First Revision No. 7973-NFPA 70-2018 [Section No. 250.64(A)]

(A) Aluminum or Copper-Clad Aluminum Conductors.

Grounding electrode conductors of bare, covered, or insulated aluminum or copper-clad aluminum shall comply with the following:

(1) Bare ~~aluminum or copper-clad aluminum grounding electrode~~ or covered conductors shall not be ~~used~~ installed where subject to corrosive conditions or be installed in direct contact with masonry or the earth ~~or where subject to corrosive conditions~~ .

(2) Terminations made within listed enclosures identified for outdoor use shall be permitted within 450 mm (18 in.) of the earth. If open bottom enclosures are installed on a concrete pad, the concrete shall not be considered earth.

(3) ~~Where used outside, aluminum~~ Aluminum or copper-clad aluminum ~~grounding electrode~~ conductors external to buildings or enclosures shall not be terminated within 450 mm (18 in.) of the earth, unless insulated. The termination shall be listed as a sealed wire-connector system and listed as grounding and bonding equipment .

Supplemental Information

File Name	Description	Approved
Panel_5_FR-7973_250.64_A_leg_changes.docx	For staff use	✓

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 11 14:01:04 EST 2018

Committee Statement and Meeting Notes

Committee Statement: The Section was formatted into a list format for improved clarity and usability and to clarify that terminations located in the interior of the listed equipment are separated from the earth. The requirement for sealed wire connector systems that are also listed as grounding and bonding equipment was added as another option for terminating aluminum conductors.

Response Message:

Public Input No. 2859-NFPA 70-2017 [Section No. 250.64(A)]

Public Input No. 408-NFPA 70-2017 [Section No. 250.64(A)]

Public Input No. 2796-NFPA 70-2017 [Section No. 250.64(A)]

Public Input No. 2826-NFPA 70-2017 [Section No. 250.64(A)]

Public Input No. 915-NFPA 70-2017 [Section No. 250.64(A)]

Editorial Comment

Click here

First Revision No. 7980-NFPA 70-2018 [Section No. 250.64(E)(1)]

(1) General.

Ferrous metal raceways, enclosures, and ~~enclosures~~ 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 ~~enclosures~~ 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 ~~enclosures~~ cable armor shall not be required to be electrically continuous.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 11 14:47:57 EST 2018

Committee Statement and Meeting Notes

Committee Statement: The revised text clarifies that cable armor is required to be bonded and grounded.
Response Message:

Public Input No. 2891-NFPA 70-2017 [Section No. 250.64(E)(1)]

First Revision No. 7985-NFPA 70-2018 [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 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 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 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 ~~that complies~~ complying with 250.52(A)(3) and ~~is~~ 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~~. The rebar extension shall not be exposed to contact with the earth without corrosion protection.~~ 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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 11 15:10:10 EST 2018

Committee Statement

Committee The revision clarifies the installation requirements and the use of rebar as an extension that is

Statement: connected to the electrode.

Response Message:

Public Input No. 3730-NFPA 70-2017 [Section No. 250.68(C)]

First Revision No. 7990-NFPA 70-2018 [Section No. 250.98]

250.98 Bonding Loosely Jointed Metal Raceways.

Expansion, expansion-deflection, or deflection fittings and telescoping sections of metal raceways shall be made electrically continuous by equipment bonding jumpers or other means.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 11 15:36:19 EST 2018

Committee Statement

Committee Statement: Expansion deflection and deflection fittings were added to the list of fittings required to be made electrically continuous. These products are similar to expansion fittings.

Response Message:

Public Input No. 781-NFPA 70-2017 [Section No. 250.98]

First Revision No. 8198-NFPA 70-2018 [Global Input]

250.25 **Grounding and Bonding Supply-Side Disconnects.**

A supply-side disconnect shall be grounded and bonded in accordance with 250.25(A) through (C).

(A) **Bonding.**

The normally non–current-carrying metal parts of equipment containing conductors from the supply-side disconnect to the serving utility shall be bonded together in accordance with 250.92.

(B) **Grounded AC Systems.**

A supply-side disconnect, supplied by an ac system operating at 1000 volts or less that is grounded at any point, shall comply with 250.25(B)(1) through (4).

(1) **Main Bonding Jumper.**

An unspliced main bonding jumper shall be used to connect the equipment grounding conductor(s) and the supply-side disconnect enclosure to the grounded conductor(s) within each supply-side disconnect enclosure in accordance with 250.28.

Exception: If more than one supply-side disconnect 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.

(2) **Grounded Conductor.**

The grounded conductor(s) shall be installed and routed with the ungrounded supply conductors from the point of connection to the serving utility to the supply-side disconnect and terminated to the supply-side disconnects grounded conductor(s) terminal or bus. The grounded conductor(s) shall comply with 250.25(B)(2)(a), (B)(2)(b), or (B)(2)(c).

(a) *Sizing.*

The grounded conductor(s) shall be sized in accordance with 250.25(B)(2)(a)(1), (2), or (3).

(1) Single Raceway or Cable.

The grounded conductor shall not be smaller than specified in 250.102(C)(1) based upon the ungrounded supply conductors.

