact surfaces or shall be connected by means of fittings designed so as to make such removal unnecessary.

(B) Isolated Grounding Circuits.

~~Where~~ If installed for the reduction of electromagnetic interference on the grounding circuit, an equipment enclosure supplied by a branch circuit shall be permitted to be isolated from a raceway containing circuits supplying only that equipment by one or more listed nonmetallic raceway fittings located at the point of attachment of the raceway to the equipment enclosure. The metal raceway shall comply with this article and shall be supplemented by an internal insulated equipment grounding conductor installed in accordance with 250.146(D) to ground the equipment enclosure.

Informational Note: Use of an isolated equipment grounding conductor does not relieve the requirement for grounding the raceway system.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Wed Dec 16 17:58:28 EST 2020

Committee Statement

Committee Statement: Revision was made to clarify that the supplementary equipment grounding conductor is to be a wire type conductor.

To comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual "safely" should not be used.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" in (A) and (B).

Response Message: FR-8167-NFPA 70-2020

[Public Input No. 2315-NFPA 70-2020 \[Section No. 250.96\(A\)\]](#)

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8174-NFPA 70-2020 [Section No. 250.97]****250.97** Bonding for Over 250 Volts to Ground .

For circuits of over 250 volts to ground, the electrical continuity of metal raceways and cables with metal sheaths that contain any conductor other than service conductors shall be ensured by one or more of the methods specified for services in 250.92(B), except for (B)(1).

Exception: ~~Where~~ if oversized, concentric, or eccentric knockouts are not encountered, or ~~where~~ if a box or enclosure with concentric or eccentric knockouts is listed to provide a reliable bonding connection, the following methods shall be permitted:

- (1) *Threadless couplings and connectors for cables with metal sheaths*
- (2) *Two locknuts, on rigid metal conduit or intermediate metal conduit, one inside and one outside of boxes and cabinets*
- (3) *Fittings with shoulders that seat ~~firmly~~ tightly against the box or cabinet, such as electrical metallic tubing connectors, flexible metal conduit connectors, and cable connectors, with one locknut on the inside of boxes and cabinets*
- (4) *Listed fittings*

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 11:04:41 EST 2020

Committee Statement

Committee Statement: The term "to ground" was added to the title to reflect the topic of this section.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

To comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual "firmly" should not be used in Item (3) of the exception.

Response Message: FR-8174-NFPA 70-2020

[Public Input No. 4549-NFPA 70-2020 \[Section No. 250.97\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8175-NFPA 70-2020 [Section No. 250.100]****250.100** Bonding in Hazardous (Classified) Locations.

Regardless of the voltage of the electrical system, the electrical continuity of normally non-current-carrying metal parts of electrical equipment, raceways, metal-clad cable, and other metal enclosures containing electrical equipment in any hazardous (classified) location, as defined in 500.5, 505.5, and 506.5, shall be ensured by any of the bonding methods specified in 250.92(B)(2) through (B)(4). One or more of these bonding methods shall be used whether or not equipment grounding conductors of the wire type are installed in the raceway or in a multiconductor cable assembly.

Informational Note: See 501.30, 502.30, 503.30, 505.30, or 506.30 for specific bonding requirements.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 11:07:18 EST 2020

Committee Statement

Committee Statement: The revisions were made to add clarity as well as include metal clad cable as a type of equipment that requires bonding.

Response Message: FR-8175-NFPA 70-2020

Ballot Results

✓ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumner, Darrell M.



First Revision No. 8258-NFPA 70-2020 [Section No. 250.102(C)]

(C) Size — Supply-Side Bonding Jumper.

(1) Size for Supply Conductors in a Single Raceway or Cable.

The supply-side bonding jumper shall not be smaller than specified in Table 250.102(C)(1).

(2) Size for Parallel Conductor Installations in Two or More Raceways or Cables.

~~Where~~ If the ungrounded supply conductors are ~~paralleled~~ connected in parallel in two or more raceways or cables, the supply-side bonding jumper shall be sized in accordance with either of the following; ~~and an individual supply-side bonding jumper is used for bonding these raceways or cables, the size of the supply-side bonding jumper for each raceway or cable shall be selected from Table 250.102(C)(1) based on the size of the ungrounded supply conductors in each raceway or cable. A single supply-side bonding jumper installed for bonding two or more raceways or cables shall be sized in accordance with 250.102(C)(1).~~

- (1) ~~An individual~~ bonding jumper for each raceway or cable shall be selected from Table 250.102(C)(1) based on the size of the largest ungrounded supply conductors in each raceway or cable.
- (2) A single ~~supply-side~~ bonding jumper installed for bonding two or more raceways or cables shall be sized in accordance with ~~250.102(C)(1)~~ Table 250.102(C)(1) based on the sum of the circular mil areas of the largest ungrounded conductors from each set connected in parallel in each raceway or cable. The size of the grounded conductor(s) in each raceway or cable shall be based on the largest ungrounded conductor in each raceway or cable, or the sum of the circular mil areas of the largest ungrounded conductors from each set connected in parallel in each raceway or cable.

Informational Note No. 1: The term *supply conductors* includes ungrounded conductors that do not have overcurrent protection on their supply side and terminate at service equipment or the first disconnecting means of a separately derived system.

Informational Note No. 2: See Chapter 9, Table 8, for the circular mil area of conductors 18 AWG through 4/0 AWG.

Table 250.102(C)(1) Grounded Conductor, Main Bonding Jumper, System Bonding Jumper, and Supply-Side Bonding Jumper for Alternating-Current Systems

<u>Size of Largest Ungrounded Conductor or Equivalent Area for Parallel Conductors (AWG/kcmil)</u>		<u>Size of Grounded Conductor or Bonding Jumper^a (AWG/kcmil)</u>	
<u>Copper</u>	<u>Aluminum or Copper-Clad Aluminum</u>	<u>Copper</u>	<u>Aluminum or Copper-Clad Aluminum</u>
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	4
2/0 or 3/0	4/0 or 250	4	2
Over 3/0 through 350	Over 250 through 500	2	1/0
Over 350 through 600	Over 500 through 900	1/0	3/0
Over 600 through 1100	Over 900 through 1750	2/0	4/0
Over 1100	Over 1750	See Notes 1 and 2.	

Notes:

1. If the circular mil area of ungrounded supply conductors ~~are~~ that are connected in parallel is larger than 1100 kcmil copper or 1750 kcmil aluminum, the grounded conductor or bonding jumper shall have an area not less than 12½ percent of the area of the largest ungrounded supply conductor or equivalent area for parallel supply conductors. The grounded conductor or bonding jumper shall not be required to be larger than the largest ungrounded conductor or set of ungrounded conductors.
2. If the circular mil area of ungrounded supply conductors ~~are~~ that are connected in parallel is larger than 1100 kcmil copper or 1750 kcmil aluminum and if the ungrounded supply conductors and the bonding jumper are of different materials (copper, aluminum, or copper-clad aluminum), the minimum size of the grounded conductor or bonding jumper shall be based on the assumed use of ungrounded supply conductors of the same material as the grounded conductor or bonding jumper ~~and will have that has~~ an ampacity equivalent to that of the installed ungrounded supply conductors.
- ~~3. If multiple sets of service-entrance conductors are used as permitted in 230.40, Exception No. 2, or if multiple sets of ungrounded supply conductors are installed for a separately derived system, the equivalent size of the largest ungrounded supply conductor(s) shall be determined by the largest sum of the areas of the corresponding conductors of each set.~~
- 4 ~~3~~. If there are no service-entrance conductors, the supply conductor size shall be determined by the equivalent size of the largest service-entrance conductor required for the load to be served.

~~^aFor the purposes of applying this table and its notes, the term *bonding jumper* refers to main bonding jumpers, system bonding jumpers, and supply-side bonding jumpers.~~

Supplemental Information

<u>File Name</u>	<u>Description Approved</u>
NEC_FR8258_250.102_C.docx	For staff use

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:14:59 EST 2020

Committee Statement

Committee Statement: Revisions are made regarding connection of conductors in parallel and including supply-side bonding conductors. Revisions are made to clarify the sizing of bonding jumpers for a single raceway or cables as well as for sizing a bonding jumper that is connected to two or more raceways or cables.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8258-NFPA 70-2020

[Public Input No. 3823-NFPA 70-2020 \[Section No. 250.102\(C\)\(2\)\]](#)

[Public Input No. 2029-NFPA 70-2020 \[Section No. 250.102\(C\)\(2\)\]](#)

[Public Input No. 128-NFPA 70-2019 \[Section No. 250.102\(C\)\(2\)\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8176-NFPA 70-2020 [Section No. 250.104(C)]

(C) Structural Metal.

Exposed structural metal that is interconnected to form a metal building frame, is not intentionally grounded or bonded, and is likely to become energized shall be bonded to any of the following:

- (1) Service equipment enclosure
- (2) Grounded conductor at the service
- (3) Disconnecting means for buildings or structures supplied by a feeder or branch circuit
- (4) Grounding electrode conductor, if ~~of sufficient size~~ not smaller than a conductor sized in accordance with Table 250.102(C)(1)
- (5) One or more grounding electrodes used, if the grounding electrode conductor or bonding jumper to the grounding electrode is ~~of sufficient size~~ not smaller than a conductor sized in accordance with Table 250.102(C)(1)

The bonding conductor(s) or jumper(s) shall be sized in accordance with Table 250.102(C)(1), except that it shall not be required to be larger than 3/0 AWG copper or 250 kcmil aluminum or copper-clad aluminum, and installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible unless installed in compliance with 250.68(A), Exception No. 2.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 11:27:08 EST 2020

Committee Statement

Committee Statement: To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual “sufficient” should not be used in 250.104(C)(4) and (5).

The AWG designation is added following 3/0 to be technically correct.

Response Message: FR-8176-NFPA 70-2020

[Public Input No. 4250-NFPA 70-2020 \[Section No. 250.104\(C\)\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
 1 Not Returned
 15 Affirmative All
 0 Affirmative with Comments
 0 Negative with Comments
 0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
 Andre, Joseph F.
 Atkins, Derrick L.
 Bowmer, Trevor N.
 Crawford, Carlie Rose
 Dobrowsky, Paul
 Gray, Bobby J.
 Harding, Joseph James
 Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8225-NFPA 70-2020 [Section No. 250.104(D)]****(D) Separately Derived Systems.**

Metal water piping systems and structural metal that is interconnected to form a building frame shall be bonded to separately derived systems in accordance with 250.104(D)(1) through 250.104(D)(3) (D)(3) .

(1) Metal Water Piping System(s).

The grounded conductor of each separately derived system shall be bonded to the nearest ~~available~~ accessible point of the metal water piping system(s) in the area served by each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1) based on the largest ungrounded conductor of the separately derived system except that it shall not be required to be larger than 3/0 AWG copper or 250 kcmil aluminum or copper-clad aluminum.