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

If ungrounded supply conductors are installed in parallel in two or more raceways or cables, the grounded conductor shall also be installed in parallel. The size of the grounded conductor in each raceway or cable shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or cable, as required in 250.25(B)(2)(a)(1), but shall not be smaller than 1/0 AWG.

Informational Note to (2): See 310.10(H) for grounded conductors connected in parallel.

(3) Delta Connected Supply-Side Disconnect.

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

(b) *Load-Side Grounding Connections.*

A grounded conductor shall not be connected to normally non–current-carrying metal parts of equipment, be connected to equipment grounding conductor(s), or be reconnected to ground on the load side of the supply-side disconnect 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) *High Impedance.*

The grounded conductor for a high impedance system supplying a supply-side disconnect shall be

installed in accordance with 250.36.

(3) **Grounding Electrode Connection.**

The grounded conductor supplying a supply-side disconnect shall be connected to the grounding electrode conductor(s) in accordance with 250.25(B)(3)(a) through (B)(3)(c).

(a) *General.*

The grounding electrode conductor connection shall be made either within the supply-side disconnect or at any accessible point up to the supply conductor's connection to the serving utility.

(b) *Main Bonding Jumper as Wire or Busbar.*

If the supply-side disconnect bonding jumper 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 supply-side disconnect, the grounding electrode conductor shall be permitted to be connected to the equipment grounding terminal, bar, or bus to which the supply-side disconnect bonding jumper is connected.

(c) *Outdoor Transformer.*

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

(4) **Grounding Electrode Conductor.**

A grounding electrode conductor shall be used to connect the equipment grounding conductor(s), the supply-side disconnect enclosure, and the grounded conductor(s) to the grounding electrode(s) required by Part III of this article. The grounding electrode conductor shall be sized in accordance with 250.66 based upon the ungrounded supply conductors.

(C) **Ungrounded AC Systems.**

A supply-side disconnect that is supplied by an ungrounded ac system operating at 1000 volts or less shall comply with 250.25(C)(1) and (C)(2).

(1) **Grounding Electrode Connection.**

The supply-side disconnect shall be connected to the grounding electrode(s) as required by Part III of this article. The grounding electrode conductor connection shall be made either within the supply-side disconnect or at any accessible point up to the supply conductor's connection to the serving utility. If the grounding electrode connection is made at any point outside of the supply-side disconnect, the grounding electrode conductor shall be connected to the supply-side disconnect by a supply-side bonding jumper.

(2) **Grounding Electrode Conductor.**

A grounding electrode conductor shall be used to connect the equipment grounding conductor(s), the supply-side disconnect enclosure, and the supply-side bonding jumper(s) to the grounding electrode(s) required by Part III of this article. The grounding electrode conductor shall be sized in accordance with 250.66 based upon the ungrounded supply conductors.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 15 12:43:00 EST 2018

Committee Statement

Committee Statement: New Section 250.25 was created to cover the requirements for grounding and bonding of supply-side disconnects. Requirements currently exist for grounding and bonding of services and separately derived systems. Systems such as solar, wind, fuel cells, and interconnected power production systems do not

fall under those requirements when connected in a line side connection as permitted in 230.82. Supply-side disconnects need to be bonded similar to service equipment in accordance with 250.92. As the supply-side disconnect is connected directly to the utility, a main bonding jumper and grounded conductor needs to be installed as it serves as the fault path back to the utility source and the new requirements of 250.25 direct the Code User to the current prescriptive requirements of Article 250. Additionally, the supply- side disconnect needs to be connected to the grounding electrode system with a grounding electrode conductor.

Response Message:

First Revision No. 8196-NFPA 70-2018 [Detail]

250.2,

Disconnect, Supply-Side.

As used in this article, a disconnecting means, other than a meter disconnect, that is connected to the serving utility and is on the supply-side of the service disconnecting means. The supply-side disconnect is used for connection of equipment not supplied by a service and is intended to constitute the main control and cutoff of the supply.

Informational Note: Examples of supply-side disconnects are solar, fuel cell, wind, energy storage, or interconnected power production system disconnecting means for equipment permitted to be connected ahead of the service disconnecting means in accordance with the connection requirements of 230.82.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 15 12:34:09 EST 2018

Committee Statement and Meeting Notes

Committee Statement: Adding a new definition for supply-side disconnect will help Code users identify the disconnecting means connected to the utility. The new definition will facilitate creation of prescriptive rules for grounding and bonding to address the disconnecting means.

Response Message:

Editorial Comment

Click here

First Revision No. 7599-NFPA 70-2018 [Definition: Ground-Fault Current Path.]

Ground-Fault Current Path.

An electrically conductive path from the point of a ground fault on a wiring system through normally non–current-carrying conductors, grounded conductors, equipment, or the earth to the electrical supply source. (CMP-5)

Informational Note: Examples of ground-fault current paths are any combination of equipment grounding conductors, metallic raceways, metallic cable sheaths, electrical equipment, and any other electrically conductive material such as metal, water, and gas piping; steel framing members; stucco mesh; metal ducting; reinforcing steel; shields of communications cables; grounded conductors; and the earth itself.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 08:24:04 EST 2018

Committee Statement and Meeting Notes

Committee Statement: Although the ground fault current is primarily carried by normally non-current carrying conductors, it will also be carried by grounded conductors.

Response Message:

Public Input No. 327-NFPA 70-2017 [Definition: Ground-Fault Current Path.]

Editorial Comment

Click here

First Revision No. 7602-NFPA 70-2018 [Definition: Grounding Conductor, Equipment (EGC).]

Grounding Conductor, Equipment (EGC).

~~The~~ A conductive path(s) that provides ~~a~~ an effective ground-fault current path and connects normally non–current-carrying metal parts of equipment together and to the system grounded conductor or to the grounding electrode conductor, or both. (CMP-5)

Informational Note No. 1: It is recognized that the equipment grounding conductor also performs bonding.

Informational Note No. 2: See 250.118 for a list of acceptable equipment grounding conductors.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 08:30:24 EST 2018

Committee Statement and Meeting Notes

Committee Statement: The revised language helps maintain the intended function while adding the needed language regarding “effective” ground-fault current path. This is to remain consistent with the language used throughout the NEC and Article 250.

Response Message:

Public Input No. 2521-NFPA 70-2017 [Definition: Grounding Conductor, Equipment (EGC).]

Editorial Comment

Click here

First Revision No. 7625-NFPA 70-2018 [Section No. 200.6(E)]

(E) Grounded Conductors of Multiconductor Cables.

The insulated grounded conductors in a multiconductor cable shall be identified by a continuous white or gray outer finish or by three continuous white or gray stripes on other than green insulation along its entire length. ~~Multiconductor~~ For cables 4 AWG or larger, identification of the grounded conductor shall be permitted to comply with 200.6(B) . Multiconductor flat cable 4 AWG or larger shall be permitted to employ an external ridge on the grounded conductor.

Exception No. 1: Where the conditions of maintenance and supervision ensure that only qualified persons service the installation, grounded conductors in multiconductor cables shall be permitted to be permanently identified at their terminations at the time of installation by a distinctive white marking or other equally effective means.

Exception No. 2: The grounded conductor of a multiconductor varnished-cloth-insulated cable shall be permitted to be identified at its terminations at the time of installation by a distinctive white marking or other equally effective means.

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

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 10:10:46 EST 2018

Committee Statement and Meeting Notes

Committee Statement: Adding the language in the charging text aligns the requirements for multiconductor cable grounded conductor identification with the general rules of 200.6(A) and 200.6(B). Removal of the requirement for conditions of maintenance and supervision would negate the general rule requirements of identification of the grounded conductor in all installations and would be in contradiction of the general requirement for continuous identification of the grounded conductor upon its entire length.

Response Message:

Public Input No. 2775-NFPA 70-2017 [Section No. 200.6(E)]

Editorial Comment

Click here

First Revision No. 7629-NFPA 70-2018 [Section No. 200.9]

200.9 Means of Identification of Terminals.

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

Exception: Where 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

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 10:20:01 EST 2018

Committee Statement and Meeting Notes

Committee Statement: By limiting the requirement to devices and utilization equipment with polarized connections, the requirement can be properly applied to the appropriate equipment. The previous language could have been applied to equipment such as panelboards, switchgear, and switchboards which typically do not differentiate the grounded conductor terminations with a substantially white color.

Response Message:

Public Input No. 4273-NFPA 70-2017 [Section No. 200.9]

Editorial Comment

Click here

First Revision No. 7631-NFPA 70-2018 [Section No. 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”.~~ “W.”

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

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 10:21:38 EST 2018

Committee Statement and Meeting Notes

Committee Statement: Silver is not "substantially white" in color. Terminal screws that are substantially white are rare. Most terminal screws intended for use with the grounded conductor are silver in color.

Response Message:

Public Input No. 2658-NFPA 70-2017 [Section No. 200.10(B)]

Editorial Comment

Click here

First Revision No. 7639-NFPA 70-2018 [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

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 10:52:48 EST 2018

Committee Statement

Committee Statement: This revision adds the words “or bonded” clarifies the importance of making good electrical connections not only for the purposes of grounding but also for bonding.
Response Message:

Public Input No. 624-NFPA 70-2017 [Section No. 250.12]

First Revision No. 7643-NFPA 70-2018 [Section No. 250.20(B)]

(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 the system can be grounded so that the maximum voltage to ground on the ungrounded conductors does not exceed 150 volts

(2) Where the system is 3-phase, 4-wire, wye connected in which the neutral conductor is used as a circuit conductor

(3) Where 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, *Standard for Electrical Safety in the Workplace* , high impedance grounding is an effective tool to reduce arc flash hazards.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 11:04:19 EST 2018

Committee Statement

Committee Statement: An informational note is added at the end of the section to emphasize that high impedance grounding is an effective tool to reduce arc flash hazard level. Placing an informational note in 250.20(D) highlights the safety benefits of high impedance grounding systems.