Exception No. 1: A separate bonding jumper to the metal water piping system shall not be required if the metal water piping system is used as the grounding electrode or grounding electrode conductor for the separately derived system and the connection to the water piping system is in the area served by the separately derived system .

Exception No. 2: A separate bonding jumper to the metal water piping bonding jumper system shall not be required if the metal in-ground support structure is used as a grounding electrode or the metal frame of a building or structure is used as the grounding electrode conductor for a separately derived system and is bonded to the metal water piping system in the area served by the separately derived system.

(2) Structural Metal.

If exposed structural metal that is interconnected to form the building frame exists in the area served by the separately derived system, it shall be bonded to the grounded conductor of each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1) based on the largest ungrounded conductor of the separately derived system except that it shall not be required to be larger than 3/0 AWG copper or 250 kcmil aluminum or copper-clad aluminum.

Exception No. 1: A separate bonding jumper to the building structural metal shall not be required if the metal in-ground support structure is used as a grounding electrode or the metal frame of a building or structure is used as the grounding electrode conductor for the separately derived system.

Exception No. 2: A separate bonding jumper to the building structural metal shall not be required if the water piping system of a building or structure is used as the grounding electrode or grounding electrode conductor for a separately derived system and is bonded to the building structural metal in the area served by the separately derived system.

[Detail FR-8226](#)**(3) Common Grounding Electrode Conductor.**

If a common grounding electrode conductor is installed for multiple separately derived systems as permitted by 250.30(A)(6), and exposed structural metal that is interconnected to form the building frame or interior metal water piping exists in the area served by the separately derived system, the metal water piping and the structural metal member shall be bonded to the common grounding electrode conductor in the area served by the separately derived system.

Exception: A separate bonding jumper from each derived system to metal water piping and to structural metal members shall not be required if the metal water piping and the structural metal members in the area served by the separately derived system are bonded to the common grounding electrode conductor.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 11:16:44 EST 2020

Committee Statement

Committee Statement: To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual, "available" should not be used.

The AWG designation is added following 3/0. The exceptions are revised for clarity. This revision recognizes the use of electrodes actually in the earth and connections extended to those electrodes by use of the above ground portions.

Response Message: FR-8225-NFPA 70-2020

[Public Input No. 4249-NFPA 70-2020 \[Section No. 250.104\(D\)\]](#)

[Public Input No. 1180-NFPA 70-2020 \[Section No. 250.104\(D\)\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8259-NFPA 70-2020 [Section No. 250.106]****250.106** Lightning Protection Systems.

The lightning protection system ground terminals shall be bonded to the building or structure grounding electrode system.

Informational Note No. 1: See 250.60 for use of strike termination devices. For further information, see NFPA 780-2017 2020 , *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and sideflash distance from lightning protection systems.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non-current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2017 2020 , *Standard for the Installation of Lightning Protection Systems*.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:17:51 EST 2020

Committee Statement

Committee Statement: To comply with Section 4.2 of the 2020 NEC Style Manual, the references to the NFPA 780 standard were updated.

Response Message: FR-8259-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8177-NFPA 70-2020 [Section No. 250.109]****250.109** Metal Enclosures.

Metal enclosures shall be permitted to be used to connect bonding jumpers or equipment grounding conductors, or both, together to become a part of an effective ground-fault current path. ~~Metal covers~~ If installed, metal covers, mud rings, extension rings, and metal fittings shall be attached to these metal enclosures to ensure an effective ground-fault current path or shall be considered as being connected to with bonding jumpers or equipment grounding conductors, or both.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 11:33:23 EST 2020

Committee Statement

Committee Statement: Changes are made to this section to ensure that adapters such as mud rings, and extension rings or fittings are in good electrical contact with the metal enclosure or are bonded to ensure an effective ground fault current path.

Response Message: FR-8177-NFPA 70-2020

[Public Input No. 1409-NFPA 70-2020 \[Section No. 250.109\]](#)

[Public Input No. 2030-NFPA 70-2020 \[Section No. 250.109\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8178-NFPA 70-2020 [Section No. 250.110]****250.110** Equipment Fastened in Place (Fixed) or Connected by Permanent Wiring Methods.

Exposed, normally non-current-carrying metal parts of fixed equipment supplied by or enclosing conductors or components that are likely to become energized shall be connected to an equipment grounding conductor under any of the following conditions:

- (1) ~~Where If~~ within 2.5 m (8 ft) vertically or 1.5 m (5 ft) horizontally of ground or grounded metal objects and subject to contact by persons
- (2) ~~Where If~~ located in a wet or damp location and not isolated
- (3) ~~Where If~~ in electrical contact with metal
- (4) ~~Where If~~ in a hazardous (classified) location ~~as covered by Articles 500 through 517~~
- (5) ~~Where If~~ supplied by a wiring method that provides an equipment grounding conductor, except as permitted by 250.86, Exception No. 2, for short sections of metal enclosures
- (6) ~~Where If~~ equipment operates with any terminal at over 150 volts to ground

Exception No. 1: If exempted by special permission, the metal frame of electrically heated appliances that have the frame permanently and effectively insulated from ground shall not be required to be grounded.

Exception No. 2: Distribution apparatus, such as transformer and capacitor cases, mounted on wooden poles at a height exceeding 2.5 m (8 ft) above ground or grade level shall not be required to be grounded.

Exception No. 3: Listed equipment protected by a system of double insulation, or its equivalent, shall not be required to be connected to the equipment grounding conductor. ~~Where If~~ such a system is employed, the equipment shall be distinctively marked.

Supplemental Information

<u>File Name</u>	<u>Description</u> <u>Approved</u>
NEC_FR8178_250.110.docx	For staff use

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 11:36:53 EST 2020

Committee Statement

Committee Statement: Changes are made to correct terms to comply with the NEC Style Manual.

Response Message: FR-8178-NFPA 70-2020

Public Input No. 3810-NFPA 70-2020 [Section No. 250.110]

Ballot Results

✓ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8260-NFPA 70-2020 [Section No. 250.112]****250.112** Specific Equipment Fastened in Place (Fixed) or Connected by Permanent Wiring Methods.

Except as permitted in 250.112(F) and (I), exposed, normally non-current-carrying metal parts of equipment described in 250.112(A) through (K), and normally non-current-carrying metal parts of equipment and enclosures described in 250.112(L) and (M), shall be connected to an equipment grounding conductor, regardless of voltage.

(A) Switchgear and Switchboard Frames and Structures.

Switchgear or switchboard frames and structures supporting switching equipment, except frames of 2-wire dc switchgear or switchboards ~~where~~ if effectively insulated from ground.

(B) Pipe Organs.

Generator and motor frames in an electrically operated pipe organ, unless effectively insulated from ground and the motor driving it.

(C) Motor Frames.

Motor frames, as provided by 430.242.

(D) Enclosures for Motor Controllers.

Enclosures for motor controllers unless attached to ungrounded portable equipment.

(E) Elevators and Cranes.

Electrical equipment for elevators and cranes.

(F) Garages, Theaters, and Motion Picture Studios.

Electrical equipment in commercial garages, theaters, and motion picture studios, except pendant lampholders supplied by circuits not over 150 volts to ground.

(G) Electric Signs.

Electric signs, outline lighting, and associated equipment as provided in 600.7.

(H) Motion Picture Projection Equipment.

Motion picture projection equipment.

(I) Remote-Control, Signaling, and Fire Alarm Circuits.

Equipment supplied by Class 1 circuits shall be grounded unless operating at less than 50 volts. Equipment supplied by Class 1 power-limited circuits, by Class 2 and Class 3 remote-control and signaling circuits, and by fire alarm circuits shall be grounded ~~where~~ if system grounding is required by Part II or Part VIII of this article.

(J) Luminaires.

Luminaires as provided in Part V of Article 410.

(K) Skid-Mounted Equipment.

Permanently mounted electrical equipment and skids shall be connected to the equipment grounding conductor. Wire-type equipment grounding conductors shall be sized as required by 250.122.

(L) Motor-Operated Water Pumps.

Motor-operated water pumps, including the submersible type.

(M) Metal Well Casings.

~~Where~~ if a submersible pump is used in a metal well casing, the well casing shall be connected to the pump circuit equipment grounding conductor.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:21:28 EST 2020

Committee Statement

Committee Statement: To add clarity and comply with Section 3.3.4 Word Clarity in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8260-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.



First Revision No. 8179-NFPA 70-2020 [Section No. 250.114]

250.114 Equipment Connected by Cord and Plug.

Exposed, normally non-current-carrying metal parts of cord-and-plug-connected equipment shall be connected to the equipment grounding conductor under any of the following conditions:

Exception: Listed tools, listed appliances, and listed equipment covered in 250.114(2) through (4), list items 2 through 4, shall not be required to be connected to an equipment grounding conductor where if protected by a system of double insulation or its equivalent. Double-insulated equipment shall be distinctively marked.

(1) In hazardous (classified) locations (~~see Articles 500 through 517~~)

(2) ~~Where if~~ operated at over 150 volts to ground

Exception No. 1 to (2): Motors, where if guarded, shall not be required to be connected to an equipment grounding conductor.

Exception No. 2 to (2): Metal frames of electrically heated appliances, exempted by special permission, shall not be required to be connected to an equipment grounding conductor, in which case the frames shall be permanently and effectively insulated from ground.

(3) In residential occupancies:

- a. Refrigerators, freezers, icemakers, and air conditioners
- b. Clothes-washing, clothes-drying, and dish-washing machines; ranges; kitchen waste disposers; information technology equipment; sump pumps; and electrical aquarium equipment
- c. Hand-held motor-operated tools, stationary and fixed motor-operated tools, and light industrial motor-operated tools
- d. Motor-operated appliances of the following types: hedge clippers, lawn mowers, snow blowers, and wet scrubbers
- e. Portable handlamps and portable luminaires

(4) In other than residential occupancies:

- a. Refrigerators, freezers, icemakers, and air conditioners
- b. Clothes-washing, clothes-drying, and dish-washing machines; information technology equipment; sump pumps; and electrical aquarium equipment
- c. Hand-held motor-operated tools, stationary and fixed motor-operated tools, and light industrial motor-operated tools
- d. Motor-operated appliances of the following types: hedge clippers, lawn mowers, snow blowers, and wet scrubbers
- e. Portable handlamps and portable luminaires
- f. Cord-and-plug-connected appliances used in damp or wet locations or by persons standing on the ground, standing on metal floors, or working inside of metal tanks or boilers
- g. Tools likely to be used in wet or conductive locations

Exception: Tools and portable handlamps and portable luminaires likely to be used in wet or conductive locations shall not be required to be connected to an equipment grounding conductor where if supplied through an isolating transformer with an ungrounded secondary of not over 50 volts.

Supplemental Information

<u>File Name</u>	<u>Description Approved</u>
NEC_FR8179_250.114.docx	For staff use

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 11:42:39 EST 2020

Committee Statement

Committee Statement: References to entire articles were deleted to comply with the NEC Style Manual. Icemakers are added to the list of equipment requiring grounding. A consequence of the icemaker design and function is the frequent introduction of water on floors and on the equipment. Users of icemakers often come into contact with moisture/water for example; stepping into puddles of water from spilled ice or condensate on the floor as a result of the refrigeration cycle. Requiring icemakers to be connected to an equipment grounding conductor will help ensure a reliable/safe path for fault current.

To add clarity and comply with Section 3.3.4 Word Clarity in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" throughout the section.

Response Message: FR-8179-NFPA 70-2020

[Public Input No. 3814-NFPA 70-2020 \[Section No. 250.114\]](#)

[Public Input No. 1210-NFPA 70-2020 \[Section No. 250.114\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8261-NFPA 70-2020 [Section No. 250.116]****250.116** Nonelectrical Equipment.

The metal parts of the following nonelectrical equipment described in this section shall be connected to the equipment grounding conductor:

- (1) Frames and tracks of electrically operated cranes and hoists
- (2) Frames of nonelectrically driven elevator cars to which electrical conductors are attached
- (3) Hand-operated metal shifting ropes or cables of electric elevators

Informational Note: ~~Where~~ If extensive metal in or on buildings or structures may become energized and is subject to personal contact, adequate bonding and grounding will provide additional safety.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:23:38 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8261-NFPA 70-2020

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumner, Darrell M.

**First Revision No. 8184-NFPA 70-2020 [Section No. 250.118]****250.118** Types of Equipment Grounding Conductors.**(A)** Permitted.

The Each equipment grounding conductor run with or enclosing the circuit conductors shall be one or more or a combination of the following:

- (1) A copper, aluminum, or copper-clad aluminum conductor. This conductor shall be solid or stranded; insulated, covered, or bare; and in the form of a wire or a busbar of any shape.
- (2) Rigid metal conduit.
- (3) Intermediate metal conduit.
- (4) Electrical metallic tubing.
- (5) Listed flexible metal conduit meeting all the following conditions:
 - a. The conduit is terminated in listed fittings.
 - b. The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
 - c. The size of the conduit does not exceed metric designator 35 (trade size 1¼).
 - d. The combined length of flexible metal conduit, flexible metallic tubing, and liquidtight flexible metal conduit in the same effective ground-fault current path does not exceed 1.8 m (6 ft).
 - e. ~~If used to connect equipment where~~ flexibility is necessary to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation, a wire-type equipment grounding conductor or a bonding jumper in accordance with 250.102(E)(2) shall be installed.
- (6) Listed liquidtight flexible metal conduit meeting all the following conditions:
 - a. The conduit is terminated in listed fittings.
 - b. For metric designators 12 through 16 (trade sizes ¾ through ½), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
 - c. For metric designators 21 through 35 (trade sizes ¾ through 1¼), the circuit conductors contained in the conduit are protected by overcurrent devices rated not more than 60 amperes and there is no flexible metal conduit, flexible metallic tubing, or liquidtight flexible metal conduit in metric designators 12 through 16 (trade sizes ¾ through ½) in the effective ground-fault current path.
 - d. The combined length of flexible metal conduit, flexible metallic tubing, and liquidtight flexible metal conduit in the same effective ground-fault current path does not exceed 1.8 m (6 ft).
 - e. ~~If used to connect equipment where~~ flexibility is necessary to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation, a wire-type equipment grounding conductor or a bonding jumper in accordance with 250.102(E)(2) shall be installed.
 - f. If liquidtight flexible metal conduit contains a stainless steel core, a wire-type equipment grounding conductor or a bonding jumper in accordance with 250.102(E)(2) shall be installed.
- (7) Flexible metallic tubing ~~where if~~ the tubing is terminated in listed fittings and meeting the following conditions:
 - a. The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.
 - b. The combined length of flexible metal conduit, flexible metallic tubing, and liquidtight flexible metal conduit in the same effective ground-fault current path does not exceed 1.8 m (6 ft).
- (8) Armor of Type AC cable as provided in 320.108.
- (9) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.
- (10) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:
 - a. It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118(1).
 - b. The combined metallic sheath and uninsulated equipment grounding/bonding conductor of interlocked metal tape-type MC cable that is listed and identified as an equipment grounding conductor
 - c. The metallic sheath or the combined metallic sheath and equipment grounding conductors of the smooth or corrugated tube-type MC cable that is listed and identified as an equipment grounding conductor
- (11) Cable trays as permitted in 392.10 and 392.60.
- (12) Cablebus framework as permitted in 370.60(1).
- (13) Other listed electrically continuous metal raceways and listed auxiliary gutters.
- (14) Surface metal raceways listed for grounding.

Informational Note: See Article 100 ~~For~~ for a definition of *effective ground-fault current path*.

Detail FR-8370

(B) Restricted Use of Equipment Grounding Conductors Not Permitted.

The following shall not be used as equipment grounding conductors.

- (1) ~~An equipment grounding conductor shall not be used as a grounding electrode conductor.~~ Grounding electrode conductors

Exception: A wire-type equipment grounding conductor installed in compliance with 250.6(A) and the applicable requirements for both the equipment grounding conductor and the grounding electrode conductor in Parts II, III, and VI of this article shall be permitted to serve as both an equipment grounding conductor and a grounding electrode conductor.

- (2) ~~The structural~~ Structural metal frame of a building or structure shall not be used as an equipment grounding conductor.

(A) Grounding Electrode Conductor.**(B) Metal Frame of Building or Structure.**

Supplemental Information

<u>File Name</u>	<u>Description</u> <u>Approved</u>
NEC_FR8184_250.118.docx	For staff use

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 12:03:26 EST 2020

Committee Statement

Committee Statement: Arranging the section into two first subdivisions with types of equipment grounding conductors permitted and not permitted will improve the clarity of the requirements. The term "each" was added to the text to clarify that all equipment grounding conductors installed must comply with all the applicable requirements of Article 250.

New Item (6)(f) has been added for installations where high resistance to corrosion is required. Stainless steel core has a higher resistivity than other metals used in flexible conduit and higher corrosion resistance properties, a separate internal equipment grounding conductor or external bonding jumper is required to be installed in all installations to provide an effective ground fault current path. For consistency, the bonding jumper reference was also added to (5)(e) and (6)(e).

To add comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Unnecessary wording was removed from Item (6)(e) and 7(e) for clarity.

Response Message: FR-8184-NFPA 70-2020

Public Input No. 2940-NFPA 70-2020 [Section No. 250.118]

Ballot Results

✔ This item has passed ballot

- 16 Eligible Voters
- 1 Not Returned
- 13 Affirmative All
 - 1 Affirmative with Comments
 - 0 Negative with Comments
 - 1 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Affirmative with Comment

Andre, Joseph F.

I would like to see more definitive testing and data for the resistance of stainless steel LFMC. If a different manufacturer submits a similar product with less resistance (thicker SS convolutions, different metallurgy, etc.) it would still require a wire-type EGC even if it would pass the testing without it. I feel this would be better as a manufacturer's requirement under 110.3(B).

Abstention

Dobrowsky, Paul

I am abstaining because I do some consulting work and want to ensure that my vote is not misconstrued as being benefited from that work.



First Revision No. 8200-NFPA 70-2020 [Section No. 250.119]

250.119 Identification of Wire-Type Equipment Grounding Conductors.

(A) General.

Unless required elsewhere in this *Code*, equipment grounding conductors shall be permitted to be bare, covered, or insulated. Individually covered or insulated equipment grounding conductors of the wire type shall have a continuous outer finish that is either green or green with one or more yellow stripes except as permitted in this section. Conductors with insulation or individual covering that is green, green with one or more yellow stripes, or otherwise identified as permitted by this section shall not be used for ungrounded or grounded circuit conductors.

Exception No. 1: Power-limited Class 2 or Class 3 cables, power-limited fire alarm cables, or communications cables containing only circuits operating at less than 50 volts ac or 60 volts dc ~~where if~~ connected to equipment not required to be grounded shall be permitted to use a conductor with green insulation or green with one or more yellow stripes for other than equipment grounding purposes.

Exception No. 2: Flexible cords having an integral insulation and jacket without an equipment grounding conductor shall be permitted to have a continuous outer finish that is green.

Informational Note: An example of a flexible cord with integral-type insulation is Type SPT-2, 2 conductor.

Exception No. 3: Conductors with green insulation shall be permitted to be used as ungrounded signal conductors where installed between the output terminations of traffic signal control and traffic signal indicating heads. Signaling circuits installed in accordance with this exception shall include an equipment grounding conductor in accordance with 250.118. Wire-type equipment grounding conductors shall be bare or have insulation or covering that is green with one or more yellow stripes.

(B) Conductors 4 AWG and Larger.

Equipment grounding conductors 4 AWG and larger shall comply with 250.119(A)(1) ~~and (A)(2): the following:~~

- (1) ~~An insulated or covered conductor 4 AWG and larger shall be permitted, at At~~ the time of installation, ~~to if the insulation does not comply with 250.119(A), it shall~~ be permanently identified as an equipment grounding conductor at each end and at every point where the conductor is accessible.

Exception: Conductors 4 AWG and larger shall not be required to be marked in conduit bodies that contain no splices or unused hubs.

- (2) Identification shall encircle the conductor and shall be accomplished by one of the following:

- a. Stripping the insulation or covering from the entire exposed length
- b. Coloring the insulation or covering green at the termination
- c. Marking the insulation or covering with green tape or green adhesive labels at the termination

(C) Multiconductor Cable.

One or more insulated conductors in a multiconductor cable, at the time of installation, shall be permitted to be permanently identified as equipment grounding conductors at each end and at every point where the conductors are accessible by one of the following means:

- (1) Stripping the insulation from the entire exposed length.
- (2) Coloring the exposed insulation green.
- (3) Marking the exposed insulation with green tape or green adhesive labels. Identification shall encircle the conductor.

(D) Flexible Cord.

Equipment grounding conductors in flexible cords shall be insulated and shall have a continuous outer finish that is either green or green with one or more yellow stripes.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 13:02:51 EST 2020

Committee Statement

Committee Statement: This revision clarifies that the identification applies only to equipment grounding conductors of the wire type. Clarity is improved by adding a new (A) General for the first subdivision, subsequent sections lettering is revised. Clarity is improved for the requirements for identification of conductors 4 AWG or larger in (B).

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" in Exception No. 1.

Response Message: FR-8200-NFPA 70-2020

Public Input No. 2391-NFPA 70-2020 [Section No. 250.119 [Excluding any Sub-Sections]]

[Public Input No. 130-NFPA 70-2019 \[Section No. 250.119 \[Excluding any Sub-Sections\]\]](#)

[Public Input No. 2291-NFPA 70-2020 \[Section No. 250.119\(A\)\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8219-NFPA 70-2020 [Section No. 250.120]

250.120 Equipment Grounding Conductor Installation.

An equipment grounding conductor shall be installed in accordance with 250.120(A), (B), and (C).