Response Message:

Public Input No. 4167-NFPA 70-2017 [Section No. 250.20(B)]

First Revision No. 7680-NFPA 70-2018 [Section No. 250.26]

250.26 Conductor to Be Grounded — Alternating-Current Systems.

For grounded ac premises wiring systems, the conductor to be grounded shall be as specified in 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 one phase is grounded — ~~one~~ that phase conductor

(5) Multiphase systems in which one phase is used as in (2) — the neutral conductor

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 14:51:31 EST 2018

Committee Statement and Meeting Notes

Committee Statement: The addition of the word “grounded” clarifies that this section refers to grounded systems. Since grounded ac premises systems are referred to, it serves the intent better to place “grounded” at the beginning of the paragraph rather than after the premises system designation. The change in line (4) was made for clarity.

Response Message:

Public Input No. 2763-NFPA 70-2017 [Section No. 250.26]

First Revision No. 7685-NFPA 70-2018 [Section No. 250.28(A)]

(A) Material.

Main bonding jumpers and system bonding jumpers shall be of copper, aluminum, copper-clad aluminum, or other corrosion-resistant material. A main bonding jumper and a system bonding jumper shall be a wire, bus, screw, or similar suitable conductor.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 15:13:26 EST 2018

Committee Statement and Meeting Notes

Committee Statement: The language was changed to correspond with the materials in table 250.102(C)(1) for consistency.

Response Message:

Public Input No. 2862-NFPA 70-2017 [Section No. 250.28(A)]

First Revision No. 7759-NFPA 70-2018 [Section No. 250.32(A)]

(A) Grounding Electrode.

~~Building~~ A building (s) or structure(s) supplied by a feeder(s) or branch circuit(s) shall have a grounding electrode or grounding electrode system installed in accordance with Part III of Article 250. ~~The grounding electrode conductor(s) shall be connected in accordance with 250.32(B) or (C).~~ Where there is no existing grounding electrode, the grounding electrode(s) required in 250.50 shall be installed.

Exception: A grounding electrode shall not be required where 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

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 08:19:38 EST 2018

Committee Statement

Committee Statement: The second sentence of 250.32(A) was deleted because 250.32(B) and (C) do not apply to grounding electrode conductors.
Response Message:

Public Input No. 2960-NFPA 70-2017 [Section No. 250.32(A)]

First Revision No. 7818-NFPA 70-2018 [Section No. 250.34]

250.34 Portable, ~~and~~ Vehicle-Mounted, and Trailer-Mounted Generators.

(A) Portable Generators.

The frame of a portable generator shall not be required to be connected to a grounding electrode as defined in 250.52 for a system supplied by the generator under both of the following conditions:

(1) The generator supplies only equipment mounted on the generator, cord-and-plug-connected equipment through receptacles mounted on the generator, or both~~, and~~ .

(2) The normally non–current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are connected to the generator frame.

(B) Vehicle-Mounted and Trailer-Mounted Generators.

The frame of a vehicle or trailer shall not be required to be connected to a grounding electrode as defined in 250.52 for a system supplied by a generator located on this vehicle or trailer under all of the following conditions:

(1) The frame of the generator is bonded to the vehicle or trailer frame~~, and~~ .

(2) The generator supplies only equipment located on the vehicle or trailer; cord-and-plug-connected equipment through receptacles mounted on the vehicle~~,~~ ; or both equipment located on the vehicle or trailer and cord-and-plug-connected equipment through receptacles mounted on the vehicle, trailer, or on the generator~~, and~~ .

(3) The normally non–current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are connected to the generator frame.

(C) Grounded Conductor Bonding.

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

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

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 11:53:57 EST 2018

Committee Statement

Committee Statement: Trailer mounted generators were added to this section because they are similar to vehicle mounted generators and need to be covered.

The additional proposed sentence was not added because the rule is already in 250.6.

Response Message:

Public Input No. 2910-NFPA 70-2017 [Section No. 250.34]

First Revision No. 7781-NFPA 70-2018 [Section No. 250.36 [Excluding any Sub-Sections]]

High-impedance grounded neutral systems in which a grounding impedance, usually 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 grounded neutral systems shall comply ~~with the provisions of~~ with 250.36(A) through (G).

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

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 09:49:36 EST 2018

Committee Statement and Meeting Notes

Committee Statement: An informational note added at the end of the section to emphasize that high impedance grounding is an effective tool to reduce arc flash hazard level. Placing an informational note in 250.36 highlights the safety benefits of high impedance grounding systems.

The phrase “the provisions of” is overused and redundant and was deleted with proper editorial revision of remaining text without affecting the Code technical requirements.

Response Message:

Public Input No. 3921-NFPA 70-2017 [Section No. 250.36 [Excluding any Sub-Sections]]

Editorial Comment

Click here

First Revision No. 7902-NFPA 70-2018 [Section No. 250.64(E)(3)]

(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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 11 09:05:33 EST 2018

Committee Statement and Meeting Notes

Committee Statement: This revision makes it clear that the bonding jumper size is determined by the largest grounding electrode conductor installed. The term “enclosure(s)” was added for consistency with 250.64(E)(1).