(A) Raceway, Cable Trays, Cable Armor, Cablebus, or Cable Sheaths.

~~Where if~~ it consists of a raceway, cable tray, cable armor, cablebus framework, or cable sheath or ~~where if~~ it is a wire within a raceway or cable, it shall be installed in accordance with the applicable provisions in this *Code* using fittings for joints and terminations approved for use with the type of raceway or cable used. All connections, joints, and fittings shall be made tight using suitable tools.

Informational Note: See the UL ~~guide information on FHIT systems~~ Guide Information for Electrical Circuit Integrity Systems (FHIT) for equipment grounding conductors installed in a raceway that are part of ~~an a listed~~ electrical circuit protective system or a listed fire-resistive cable system. ~~-rated cable listed to maintain circuit integrity.~~

(B) Aluminum and Copper-Clad Aluminum Conductors.

Equipment grounding conductors of bare, covered, or insulated aluminum or copper-clad aluminum shall comply with the following:

- (1) Unless part of ~~a suitable Chapter 3~~ an applicable cable wiring method, bare or covered conductors shall not be installed ~~where if~~ subject to corrosive conditions or be installed in direct contact with concrete, masonry, or the earth.
- (2) Terminations made within outdoor enclosures that are listed and identified for the environment shall be permitted within 450 mm (18 in.) of the bottom of the enclosure.
- (3) Aluminum or copper-clad aluminum conductors external to buildings or enclosures shall not be terminated within 450 mm (18 in.) of the earth, unless terminated within a listed wire connector system.

(C) Equipment Grounding Conductors Smaller Than 6 AWG.

~~Where if~~ not routed with circuit conductors as permitted in 250.130(C) and ~~250.134(A)~~ 250.134, Exception No. 2, equipment grounding conductors smaller than 6 AWG shall be protected from physical damage by an identified raceway or cable armor unless installed within hollow spaces of the framing members of buildings or structures and ~~where if~~ not subject to physical damage.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Thu Dec 17 16:11:36 EST 2020

Committee Statement

Committee Statement: The Informational Note is made to update the document title from the UL Guide Information on FHIT to the current title.

The revision to 250.120(C) is editorial and corrects a legacy error caused by renumbering Section 250.134 in the 2020 NEC cycle.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word “where” was changed to “if” throughout 250.120.

List Item (1) in (B) has been revised to comply with NEC Style Manual, Section 4.3.1 Reference Structure.

Response Message: FR-8219-NFPA 70-2020

Public Input No. 2097-NFPA 70-2020 [Section No. 250.120(A)]

Public Input No. 3324-NFPA 70-2020 [Section No. 250.120(C)]

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8281-NFPA 70-2020 [Section No. 250.122]

250.122 Size of Wire-Type Equipment Grounding Conductors.

(A) General.

Copper, aluminum, or copper-clad aluminum equipment grounding conductors of the wire type shall not be smaller than shown in Table 250.122. The equipment grounding conductor shall not be required to be larger than the circuit conductors largest circuit conductor, or sum of the circular mil area for parallel conductors, supplying the equipment. If a cable tray, a raceway, or a cable armor or sheath is used as the equipment grounding conductor, as provided in 250.118 and 250.134(1), it shall comply with 250.4(A)(5) or (B)(4).

Equipment grounding conductors shall be permitted to be sectioned within a multiconductor cable, provided the combined circular mil area complies with Table 250.122.

(B) Increased in Size.

If ungrounded conductors are increased in size for any reason other than as required in 310.15(B) or 310.15(C), wire-type equipment grounding conductors, if installed, shall be increased in size proportionately to the increase in circular mil area of the ungrounded conductors.

Exception: Equipment grounding conductors shall be permitted to be sized under engineering supervision or by a qualified person to provide an effective ground-fault current path in accordance with using industry practices to meet the performance objectives of 250.4(A)(5) or (B)(4). Documentation of the method used and the equipment grounding conductor size shall be made available to the authority having jurisdiction upon request.

(C) Multiple Circuits.

A single equipment grounding conductor shall be permitted to be installed for multiple circuits that are installed in the same raceway, cable, trench, or cable tray. It shall be sized from Table 250.122 for the largest overcurrent device protecting circuit conductors in the raceway, cable, trench, or cable tray. Equipment grounding conductors installed in cable trays shall meet the minimum requirements of 392.10(B)(1)(c).

(D) Motor Circuits.

Equipment grounding conductors for motor circuits shall be sized in accordance with 250.122(D)(1) or (D)(2).

(1) General.

The equipment grounding conductor size shall not be smaller than determined by 250.122(A) based on the rating of the branch-circuit short-circuit and ground-fault protective device.

(2) Instantaneous-Trip Circuit Breaker and Motor Short-Circuit Protector.

If the overcurrent device is an instantaneous-trip circuit breaker or a motor short-circuit protector, the equipment grounding conductor shall be sized not smaller than that given by 250.122(A) using the maximum permitted rating of a dual element time-delay fuse selected for branch-circuit short-circuit and ground-fault protection in accordance with 430.52(C)(1), Exception No. 1.

(E) Flexible Cord and Fixture Wire.

The equipment grounding conductor in a flexible cord with the largest circuit conductor 10 AWG or smaller, and the equipment grounding conductor used with fixture wires of any size in accordance with 240.5, shall not be smaller than 18 AWG copper and shall not be smaller than the circuit conductors. The equipment grounding conductor in a flexible cord with a circuit conductor larger than 10 AWG shall be sized in accordance with Table 250.122.

(F) Conductors in Parallel.

For circuits of parallel conductors as permitted in 310.10(G), the equipment grounding conductor shall be installed in accordance with 250.122(F)(1) or (F)(2).

(1) Conductor Installations in Raceways, Auxiliary Gutters, or Cable Trays.

(a) *Single Raceway or Cable Tray, Auxiliary Gutter, or Cable Tray.* If circuit conductors are connected in parallel in the same raceway, auxiliary gutter, or cable tray, a single wire-type conductor shall be permitted as the equipment grounding conductor. The wire-type equipment grounding conductor shall be sized in accordance with 250.122; based on the overcurrent protective device for the feeder or branch circuit.

(b) *Multiple Raceways.* If conductors are installed in multiple raceways and are connected in parallel, a wire-type equipment grounding conductor, if used, shall be installed in each raceway and shall be connected in parallel. The equipment grounding conductor installed in each raceway shall be sized in accordance with 250.122 based on the rating of the overcurrent protective device for the feeder or branch circuit.

(c) *Wire-Type Equipment Grounding Conductors in Cable Trays.* Wire-type equipment grounding conductors installed in cable trays shall meet the minimum requirements of 392.10(B)(1)(c).

(c) *Metal Raceways, Auxiliary Gutters, or Cable Trays.* ~~Metal raceways or auxiliary gutters in accordance with 250.118 or cable trays complying with 392.60(B) shall be permitted as the equipment grounding conductor.~~

(2) Multiconductor Cables.

(a) Except as provided in 250.122(F)(2)(c) for raceway or cable tray installations, the equipment grounding conductor in each multiconductor cable shall be sized in accordance with 250.122 based on the overcurrent protective device for the feeder or branch circuit.

(b) If circuit conductors of multiconductor cables are connected in parallel, the equipment grounding conductor(s) in each cable shall be connected in parallel.

(c) If multiconductor cables are paralleled in the same raceway, auxiliary gutter, or cable tray, a single equipment grounding conductor that is sized in accordance with 250.122 shall be permitted in combination with the equipment grounding conductors provided within the multiconductor cables and shall all be connected together.

(d) Equipment grounding conductors installed in cable trays shall meet the minimum requirements of 392.10(B)(1)(c). Cable trays complying with 392.60(B), metal raceways in accordance with 250.118, or auxiliary gutters shall be permitted as the equipment grounding conductor.

(G) Feeder Taps.

Equipment grounding conductors installed with feeder taps shall not be smaller than shown in Table 250.122 based on the rating of the overcurrent device ahead of the feeder on the supply side ahead of the tap but shall not be required to be larger than the tap conductors.

Table 250.122 Minimum Size Equipment Grounding Conductors for Grounding Raceway and Equipment

<u>Rating or Setting of Automatic Overcurrent Device in Circuit Ahead of Equipment, Conduit, etc., Not Exceeding (Amperes)</u>	<u>Size (AWG or kcmil)</u>	
	<u>Copper</u>	<u>Aluminum or Copper-Clad Aluminum*</u>
15	14	12
20	12	10
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	750
5000	700	1250
6000	800	1250

Note: ~~Where~~ If necessary to comply with 250.4(A)(5) or (B)(4), the equipment grounding conductor shall be sized larger than given in this table.

*See installation restrictions in 250.120.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Wed Dec 23 10:46:24 EST 2020

Committee Statement

Committee Statement: The subject of 250.122 is sizing wire type equipment grounding conductor, not the other choices included in 250.118. Emphasizing the subject in the title excludes other types of equipment grounding conductors from the scope and allows the superfluous language in 250.122(F)(1)(d) to be removed.

The added language in 250.122(A) is necessary to clarify the maximum size of an equipment grounding conductor is not limited to the individual circuit conductors of a parallel installation.

Using alternative methods under engineering supervision is consistent with other requirements in the NEC. Industry practices in the form of software is readily available to confirm that equipment grounding conductors are sized

appropriately. The requirement for documentation was added to allow the AHJ to confirm the equipment grounding conductor size determination is valid.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if in Table 250.122 Note.

Response Message: FR-8281-NFPA 70-2020

[Public Input No. 1836-NFPA 70-2020 \[Section No. 250.122\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

11 Affirmative All

2 Affirmative with Comments

1 Negative with Comments

1 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Atkins, Derrick L.

Bowmer, Trevor N.

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Affirmative with Comment

Andre, Joseph F.

There should be an Informational Note added to 250.122(B) after the exception to read as follows: Informational Note. See Grounding and Electromagnetic Interference (GEMI) Software for an industry practice method of determining acceptable equipment grounding conductor sizes. Reason: There was significant discussion during the First Revision hearings about the availability of software specific to sizing EGC's. The referenced program will reduce confusion, add clarity, and provide a specific resource for applying the exception.

Mohla, Daleep C.

See Document CMP5 FR 8281 Affirmative Comment- Mohla sent separately to Sarah Caldwell and Patrick Foley.

Negative with Comment

Crawford, Carlie Rose

See attached file for comment

Abstention

Dobrowsky, Paul

I am abstaining because I do some consulting work and want to ensure that my vote is not misconstrued as being benefited from that work.

Carlie Rose Crawford

CDA votes negative because inadequate and flawed substantiation was supplied for a change of this magnitude. No documentation was supplied to indicate that the equipment grounding conductors required in this table can be reduced in size without compromising safety. The allowance in the Exception to 250.122(B) for a "qualified person" to revise the size of the equipment grounding conductor using "industry practices" is faulty. The size of the EGC is an important safety requirement in Article 250. It should never be allowed to be smaller than provided in Table 250.122. In fact, the title of Table 250.122 requires that the EGC is the "Minimum Size EGC ...". The EGC is permitted to be larger than the minimum size provided in Table 250.122 but not smaller. The Note at the bottom of Table 250.122 provides additional important safeguards stating that "Where necessary to comply with 250.4(A) (5) or (B)(4), the equipment grounding conductor shall be sized larger than given in this table". These sections provide important safeguards in providing an EGC that will provide an effective groundfault return path. There is no assurance that a qualified person will select the proper parameters to evaluate the capability of the EGC to carry fault current for an unspecified duration until an overcurrent device operates. Also, the revision does not specify the "industry practice" that must be used in application of this exception. What industry practice? This is wide-open to differing interpretation and will make enforcement of this section impossible.

CMP 5 -First Revision 8281 Affirmative Comment – Daleep Mohla

Affirmative Comment to First Revision No. 8281-NFPA 70-2020 [Section No. 250.122 (A)

Background

250.122 Size of Wire Type Equipment Grounding Conductors.

(A) General.

Copper, aluminum, or copper-clad aluminum equipment grounding conductors of the wire type shall not be smaller than shown in Table 250.122. The equipment grounding conductor shall not be required to be larger than the circuit conductors largest circuit conductor, or sum of the circular mil area for parallel conductors, supplying the equipment. If a cable tray, a raceway, or a cable armor or sheath is used as the equipment grounding conductor, as provided in 250.118 and 250.134(1), it shall comply with 250.4(A)(5) or (B)(4). Equipment grounding conductors shall be permitted to be sectioned within a multiconductor cable, provided the combined circular mil area complies with Table 250.122

Statement

There is no technical justification for the new text added requiring that the EGC shall not be required to be larger than sum of circular mill area for parallel conductors. This can result in an EGC larger than the circuit conductors. The largest size of EGC should not be required to be larger than the largest circuit conductors.

A properly sized equipment grounding conductor (EGC) is to provide a ground fault current return path to permit circuit protective device used to clear a fault and to do so without extensive damage to the electrical equipment of the circuit as stipulated in NEC 2020 – 110.10

250.122 (A) is based on the premise that the wire type equipment grounding conductors (EGC) in parallel will not share ground fault current. This premise is technically is not defensible.

If we rely on multiple conductors to provide the desired ampacity for ungrounded and grounded conductors, why is the same rationale and engineering principle not valid for the wire type equipment grounding conductors?

250.102 (C)(2) permits supply side bonding jumper to be sized based on size of ungrounded conductors in each raceway and cable. The same approach should be valid for 250.122, The EGC in parallel raceways should not be required to be larger than the size of circuit conductors in each raceway or cable.

CMP 5 -First Revision 8281 Affirmative Comment – Daleep Mohla

Connectors used for grounding are tested and listed according to UL 467 Standard for Safety Grounding and Bonding Equipment. The current and time used for this testing are listed in Table 5. of UL 467. I understand that pass fail criteria from the UL467 Short Time Current test is electrical continuity after current test.

Test current values are derived from the formula listed in Annex C of IEEE Standard 837 and is based on 1083°C for melting point of copper and 657°C for aluminum. The formula can be used to calculate fusing current at other values of current and clearing time than table 5 specifies.

Using formulas in Annex C of IEEE Std 837-2002 and taking into account the thermal characteristics of the material carrying the current the short-time current value was calculated. The formula yields the fusing current for the conductors and materials for which material constants are known. In short, Table 5 identifies the test time which is also the fusing current for the conductor.

Correlating committee is requested to consider have testing done by NFPA Research Foundation to establish and document that the ground fault current will be shared by multiple equipment grounding conductors in parallel same as ungrounded and grounded conductors and it is not necessary to oversize EGC for proper protection of electrical equipment.

**First Revision No. 8262-NFPA 70-2020 [Section No. 250.124(A)]****(A) Separable Connections.**

Separable connections such as those provided in drawout equipment or attachment plugs and mating connectors and receptacles shall provide for first-make, last-break of the equipment grounding conductor. First-make, last-break shall not be required ~~where~~ if interlocked equipment, plugs, receptacles, and connectors preclude energization without grounding continuity.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:27:42 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if."

Response Message: FR-8262-NFPA 70-2020

Ballot Results**✔ This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8228-NFPA 70-2020 [Section No. 250.130]

250.130 Equipment Grounding Conductor Connections.

Equipment grounding conductor connections at the source of separately derived systems shall be made in accordance with 250.30(A)(1). Equipment grounding conductor connections at service equipment shall be made as indicated in 250.130(A) or (B). For replacement of non-grounding-type receptacles with grounding-type receptacles, or snap switches without an equipment grounding terminal with snap switches with an equipment grounding terminal, and for branch-circuit extensions only in existing installations that do not have an equipment grounding conductor in the branch circuit, connections shall be permitted as indicated in 250.130(C).

(A) For Grounded Systems.

The connection shall be made by bonding the equipment grounding conductor to the grounded service conductor and the grounding electrode conductor.

(B) For Ungrounded Systems.

The connection shall be made by bonding the equipment grounding conductor to the grounding electrode conductor.

(C) Replacement of Nongrounding Receptacle ~~Replacement~~ or Snap Switch and Branch Circuit Extensions.

The equipment grounding conductor of a grounding-type receptacle, a snap switch with an equipment grounding terminal, or a branch-circuit extension point shall be permitted to be connected to any of the following:

- (1) Any accessible point on the grounding electrode system as described in 250.50
- (2) Any accessible point on the grounding electrode conductor
- (3) The equipment grounding terminal bar within the enclosure where the branch circuit for the receptacle or branch circuit originates
- (4) An equipment grounding conductor that is part of another branch circuit that originates from the enclosure where the branch circuit for the receptacle or branch circuit originates
- (5) For grounded systems, the grounded service conductor within the service equipment enclosure
- (6) For ungrounded systems, the grounding terminal bar within the service equipment enclosure

Informational Note No. 1: See 406.4(D) for the use of a ground-fault circuit-interrupting type of receptacle.

Informational Note No. 2: See 404.9(B) for requirements regarding grounding of snap switches.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 12:26:46 EST 2020

Committee Statement

Committee Statement: Section 250.130 provides coordination with Article 406 regarding the replacement of non-grounding type receptacles but is silent on replacement of snap switches without an equipment grounding conductor as permitted in 404.9(B), for equivalent safety concerns. This revision provides direction to the user regarding providing an equipment grounding conductor or equipment bonding jumper to meet the requirements of Article 404 when an existing means is not provided. An added information note provides a link to the 404.9 requirements.

Response Message: FR-8228-NFPA 70-2020

Public Input No. 4379-NFPA 70-2020 [Section No. 250.130(C)]

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8229-NFPA 70-2020 [Section No. 250.132]****250.132** Short Sections of Raceway or Cable Armor .

Isolated sections of metal raceway or cable armor, if required to be connected to an equipment grounding conductor, shall be connected in accordance with 250.134.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 12:34:03 EST 2020

Committee Statement

Committee Statement: The title is revised to reflect the information in the text.

Response Message: FR-8229-NFPA 70-2020

Public Input No. 145-NFPA 70-2019 [Section No. 250.132]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8230-NFPA 70-2020 [Section No. 250.136]****250.136** Equipment Secured to Grounded a Metal Supports Rack or Structure .

~~Electrical equipment secured to and in electrical contact with~~ If a metal rack or structure provided for its support is connected to an equipment grounding conductor in accordance with 250.134 , it shall be permitted to be considered as being connected to an serve as the equipment grounding conductor if for electrical equipment secured to and in electrical contact with the metal rack or structure, is connected to an equipment grounding conductor by one of the means indicated in 250.134 .

Submitter Information Verification**Committee:** NEC-P05**Submittal Date:** Fri Dec 18 12:39:03 EST 2020**Committee Statement**

Committee Statement: This modification revises the title to 250.136 to reflect the content in the text.

To add clarity the section was revised and to comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual the term "considered" is not used.

Response Message: FR-8230-NFPA 70-2020

Public Input No. 1312-NFPA 70-2020 [Section No. 250.136]

Ballot Results

✓ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumner, Darrell M.

**First Revision No. 8263-NFPA 70-2020 [Section No. 250.138(B)]**

(B) By Means of a Separate Flexible Wire or Strap.

By means of a separate flexible wire or strap, insulated or bare, connected to an equipment grounding conductor, and protected as well as practicable against physical damage, ~~where~~ if part of equipment.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:29:38 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if."

Response Message: FR-8263-NFPA 70-2020

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8231-NFPA 70-2020 [Section No. 250.140]****250.140** Frames of Ranges and Clothes Dryers.

Frames of electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers, and outlet or junction boxes that are part of the circuit for these appliances shall be connected to the equipment grounding conductor in the manner specified by 250.134 or 250.138.

Exception: For existing branch-circuit installations only ~~where~~ if an equipment grounding conductor is not present in the outlet or junction box, the frames of electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers, and outlet or junction boxes that are part of the circuit for these appliances shall be permitted to be connected to the grounded circuit conductor if all the following conditions are met.

- (1) *The supply circuit is 120/240-volt, single-phase, 3-wire; or 208Y/120-volt derived from a 3-phase, 4-wire, wye-connected system.*
- (2) *The grounded conductor is not smaller than 10 AWG copper or 8 AWG aluminum or copper-clad aluminum.*
- (3) *The grounded conductor is insulated, or the grounded conductor is uninsulated and part of a Type SE service-entrance cable and the branch circuit originates at the service equipment.*
- (4) *Grounding contacts of receptacles furnished as part of the equipment are bonded to the equipment.*

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 13:07:02 EST 2020

Committee Statement

Committee Statement: Copper-clad aluminum was added to 250.140(3) because it is recognized in the NEC as an acceptable conductor material.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if."

Response Message: FR-8231-NFPA 70-2020

[Public Input No. 2473-NFPA 70-2020 \[Section No. 250.140\]](#)

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
13 Affirmative All
0 Affirmative with Comments
2 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Negative with Comment

Abernathy, Paul W.

Inadequate substantiation was provided to support this change.

Crawford, Carlie Rose

CDA votes negative. Inadequate substantiation was submitted to show that Copper-clad aluminum conductor is suitable for this application.

**First Revision No. 8238-NFPA 70-2020 [Section No. 250.144]****250.144 Multiple Circuit Connections.**

Where ~~If~~ equipment is required to be grounded and is supplied by ~~separate connection to~~ more than one circuit or grounded premises wiring system, containing an equipment grounding conductor ~~termination~~, a means to terminate each equipment grounding conductor meeting the requirements of 250.8 shall be provided for each such connection as specified in 250.134 and 250.138.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 15:03:16 EST 2020

Committee Statement

Committee Statement: This revision clarifies the requirement and simplifies the language. An additional requirement is added to ensure the means for termination is compliant with 250.8.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if."