Response Message:

Public Input No. 572-NFPA 70-2017 [Section No. 250.64(E)(3)]

First Revision No. 7920-NFPA 70-2018 [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 of the following methods:

(1) Bonding equipment to the grounded service conductor in a manner provided in 250.8

(2) Connections ~~utilizing~~ using threaded couplings or ~~threaded hubs~~ 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

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Street Address:
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Submittal Date: Thu Jan 11 10:13:53 EST 2018

Committee Statement

Committee Statement: The change will affirm that hubs used for a service installation must be listed in accordance with Section 344.6.
Response Message:

Public Input No. 189-NFPA 70-2017 [Section No. 250.92(B)]

First Revision No. 7542-NFPA 70-2018 [Section No. 250.136]

250.136 Equipment ~~Considered Grounded~~ Secured to Grounded Metal Supports .

~~Under the conditions specified in 250.136(A) and (B), the normally non-current-carrying metal parts of the equipment shall be considered grounded.~~

Electrical equipment secured to and in electrical contact with a metal rack or structure provided for its support shall be permitted to be considered as being ~~and~~ connected to an equipment grounding conductor if the metal rack or structure is connected to an equipment grounding conductor by one of the means indicated in 250.134. ~~The structural metal frame of a building shall not be used as the required equipment grounding conductor for ac equipment.~~

~~**(A)** Equipment Secured to Grounded Metal Supports.~~

~~**(A)** Metal Car Frames.~~

~~Metal car frames supported by metal hoisting cables attached to or running over metal sheaves or drums of elevator machines that are connected to an equipment grounding conductor by one of the methods indicated in 250.134 .~~

Supplemental Information

File Name	Description	Approved
Panel_5_FR-7542_250.136_leg_changes.docx	For staff use	

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
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Submittal Date: Mon Jan 08 12:43:49 EST 2018

Committee Statement

Committee Statement: This section is revised for clarity.

The sentence that prohibits the use of the metal frame of a building as an equipment grounding conductor is moved to 250.121 where similar requirements are located. See FR #7544.

Existing subdivision (B) is being deleted because the connection of the elevator equipment to the equipment grounding conductor is covered in Part IX of Article 620. The requirements in Article 620 amend those of Article 250 as directed by 90.3.

Response Message:

Public Input No. 1840-NFPA 70-2017 [Section No. 250.136]

First Revision No. 7545-NFPA 70-2018 [Section No. 250.142(A)]

(A) Supply-Side Equipment.

A grounded circuit conductor shall be permitted to ~~ground~~ be connected to non–current-carrying metal parts of equipment, raceways, and other enclosures ~~at~~ under any of the following ~~locations~~ conditions :

(1) On the supply side or within the enclosure of the ac service-disconnecting means

(2) On the supply side or within the enclosure of the main disconnecting means for separate buildings as provided in 250.32(B)(1) Exception No. 1

(3) On the supply side or within the enclosure of the main disconnecting means or overcurrent devices of a separately derived system where permitted by 250.30(A)(1)

(4) On the supply side or within the enclosure of a supply-side disconnect(s)

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Submittal Date: Mon Jan 08 12:59:57 EST 2018

Committee Statement and Meeting Notes

Committee Statement: This revision is made to be consistent with the language elsewhere in Article 250.

Editorial improvements are made to the existing language of this section. The revision to List Item (2) specifies a referenced citation more accurately. The term supply-side disconnect was added to the list of items permitted 250.142 to be grounded by the grounded conductor.

Response Message:

Public Input No. 1842-NFPA 70-2017 [Section No. 250.142(A)]

Editorial Comment

Click here

First Revision No. 7548-NFPA 70-2018 [Section No. 250.142(B)]

(B) Load-Side Equipment.

Except as permitted in 250.30(A)(1), ~~and~~ 250.32(B)(1), Exception~~,~~ No. 1, and Part X of Article 250 , a grounded circuit conductor shall not be ~~used for grounding~~ connected to non–current-carrying metal parts of equipment on the load side of the service disconnecting means, on the supply-side disconnect, or on the load side of a separately derived system disconnecting means or the overcurrent devices for a separately derived system not having a main disconnecting means.

Exception No. 1: The frames of ranges, wall-mounted ovens, counter-mounted cooking units, and clothes dryers under the conditions permitted for existing installations by 250.140 shall be permitted to be connected to the grounded circuit conductor.

Exception No. 2: It shall be permissible to ~~ground~~ connect meter enclosures ~~by connection~~ to the grounded circuit conductor on the load side of the service disconnect ~~where~~ if all of the following conditions apply:

(1) ~~No service ground~~ Ground -fault protection of equipment is not installed.

(2) All meter enclosures are located immediately adjacent to the service disconnecting means.

(3) The size of the grounded circuit conductor is not smaller than the size specified in Table 250.122 for equipment grounding conductors.

~~Exception No. 3: Direct-current systems shall be permitted to be grounded on the load side of the disconnecting means or overcurrent device in accordance with 250.164 .~~

Exception No. 3: Electrode-type boilers operating at over 1000 volts shall be grounded as required in 490.72(E)(1) and 490.74.

Submitter Information Verification

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City:
State:
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Submittal Date: Mon Jan 08 13:34:21 EST 2018

Committee Statement

Committee Statement: The revised language expands the application regardless of purpose. Equipment on the supply side of the service disconnecting means is permitted to be connected to the grounded conductor as stated in 250.142(A). Exception No. 3 is removed because 250.164 does not specifically address making a grounded conductor connection on the load side of the disconnecting means. Additional edits are made for clarity and accuracy. The term supply-side disconnect was added to the list of items permitted 250.142 to be grounded by the grounded conductor.