Response Message: FR-8238-NFPA 70-2020

Public Input No. 1314-NFPA 70-2020 [Section No. 250.144]

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.



First Revision No. 8264-NFPA 70-2020 [Section No. 250.146]

250.146 Connecting Receptacle Grounding Terminal to an Equipment Grounding Conductor.

An equipment bonding jumper shall be used to connect the grounding terminal of a grounding-type receptacle to a metal box that is connected to an equipment grounding conductor, except as permitted in 250.146(A) through (D). The equipment bonding jumper shall be sized in accordance with Table 250.122.

(A) Surface-Mounted Box.

If a metal box is mounted on the surface, the direct metal-to-metal contact between the device yoke or strap to the box shall be permitted to provide the required effective ground-fault current path. At least one of the insulating washers shall be removed from receptacles that do not have a contact yoke or device to ensure direct metal-to-metal contact. Direct metal-to-metal contact for providing continuity applies to cover-mounted receptacles if the box and cover combination are listed as providing ~~satisfactory~~ continuity between the box and the receptacle. A listed exposed work cover shall be permitted to be the grounding and bonding means under both of the following conditions:

- (1) The device is attached to the cover with at least two fasteners that are permanent (such as a rivet) or have a thread-locking or screw- or nut-locking means.
- (2) The cover mounting holes are located on a flat nonraised portion of the cover.

(B) Contact Devices or Yokes.

Contact devices or yokes designed and listed as self-grounding shall be permitted in conjunction with the supporting screws to establish equipment bonding between the device yoke and flush-type boxes.

(C) Floor Boxes.

Floor boxes designed for and listed as providing ~~satisfactory~~ continuity between the box and the device shall be permitted.

(D) Isolated Ground Receptacles.

~~Where~~ If installed for the reduction of electromagnetic interference on the equipment grounding conductor, a receptacle in which the grounding terminal is purposely insulated from the receptacle mounting means shall be permitted. The receptacle grounding terminal shall be connected to an insulated equipment grounding conductor run with the circuit conductors. This equipment grounding conductor shall be permitted to pass through one or more panelboards without a connection to the panelboard grounding terminal bar as permitted in 408.40, Exception, so as to terminate within the same building or structure directly at an equipment grounding conductor terminal of the applicable derived system or service. ~~Where~~ If installed in accordance with this section, this equipment grounding conductor shall also be permitted to pass through boxes, wireways, or other enclosures without being connected to such enclosures.

Informational Note: Use of an isolated equipment grounding conductor does not relieve the requirement for connecting the raceway system and outlet box to an equipment grounding conductor.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:31:46 EST 2020

Committee Statement

Committee Statement: To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual "satisfactory" should not be used in (A) and (C).

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if in (D).

Response Message: FR-8264-NFPA 70-2020

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8240-NFPA 70-2020 [Section No. 250.148]

250.148 Continuity of Equipment Grounding Conductors and Attachment in Boxes.

If circuit conductors are spliced within a box or terminated on equipment within or supported by a box, ~~all wire-type equipment grounding conductor(s) associated with any of those circuit conductors shall be connected within the box or to the box in accordance the installation shall comply with 250.8 and 250.148(A) through (D).~~

Exception: The equipment grounding conductor permitted in 250.146(D) shall not be required to be connected to the other equipment grounding conductors or to the box.

(A) Connections and Splices.

All equipment grounding conductors that are spliced or terminated within the box shall be connected together. Connections and splices shall be made in accordance with 110.14(B) and 250.8 except that insulation shall not be required.

(B) Equipment Grounding Conductor Continuity.

The arrangement of grounding connections shall be such that the disconnection or the removal of a luminaire, receptacle, or other device fed from the box does not interrupt the electrical continuity of the equipment grounding conductor(s) providing an effective ground-fault current path.

(C) Metal Boxes.

A connection used for no other purpose shall be made between the metal box and the equipment grounding conductor(s). in accordance with 250.8 The equipment bonding jumper or equipment grounding conductor shall be sized from Table 250.122 based on the largest overcurrent device protecting circuit conductors in the box .

(D) Nonmetallic Boxes.

One or more equipment grounding conductors brought into a nonmetallic outlet box shall be arranged such that to provide a connection can be made to any fitting or device in that box requiring connection to an equipment grounding conductor.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 15:36:49 EST 2020

Committee Statement

Committee Statement: Changes made to this section clarify that all equipment grounding conductors in a box are to be connected to each other. This ensures that the equipment grounding conductor of any faulted circuit is routed with the ungrounded conductors of the faulted circuit. Language is added to ensure the common bonding jumper to the box is sized to 250.122. Redundant language is removed for clarity.

To add clarity and comply with Section 3.2.1 Unenforceable Terms and Section 3.1.1 Mandatory Rules of the 2020 NEC Style Manual "such that" should not be used in (D).

Response Message: FR-8240-NFPA 70-2020

Public Input No. 4612-NFPA 70-2020 [Section No. 250.148 [Excluding any Sub-Sections]]

Public Input No. 1601-NFPA 70-2020 [Section No. 250.148]

Public Input No. 1053-NFPA 70-2020 [Section No. 250.148 [Excluding any Sub-Sections]]

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.



First Revision No. 8265-NFPA 70-2020 [Section No. 250.162]

250.162 Direct-Current Circuits and Systems to Be Grounded.

Direct-current circuits and systems shall be grounded as provided for in 250.162(A) and (B).

(A) Two-Wire, Direct-Current Systems.

A 2-wire, dc system supplying premises wiring and operating at greater than 60 volts but not greater than 300 volts shall be grounded.

Exception No. 1: A system equipped with a ground detector and supplying only industrial equipment in limited areas shall not be required to be grounded where if installed immediately adjacent to, or integral with, the source of supply.

Exception No. 2: A rectifier-derived dc system supplied from an ac system complying with 250.20 shall not be required to be grounded.

Exception No. 3: Direct-current fire alarm circuits having a maximum current of 0.030 ampere as specified in Article 760, Part III, shall not be required to be grounded.

(B) Three-Wire, Direct-Current Systems.

The neutral conductor of all 3-wire, dc systems supplying premises wiring shall be grounded.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:33:56 EST 2020

Committee Statement

Committee Statement: To add clarity by what is meant with the term "adjacent" and to comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual.

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8265-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8266-NFPA 70-2020 [Section No. 250.164]****250.164** Point of Connection for Direct-Current Systems.**(A)** Off-Premises Source.

Direct-current systems to be grounded and supplied from an off-premises source shall have the grounding connection made at one or more supply stations. A grounding connection shall not be made at individual services or at any point on the premises wiring.

(B) On-Premises Source.

~~Where~~ If the dc system source is located on the premises, a grounding connection shall be made at one of the following:

- (1) The source
- (2) The first system disconnection means or overcurrent device
- (3) By other means that accomplish ~~equivalent~~ system protection and that ~~utilize~~ use equipment listed and identified for the use

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:36:08 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if."

To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual "equivalent" should not be used.

Response Message: FR-8266-NFPA 70-2020

Ballot Results**✔ This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.

Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.



First Revision No. 8100-NFPA 70-2020 [Section No. 250.166]

250.166 Size of the Direct-Current Grounding Electrode Conductor.

The size of the grounding electrode conductor for a dc system shall be as specified in 250.166(A) and (B), except as permitted by 250.166(C) through (E). The grounding electrode conductor for a dc system shall meet the sizing requirements in this section but shall not be required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum.

(A) Not Smaller Than the Neutral Conductor.

~~Where~~ If the dc system consists of a 3-wire balancer set or a balancer winding with overcurrent protection as provided in 445.12(D), the grounding electrode conductor shall not be smaller than the neutral conductor and not smaller than 8 AWG copper or 6 AWG aluminum or copper-clad aluminum.

(B) Not Smaller Than the Largest Conductor.

~~Where~~ If the dc system is other than as in 250.166(A), the grounding electrode conductor shall not be smaller than the largest conductor supplied by the system; and not smaller than 8 AWG copper or 6 AWG aluminum or copper-clad aluminum.

(C) Connected to Rod, Pipe, or Plate Electrodes.

~~Where~~ If connected to rod, pipe, or plate electrodes as in 250.52(A)(5) or (A)(7), that portion of the grounding electrode conductor that is the sole connection to the grounding electrode shall not be required to be larger than 6 AWG copper wire or 4 AWG aluminum ~~wire~~ or copper-clad aluminum wire.

(D) Connected to a Concrete-Encased Electrode.

~~Where~~ If connected to a concrete-encased electrode as in 250.52(A)(3), that portion of the grounding electrode conductor that is the sole connection to the grounding electrode shall not be required to be larger than 4 AWG copper wire.

(E) Connected to a Ground Ring.

~~Where~~ If connected to a ground ring as in 250.52(A)(4), that portion of the grounding electrode conductor that is the sole connection to the grounding electrode shall not be required to be larger than the conductor used for the ground ring.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 17:26:21 EST 2020

Committee Statement

Committee Statement: Copper-clad aluminum was added to 250.166 because it is recognized in the NEC as an acceptable conductor material.

To add clarity and comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8100-NFPA 70-2020 Copper-clad steel was not accepted because no technical substantiation was provided to ensure that under expected conditions of use the copper layer will not delaminate, that the steel core stiffness and strength is sufficient to prevent failure, and that it can be bent and installed without stressing terminations within equipment. The series of Public Inputs do not require 40% copper-clad steel in all cases which was used in all of the submitted testing reports. The current values used in the short time current test are less than those required in UL 467. Copper-clad steel needs to be listed in all cases to ensure acceptable performance.

[Public Input No. 2479-NFPA 70-2020 \[Section No. 250.166\(D\)\]](#)

[Public Input No. 2476-NFPA 70-2020 \[Section No. 250.166\(A\)\]](#)

[Public Input No. 2474-NFPA 70-2020 \[Section No. 250.166 \[Excluding any Sub-Sections\]\]](#)

[Public Input No. 2477-NFPA 70-2020 \[Section No. 250.166\(B\)\]](#)

[Public Input No. 2478-NFPA 70-2020 \[Section No. 250.166\(C\)\]](#)

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

14 Affirmative All

0 Affirmative with Comments

1 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Negative with Comment

Abernathy, Paul W.

Inadequate substantiation was provided to support this change.

**First Revision No. 8267-NFPA 70-2020 [Section No. 250.170]****250.170** Instrument Transformer Circuits.

Secondary circuits of current and potential instrument transformers shall be grounded ~~where~~ if the primary windings are connected to circuits of 300 volts or more to ground and, ~~where~~ if installed on or in switchgear and on switchboards, shall be grounded irrespective of voltage.

Exception No. 1: Circuits where the primary windings are connected to circuits of 1000 volts or less with no live parts or wiring exposed or accessible to other than qualified persons.

Exception No. 2: Current transformer secondaries connected in a three-phase delta configuration shall not be required to be grounded.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 19:38:10 EST 2020

Committee Statement

Committee Statement: To add clarity and comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8267-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8268-NFPA 70-2020 [Section No. 250.172]****250.172** Instrument Transformer Cases.

Cases or frames of instrument transformers shall be connected to the equipment grounding conductor ~~where~~ if accessible to other than qualified persons.

Exception: Cases or frames of current transformers, the primaries of which are not over 150 volts to ground and that are used exclusively to supply current to meters.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 20:57:06 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8268-NFPA 70-2020

Ballot Results

✓ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8269-NFPA 70-2020 [Section No. 250.174(C)]****(C) On Live-Front Switchboards.**

Instruments, meters, and relays (whether operated from current and potential transformers or connected directly in the circuit) on switchboards having exposed live parts on the front of panels shall not have their cases connected to the equipment grounding conductor. Mats of insulating rubber or other suitable approved means of floor insulation shall be provided for the operator where the voltage to ground exceeds 150 volts.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 20:58:33 EST 2020

Committee Statement

Committee Statement: To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual "suitable" should not be used.

Response Message: FR-8269-NFPA 70-2020

Ballot Results**✔ This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8270-NFPA 70-2020 [Section No. 250.176]****250.176** Cases of Instruments, Meters, and Relays — Operating at Over 1000 Volts.

Where ~~if~~ instruments, meters, and relays have current-carrying parts of over 1000 volts to ground, they shall be isolated by elevation or protected by ~~suitable barriers~~ a barrier(s) , grounded metal, or insulating covers or guards. Their cases shall not be connected to the equipment grounding conductor.

Exception: Cases of electrostatic ground detectors shall be permitted to be connected to an equipment grounding conductor if the internal ground segments of the instrument are connected to the instrument case and grounded and the ground detector is isolated by elevation.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 21:03:01 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

To add clarity and comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual "suitable" should not be used.

Response Message: FR-8270-NFPA 70-2020

Ballot Results

✔ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

**First Revision No. 8104-NFPA 70-2020 [Section No. 250.178]****250.178** Instrument Equipment Grounding Conductor.

The equipment grounding conductor for secondary circuits of instrument transformers and for instrument cases shall not be smaller than 12 AWG copper or 10 AWG aluminum or copper-clad aluminum . Cases of instrument transformers, instruments, meters, and relays that are mounted directly on grounded metal surfaces of enclosures or grounded metal of switchgear or switchboard panels shall not be ~~considered~~ required to be grounded, ~~and no connected to an~~ additional equipment grounding conductor. ~~-shall be required.~~

Submitter Information Verification**Committee:** NEC-P05**Submittal Date:** Tue Dec 15 17:32:47 EST 2020**Committee Statement**

Committee Statement: Copper-clad aluminum was added to 250.178 because it is recognized in the NEC as an acceptable conductor material.

To add clarity the second sentence was revised and to comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual, "considered" should not be used.

Response Message: FR-8104-NFPA 70-2020

[Public Input No. 2480-NFPA 70-2020 \[Section No. 250.178\]](#)

Ballot Results

✓ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

13 Affirmative All

0 Affirmative with Comments

2 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Negative with Comment

Abernathy, Paul W.

Inadequate substantiation was provided to support this change.

Crawford, Carlie Rose

CDA votes negative. Inadequate substantiation was submitted to show that Copper-clad aluminum conductor is suitable for this application.

**First Revision No. 8271-NFPA 70-2020 [Section No. 250.184]****250.184 Solidly Grounded Neutral Systems.**

Solidly grounded neutral systems shall be permitted to be either single point grounded or multigrounded neutral.

(A) Neutral Conductor.**(1) Insulation Level.**

The minimum insulation level for neutral conductors of solidly grounded systems shall be 600 volts.

Exception No. 1: For multigrounded neutral systems as permitted in 250.184(C), bare copper conductors shall be permitted to be used for the neutral conductor of the following:

- (1) Service-entrance conductors*
- (2) Service laterals or underground service conductors*
- (3) Direct-buried portions of feeders*

Exception No. 2: Bare conductors shall be permitted for the neutral conductor of overhead portions installed outdoors.

Exception No. 3: The grounded neutral conductor shall be permitted to be a bare conductor if isolated from phase conductors and protected from physical damage.

Informational Note: See 225.4 for conductor covering where within 3.0 m (10 ft) of any building or other structure.

(2) Ampacity.

The neutral conductor shall ~~have an ampacity that is not less than the load imposed and~~ be of sufficient ampacity for the load imposed on the conductor but not less than 33⅓ percent of the ampacity of the phase conductors.

Exception: In industrial and commercial premises under engineering supervision, it shall be permissible to size the ampacity of the neutral conductor to not less than 20 percent of the ampacity of the phase conductor.

(B) Single-Point Grounded Neutral System.

Where ~~if~~ a single-point grounded neutral system is used, the following shall apply:

- (1) A single-point grounded neutral system shall be permitted to be supplied from ~~(a) or (b)~~ one of the following :
 - a. A separately derived system
 - b. A multigrounded neutral system with an equipment grounding conductor connected to the multigrounded neutral conductor at the source of the single-point grounded neutral system
- (2) A grounding electrode shall be provided for the system.
- (3) A grounding electrode conductor shall connect the grounding electrode to the system neutral conductor.
- (4) A bonding jumper shall connect the equipment grounding conductor to the grounding electrode conductor.
- (5) An equipment grounding conductor shall be provided to each building, structure, and equipment enclosure.
- (6) A neutral conductor shall only be required ~~where if~~ phase-to-neutral loads are supplied.
- (7) The neutral conductor, ~~where if~~ provided, shall be insulated and isolated from earth except at one location.
- (8) An equipment grounding conductor shall be run with the phase conductors and shall comply with ~~(a), (b), and (c)~~ all of the following :
 - a. Shall not carry continuous load
 - b. ~~May~~ Shall be bare, covered, or insulated
 - c. Shall have ~~sufficient~~ ampacity for fault current duty

(C) Multigrounded Neutral Systems.

~~Where~~ If a multigrounded neutral system is used, the following shall apply:

- (1) The neutral conductor of a solidly grounded neutral system shall be permitted to be grounded at more than one point. Grounding shall be permitted at one or more of the following locations:
 - a. Transformers supplying conductors to a building or other structure
 - b. Underground circuits ~~where~~ if the neutral conductor is exposed
 - c. Overhead circuits installed outdoors
- (2) The multigrounded neutral conductor shall be grounded at each transformer and at other additional locations by connection to a grounding electrode.
- (3) At least one grounding electrode shall be installed and connected to the multigrounded neutral conductor every 400 m (1300 ft).
- (4) The maximum distance between any two adjacent electrodes shall not be more than 400 m (1300 ft).
- (5) In a multigrounded shielded cable system, the shielding shall be grounded at each cable joint that is exposed to personnel contact.

Exception: In a multipoint grounded system, a grounding electrode shall not be required to bond the neutral conductor in an uninterrupted conductor exceeding 400 m (1300 ft) if the only purpose for removing the cable jacket is for bonding the neutral conductor to a grounding electrode.

Supplemental Information

<u>File Name</u>	<u>Description</u> <u>Approved</u>
NEC_FR8271_250.184.docx	For staff use

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 21:04:50 EST 2020

Committee Statement

Committee Statement:	To add clarity the sentence was revised to comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual "sufficient" should not be used.
	To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" in (B) and (C).
	A covered conductor was added to (8)b. to address all types of permitted equipment grounding conductors.
	To and clarity comply with Section 3.2.1 Unenforceable Terms and 3.1.1 Mandatory Rules of the 2020 NEC Style Manual, "may" and "sufficient" should not be used in (B).
Response Message:	FR-8271-NFPA 70-2020

Ballot Results**✔ This item has passed ballot**

16 Eligible Voters
1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.

Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.



First Revision No. 8241-NFPA 70-2020 [Section No. 250.186]

250.186 Grounding Service-Supplied Alternating-Current Systems.

(A) Systems with a Grounded Conductor at the Service Point.

~~Where~~ If an ac system is grounded at any point and is provided with a grounded conductor at the service point, a grounded conductor(s) shall be installed and routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means grounded conductor(s) terminal or bus. A main bonding jumper shall connect the grounded conductor(s) to each service disconnecting ~~means's means~~ enclosure. The grounded conductor(s) shall be installed in accordance with 250.186(A)(1) through (A)(4). The size of the solidly grounded circuit conductor(s) shall be the larger of that determined by 250.184 or 250.186(A)(1) or (A)(2).

Exception: ~~Where~~ If two or more service disconnecting means are located in a single assembly listed for use as service equipment, it shall be permitted to connect the grounded conductor(s) to the assembly common grounded conductor(s) terminal or bus. The assembly shall include a main bonding jumper for connecting the grounded conductor(s) to the assembly enclosure.

(1) Sizing for a Single Raceway or Overhead Conductor.

The grounded conductor shall not be smaller than the required grounding electrode conductor specified in Table 250.102(C)(1) but shall not be required to be larger than the largest ungrounded service-entrance conductor(s).

(2) Parallel Conductors in Two or More Raceways or Overhead Conductors.

If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or as overhead parallel conductors, the grounded conductors shall also be installed in parallel. The size of the grounded conductor in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

Informational Note: See 310.10(G) for grounded conductors connected in parallel.

(3) Delta-Connected Service.

The grounded conductor of a 3-phase, 3-wire delta service shall have an ampacity not less than that of the ungrounded conductors.

(4) Impedance Grounded ~~Neutral~~ Systems.

Impedance grounded ~~neutral~~ systems shall be installed in accordance with 250.187.

(B) Systems Without a Grounded Conductor at the Service Point.

~~Where~~ If an ac system is grounded at any point and is not provided with a grounded conductor at the service point, a supply-side bonding jumper shall be installed and routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means equipment grounding conductor terminal or bus. The supply-side bonding jumper shall be installed in accordance with 250.186(B)(1) through (B)(3).

Exception: ~~Where~~ If two or more service disconnecting means are located in a single assembly listed for use as service equipment, it shall be permitted to connect the supply-side bonding jumper to the assembly common equipment grounding terminal or bus.

(1) Sizing for a Single Raceway or Overhead Conductor.

The supply-side bonding jumper shall not be smaller than the required grounding electrode conductor specified in Table 250.102(C)(1) but shall not be required to be larger than the largest ungrounded service-entrance conductor(s).

(2) Parallel Conductors in Two or More Raceways or Overhead Conductors.

If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or overhead conductors, the supply-side bonding jumper shall also be installed in parallel. The size of the supply-side bonding jumper in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

(3) Impedance Grounded ~~Neutral~~ Systems.