Response Message:

Public Input No. 193-NFPA 70-2017 [Section No. 250.142(B)]

Public Input No. 1843-NFPA 70-2017 [Section No. 250.142(B)]

First Revision No. 7566-NFPA 70-2018 [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 floor insulation shall be provided for the operator where the voltage to ground exceeds 150 volts .

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Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
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Submittal Date: Mon Jan 08 15:37:53 EST 2018

Committee Statement

Committee Statement: The word “volts” is added for clarity and to be consistent with other parts of the Code.

Response Message:

Public Input No. 2733-NFPA 70-2017 [Section No. 250.174(C)]

First Revision No. 7568-NFPA 70-2018 [Section No. 250.176]

250.176 Cases of Instruments, Meters, and Relays — Operating at Over 1000 Volts ~~and Over~~ .

Where instruments, meters, and relays have current-carrying parts of over 1000 volts ~~and over~~ to ground, they shall be isolated by elevation or protected by suitable barriers, grounded metal, or insulating covers or guards. Their cases shall not be connected to the equipment grounding conductor.

Exception: Cases of electrostatic ground detectors where the internal ground segments of the instrument are connected to the instrument case and grounded and the ground detector is isolated by elevation.

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Committee Statement and Meeting Notes

Committee Statement: The editorial change is to be consistent with other parts of the Code.
Response Message:

Public Input No. 1172-NFPA 70-2017 [Section No. 250.176]

Editorial Comment

Click here

First Revision No. 7814-NFPA 70-2018 [Section No. 250.184(A)(1)]

(1) Insulation Level.

The minimum insulation level for neutral conductors of solidly grounded systems shall be 600 volts.

Exception No. 1: ~~Bare~~ 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.

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Street Address:
City:
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Submittal Date: Wed Jan 10 11:36:31 EST 2018

Committee Statement

Committee Statement: Exception No. 1 does not apply to single-point grounded systems since bare underground neutral conductors would be grounded a multiple locations.

Response Message:

Public Input No. 699-NFPA 70-2017 [Section No. 250.184(A)(1)]

First Revision No. 7819-NFPA 70-2018 [Section No. 250.184(C)]

(C) Multigrounded Neutral Systems.

Where a multigrounded neutral system is used, the following shall apply:

(1) The neutral conductor of a solidly grounded neutral system shall be permitted to be grounded at more than one point. Grounding shall be permitted at one or more of the following locations:

a. Transformers supplying conductors to a building or other structure

b. Underground circuits where the neutral conductor is exposed

c. Overhead circuits installed outdoors

(2) The multigrounded neutral conductor shall be grounded at each transformer and at other additional locations by connection to a grounding electrode.

(3) At least one grounding electrode shall be installed and connected to the multigrounded neutral conductor every 400 m (1300 ft).

(4) The maximum distance between any two adjacent electrodes shall not be more than 400 m (1300 ft).

(5) In a multigrounded shielded cable system, the shielding shall be grounded at each cable joint that is exposed to personnel contact.

Exception: In a multipoint grounded system, a grounding electrode shall not be required to bond the neutral conductor in an 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.

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Submitter Full Name: NEC-CMP Panel 05
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Street Address:
City:
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Submittal Date: Wed Jan 10 12:36:44 EST 2018

Committee Statement

Committee Statement: The NESC recently revised their language to allow long cable runs such as those for wind farms and solar farms to still be considered multi-point grounded but not held to the 400 m (1300 ft) maximum length between bonding of the neutral conductor to a grounding electrode. The reasoning is that removing the cable jacket only to create a point for bonding creates a less desirable condition than allowing further space between bonds. Removing the jacket creates a weak spot in the cable that could lead to premature cable failure, and the bonding is also bonding to the shielding material potentially affecting the shielding of the cables that could allow for undesirable EMF to occur at the point where this would occur.

Response Message:

Public Input No. 503-NFPA 70-2017 [Section No. 250.184(C)]

First Revision No. 7651-NFPA 70-2018 [Part II.]

Part II. System Grounding and Bonding

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
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Submittal Date: Tue Jan 09 12:09:49 EST 2018

Committee Statement

Committee Statement: Adding the term "bonding" to the title of Part II of Article 250 clarifies the importance of both grounding and bonding electrical systems.

Response Message:

Public Input No. 3383-NFPA 70-2017 [Part II.]

First Revision No. 7527-NFPA 70-2018 [Part VII.]

Part VII. Methods of Equipment Grounding Conductor Connections

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
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Submittal Date: Mon Jan 08 11:12:23 EST 2018

Committee Statement

Committee Statement: The title of Part VII of Article 250 is revised to reflect the content of the part.
Response Message:

Public Input No. 1838-NFPA 70-2017 [Part VII.]

First Revision No. 8070-NFPA 70-2018 [Definition: Bonding Jumper, Main.]

Bonding Jumper, Main.