Impedance grounded ~~neutral~~ systems shall be installed in accordance with 250.187.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 15:50:07 EST 2020

Committee Statement

Committee Statement: A new definition of "impedance grounded system" has been created. Currently, no definition exists for an impedance grounded system in the NEC. The changes in 250.186 reflect this new definition.

An editorial correction is made in 250.186(A).

To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where"

was changed to "if".

**Response
Message:**

FR-8241-NFPA 70-2020

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.



First Revision No. 8227-NFPA 70-2020 [Section No. 250.187]

250.187 Impedance Grounded Systems.

Impedance grounded systems in which a grounding impedance device, usually typically a resistor, limits the ground-fault current shall be permitted ~~where if~~ all of the following conditions are met:

- (1) The conditions of maintenance and supervision ensure that only qualified persons service the installation.
- (2) Ground detectors are installed on the system.
- (3) Line-to-neutral loads are not served.

Impedance grounded systems shall comply with 250.187(A) through (D).

(A) Location.

The grounding impedance device shall be ~~inserted in~~ installed between the grounding electrode conductor ~~between and the impedance grounding electrode of conductor connected to the supply system and the neutral point of the supply transformer or generator.~~

(B) Insulated.

The ~~grounded~~ impedance grounding conductor shall be insulated for the maximum neutral voltage.

Exception: A bare impedance grounding conductor shall be permitted if the bare portion of the grounding impedance device and conductor are not in a readily accessible location and securely separated from the ungrounded conductors.

Informational Note: The maximum neutral voltage in a 3-phase wye system is 57.7 percent of the phase-to-phase voltage.

(C) ~~Grounded~~ System Conductor Neutral Point Connection.

The system ~~grounded-conductor~~ neutral point shall not be connected to ground, except through the grounding impedance device.

(D) Equipment Grounding Conductors.

Equipment grounding conductors shall be permitted to be bare and shall be electrically connected to the ground bus and grounding electrode conductor.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 12:07:24 EST 2020

Committee Statement

Committee Statement: The language is revised for clarity. The grounding impedance device does not connect to the neutral point; it connects to a conductor that connects to the neutral point.

The conductor that connects the neutral point to the impedance of an impedance grounded system does not meet the definition of a grounded conductor in Article 100. The conductor is grounded through an impedance.

An added exception recognizes that there are equivalent methods to prevent inadvertent contact with bare or covered conductors by persons or other current-carrying conductors. This is consistent with other sections of the NEC such as 110.27(A).

These changes will make the section easier to understand and consistent with other parts of the code.

In the lead paragraph, to comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if". In addition, to comply with Section 3.2.1 Unenforceable Terms of the 2020 NEC Style Manual, "usually" was changed to "typically".

Response Message: FR-8227-NFPA 70-2020

[Public Input No. 748-NFPA 70-2020 \[Section No. 250.187\(C\)\]](#)

[Public Input No. 2764-NFPA 70-2020 \[Section No. 250.187\(B\)\]](#)

[Public Input No. 746-NFPA 70-2020 \[Section No. 250.187\(A\)\]](#)

[Public Input No. 747-NFPA 70-2020 \[Section No. 250.187\(B\)\]](#)

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned
15 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.
Andre, Joseph F.
Atkins, Derrick L.
Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.

**First Revision No. 8272-NFPA 70-2020 [Section No. 250.188]****250.188** Grounding of Systems Supplying Portable or Mobile Equipment.

Systems supplying portable or mobile equipment over 1000 volts, other than substations installed on a temporary basis, shall comply with 250.188(A) through (F).

(A) Portable or Mobile Equipment.

Portable or mobile equipment over 1000 volts shall be supplied from a system having its neutral conductor grounded through an impedance. ~~Where~~ If a delta-connected system over 1000 volts is used to supply portable or mobile equipment, a system neutral point and associated neutral conductor shall be derived.

(B) Exposed Non-Current-Carrying Metal Parts.

Exposed non-current-carrying metal parts of portable or mobile equipment shall be connected by an equipment grounding conductor to the point at which the system neutral impedance is grounded.

(C) Ground-Fault Current.

The voltage developed between the portable or mobile equipment frame and ground by the flow of maximum ground-fault current shall not exceed 100 volts.

(D) Ground-Fault Detection and Relaying.

Ground-fault detection and relaying shall be provided to automatically de-energize any component of a system over 1000 volts that has developed a ground fault. The continuity of the equipment grounding conductor shall be continuously monitored so as to automatically de-energize the circuit of the system over 1000 volts to the portable or mobile equipment upon loss of continuity of the equipment grounding conductor.

(E) Isolation.

The grounding electrode to which the portable or mobile equipment system neutral impedance is connected shall be isolated from and separated in the ground by at least 6.0 m (20 ft) from any other system or equipment grounding electrode, and there shall be no direct connection between the grounding electrodes, such as buried pipe and fence, and so forth.

(F) Trailing Cable and Couplers.

Trailing cable and couplers of systems over 1000 volts for interconnection of portable or mobile equipment shall meet the requirements of Part III of Article 400 for cables and 490.65 for couplers.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 21:27:43 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8272-NFPA 70-2020

Ballot Results

✔ **This item has passed ballot**

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.
Crawford, Carlie Rose
Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.



First Revision No. 8106-NFPA 70-2020 [Section No. 250.190]

250.190 Grounding of Equipment.

(A) Equipment Grounding.

All non-current-carrying metal parts of fixed, portable, and mobile equipment and associated fences, housings, enclosures, and supporting structures shall be grounded.

Exception: ~~Where~~ If isolated from ground and located such that any person in contact with ground cannot contact such metal parts when the equipment is energized, the metal parts shall not be required to be grounded.

Informational Note: See 250.110, Exception No. 2, for pole-mounted distribution apparatus.

(B) Grounding Electrode Conductor.

If a grounding electrode conductor connects non-current-carrying metal parts to ground, the grounding electrode conductor shall be sized in accordance with Table 250.66, based on the size of the largest ungrounded service, feeder, or branch-circuit conductors supplying the equipment. The grounding electrode conductor shall not be smaller than 6 AWG copper or 4 AWG aluminum or copper-clad aluminum.

(C) Equipment Grounding Conductor.

Equipment grounding conductors shall comply with 250.190(C)(1) through (C)(3).

(1) General.

Equipment grounding conductors that are not an integral part of a cable assembly shall not be smaller than 6 AWG copper or 4 AWG aluminum or copper-clad aluminum.

(2) Shielded Cables.

The metallic insulation shield encircling the current-carrying conductors shall be permitted to be used as an equipment grounding conductor, if it is rated for clearing time of ground-fault current protective device operation without damaging the metallic shield. The metallic tape insulation shield and drain wire insulation shield shall not be used as an equipment grounding conductor for solidly grounded systems.

(3) Sizing.

Equipment grounding conductors shall be sized in accordance with Table 250.122 based on the current rating of the fuse or the overcurrent setting of the protective relay.

Informational Note: The overcurrent rating for a circuit breaker is the combination of the current transformer ratio and the current pickup setting of the protective relay.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Tue Dec 15 17:36:45 EST 2020

Committee Statement

Committee Statement: Copper-clad aluminum was added to 250.190 because it is recognized in the NEC as an acceptable conductor material.

To add clarity and comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if" in the exception.

Response Message: FR-8106-NFPA 70-2020 Copper-clad steel was not accepted because no technical substantiation was provided to ensure that under expected conditions of use the copper layer will not delaminate, that the steel core stiffness and strength is sufficient to prevent failure, and that it can be bent and installed without stressing terminations within equipment. The series of Public Inputs do not require 40% copper-clad steel in all cases which was used in all of the submitted testing reports. The current values used in the short time current test are less than those required in UL 467. Copper-clad steel needs to be listed in all cases to ensure acceptable performance.

[Public Input No. 2481-NFPA 70-2020 \[Section No. 250.190\(B\)\]](#)

[Public Input No. 2482-NFPA 70-2020 \[Section No. 250.190\(C\)\(1\)\]](#)

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned

14 Affirmative All

0 Affirmative with Comments

1 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul

Gray, Bobby J.

Harding, Joseph James

Harding, G. Scott

Jensen, Christopher M.

Mohla, Daleep C.

Pancake, III, William A.

Porter, Christine T.

Steinman, Gregory J.

Sumbera, Darrell M.

Negative with Comment

Abernathy, Paul W.

Inadequate substantiation was provided to support this change.



First Revision No. 8273-NFPA 70-2020 [Section No. 250.194]

250.194 Grounding and Bonding of Fences and Other Metal Structures.

Metallic fences enclosing, and other metal structures in or surrounding, a substation with exposed electrical conductors and equipment shall be grounded and bonded to limit step, touch, and transfer voltages.

(A) Metal Fences.

Where If metal fences are located within 5 m (16 ft) of the exposed electrical conductors or equipment, the fence shall be bonded to the grounding electrode system with wire-type bonding jumpers as follows:

- (1) Bonding jumpers shall be installed at each fence corner and at maximum 50 m (160 ft) intervals along the fence.
- (2) Where If bare overhead conductors cross the fence, bonding jumpers shall be installed on each side of the crossing.
- (3) Gates shall be bonded to the gate support post, and each gate support post shall be bonded to the grounding electrode system.
- (4) Any gate or other opening in the fence shall be bonded across the opening by a buried bonding jumper.
- (5) The grounding grid or grounding electrode systems shall be extended to cover the swing of all gates.
- (6) The barbed wire strands above the fence shall be bonded to the grounding electrode system.

Alternate designs performed under engineering supervision shall be permitted for grounding or bonding of metal fences.

Informational Note No. 1: A nonconducting fence or section may provide isolation for transfer of voltage to other areas.

Informational Note No. 2: See IEEE 80-2013, *IEEE Guide for Safety In AC Substation Grounding*, for design and installation of fence grounding.

(B) Metal Structures.

All exposed conductive metal structures, including guy wires within 2.5 m (8 ft) vertically or 5 m (16 ft) horizontally of exposed conductors or equipment and subject to contact by persons, shall be bonded to the grounding electrode systems in the area.

Submitter Information Verification

Committee: NEC-P05

Submittal Date: Fri Dec 18 21:32:35 EST 2020

Committee Statement

Committee Statement: To comply with Section 3.3.4 Word Clarity, in the 2020 NEC Style Manual, when stating a condition, the word "where" was changed to "if".

Response Message: FR-8273-NFPA 70-2020

Ballot Results

✓ This item has passed ballot

16 Eligible Voters

1 Not Returned

15 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Beltran Feliciano, David Enrique

Affirmative All

Abernathy, Paul W.

Andre, Joseph F.

Atkins, Derrick L.

Bowmer, Trevor N.

Crawford, Carlie Rose

Dobrowsky, Paul
Gray, Bobby J.
Harding, Joseph James
Harding, G. Scott
Jensen, Christopher M.
Mohla, Daleep C.
Pancake, III, William A.
Porter, Christine T.
Steinman, Gregory J.
Sumbera, Darrell M.