The connection between the grounded circuit conductor and the equipment grounding conductor, or the supply-side bonding jumper, or both, at the service or at a supply-side disconnect(s) . (CMP-5)

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Submitter Full Name: NEC-CMP Panel 05
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Committee Statement

Committee Statement: The definition of Main Bonding jumper is modified to include the new term supply-side disconnect as it is not limited strictly to service equipment.

Response Message:

Public Input No. 1827-NFPA 70-2017 [Definition: Bonding Jumper, Main.]

First Revision No. 7614-NFPA 70-2018 [Section No. 200.3]

200.3 Connection to Grounded System.

~~Premises~~ Grounded conductors of premises wiring systems shall ~~wiring shall not~~ be electrically connected to ~~a~~ the supply system ~~unless the latter contains, for any~~ grounded conductor ~~of the interior system, a corresponding conductor that is grounded. For~~ to ensure a common, continuous grounded system. For the purpose of this section, *electrically connected* shall mean ~~connected so as to be~~ making a direct electrical connection capable of carrying current, as distinguished from ~~connection through electromagnetic induction~~ induced currents .

Exception: Listed ~~utility-~~ interactive inverters identified for use in distributed resource generation systems such as photovoltaic and fuel cell power systems shall be permitted to be connected to premises wiring without a grounded conductor ~~where~~ if the connected premises wiring or utility system includes a grounded conductor.

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City:
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Submittal Date: Tue Jan 09 09:15:06 EST 2018

Committee Statement

Committee Statement: The first sentence was revised to make it clear that this text refers to all premises wiring, not just interior wiring. The sentence was also reworded for clarity. The word “utility” was deleted because it is redundant based on the definition in Article 100.

Response Message:

Public Input No. 180-NFPA 70-2017 [Section No. 200.3]

Public Input No. 4270-NFPA 70-2017 [Section No. 200.3]

First Revision No. 7624-NFPA 70-2018 [Section No. 200.6(A)]

(A) Sizes 6 AWG or Smaller.

An insulated grounded conductor of 6 AWG or smaller 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) Wires that have their outer covering finished to show a white or gray color but have colored tracer threads in the braid identifying the source of manufacture ~~shall be considered as meeting the provisions of this section~~ .

(5) The grounded conductor of a mineral-insulated, metal-sheathed cable (Type MI) shall be identified at the time of installation by distinctive marking at its terminations.

(6) A single-conductor, sunlight-resistant, outdoor-rated cable used as a solidly grounded conductor in photovoltaic power systems, as permitted by 690.31, shall be identified at the time of installation by ~~distinctive white marking at all terminations~~ markings at terminations in accordance with 200.6(A)(1) through (A)(4) .

(7) Fixture wire shall comply with the requirements for grounded conductor identification as specified in 402.8.

(8) For aerial cable, the identification shall be as above, or by means of a ridge located on the exterior of the cable so as to identify it.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
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Street Address:
City:
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Submittal Date: Tue Jan 09 10:03:00 EST 2018

Committee Statement

Committee Statement: The Panel added the word “solidly” to clarify the requirements apply to solidly grounded systems and not to functionally grounded systems. Termination marking requirements were revised to allow markings similar to other applications.

The phrase “the provisions of” is overused and redundant and was deleted with proper editorial revision of remaining text without affecting the Code technical requirements.

Response Message:

Public Input No. 1936-NFPA 70-2017 [Section No. 200.6(A)]

Public Input No. 746-NFPA 70-2017 [Section No. 200.6(A)]

Public Input No. 4141-NFPA 70-2017 [Section No. 200.6(A)]

First Revision No. 7637-NFPA 70-2018 [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 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-~~2014~~ 2017 , *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 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-~~2014~~ 2017 , *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.

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Committee Statement

Committee Statement: This revision updates the reference to the current edition of NFPA 780.
Response Message:

First Revision No. 8107-NFPA 70-2018 [Section No. 250.6(D)]

(D) Limitations to Permissible Alterations.

~~The provisions of this section~~ Electronic equipment shall not be ~~considered as permitting electronic equipment from being~~ permitted to be operated on ac systems or branch circuits that are not connected to an equipment grounding conductor as required by this article. Currents that introduce noise or data errors in electronic equipment shall not be considered the objectionable currents addressed in this section.

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Submitter Full Name: NEC-CMP Panel 05
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Committee Statement

Committee Statement: The phrase “the provisions of” is overused and redundant and was deleted with proper editorial revision of remaining text without affecting the Code technical requirements.
Response Message:

First Revision No. 8061-NFPA 70-2018 [Section No. 250.24]

250.24 Grounding and Bonding of Service-Supplied Alternating-Current Systems.

(A) Grounded System.

If an ac system operating at 1000 volts or less is grounded at any point, it shall comply with 250.24(A)(1) through (A)(3).

(1) Grounded Conductor Brought to Service Equipment.

~~Where an ac system operating at 1000 volts or less is grounded at any point, the~~ A grounded conductor(s) shall be routed with the ungrounded conductors to each service disconnecting means. ~~and~~ The grounded conductor(s) 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) through 250.24(C)(4)~~ The grounded conductor on a high impedance grounded neutral system shall be installed in accordance with 250.36 .

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.

(a) *Sizing of Grounding Conductor.*

(1) The grounded service conductor(s) shall be sized not smaller than given in 250.102(C)(1) or (C)(2).

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

(b) *Load-Side Connections.* A grounded conductor shall not be connected to normally non–current-carrying metal parts of equipment, ground, or equipment grounding conductors on the load side of the service disconnecting means except as follows:

(1) Separately derived systems as permitted in 250.30

(2) Separate buildings or structures as permitted in 250.32

(3) Electric ranges and clothes dryers as permitted in 250.140

(4) Grounding of equipment as permitted in 250.142

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

~~**(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.~~

~~If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or cables, the grounded conductor shall also be installed in parallel. The size of the grounded conductor in each raceway or cable shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or cable, as indicated in 250.24(B)(1) , but not smaller than 1/0 AWG.~~

~~Informational Note: See 310.10(H) 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.~~

~~The grounded conductor on a high-impedance grounded neutral system shall be grounded in accordance with 250.36 .~~

(2) Main Bonding Jumper.

For a solidly 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~~ all of the following:

(1) The grounded service conductor to the equipment grounding conductor(s)

(2) The service-disconnect within the enclosure for each service disconnect

.

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 250.36 and 250.187.

(3) ~~System~~ Grounding ~~Connections~~ Electrode Conductor .

A premises wiring system supplied by a solidly grounded ac service shall have ~~a grounding electrode conductor connected to the grounded service conductor, at each service, in accordance with 250.24(A)(2) through (A)(5).~~ the grounded service conductor connected to all of the following:

(1) The grounding electrode system in accordance with Part III

(2) The equipment grounding conductors

(3) The service equipment enclosures

(a) ~~General~~ Grounding Electrode Conductor Connection .

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.

(b) 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 .~~

(c) 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.

(d) 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.

~~**(6)** 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)** Grounding Electrode Conductor.~~

~~A grounding electrode conductor shall be used to connect the equipment grounding conductors, the service-equipment enclosures, and, where 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 grounded neutral system connections shall be made as covered in 250.36 .~~

(B) 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 in accordance with both of the following:

(1) ~~to~~ To the grounding electrode(s) required by Part III of this article

(2) ~~The grounding electrode conductor shall be connected to~~ 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

Supplemental Information

File Name	Description	Approved
70_FR8061_250.24.docx	Clean version 250.24--for staff use	
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Submitter Information Verification

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Street Address:
City:
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Submittal Date: Fri Jan 12 09:22:10 EST 2018

Committee Statement

Committee Statement: The Panel edited and reorganized Section 250.24 for usability. The reorganization portion of this FR does not create any technical changes. The reorganization creates two distinct sections:

A. Grounded Systems

B. Ungrounded Systems

All 2017 existing code text within 250.24 related to grounded systems was relocated into new part A. This includes sizing requirements for the grounded conductor, grounding electrode conductor connections, main bonding jumper connections and high impedance grounded systems. The Section for Ungrounded Systems was reorganized to include all applicable requirements and reorganized into Part B.

PI 2764 changes for “where” to “if” and other locations were included.

PI 1659 revises the word “grounded” to “installed” within 250.24(C)(4) [2017 text]. This section was relocated to 250.24(A) as part of the reorganization.

PI 2583 adds the words “and Bonding” to the title of 250.24. The other remaining proposed changes were not accepted due to lack of technical substantiation or clarity.

Response Message:

Public Input No. 1823-NFPA 70-2017 [Section No. 250.24(A)(5)]

Public Input No. 1826-NFPA 70-2017 [Section No. 250.24(C) [Excluding any Sub-Sections]]

Public Input No. 2583-NFPA 70-2017 [Section No. 250.24]

Public Input No. 2764-NFPA 70-2017 [Section No. 250.24(D)]

Public Input No. 1825-NFPA 70-2017 [Section No. 250.24(B)]

Public Input No. 1659-NFPA 70-2017 [Section No. 250.24(C)(4)]

First Revision No. 8108-NFPA 70-2018 [Section No. 250.28(C)]

(C) Attachment.

Main bonding jumpers and system bonding jumpers shall be connected in the manner specified ~~by the applicable provisions of~~ in 250.8.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
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Committee Statement

Committee Statement: The phrase “the provisions of” is overused and redundant and was deleted with proper editorial revision of remaining text without affecting the Code technical requirements.
Response Message:

First Revision No. 8118-NFPA 70-2018 [Section No. 250.28(D)(2)]

(2) Main Bonding Jumper for Service with More Than One Enclosure.

~~Where~~ If a service consists of more than a single enclosure as permitted in 230.71(A), or if there are two or more supply-side disconnect enclosures, the main bonding jumper for each enclosure shall be sized in accordance with 250.28(D)(1) based on the largest ungrounded service or supply conductor serving that enclosure.

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Submittal Date: Sun Jan 14 09:50:43 EST 2018

Committee Statement

Committee Statement: The term supply-side disconnect was added to the requirement for sizing main bonding jumpers when multiple supply-side disconnects are present.

Response Message:

Public Input No. 1828-NFPA 70-2017 [Section No. 250.28(D)(2)]

First Revision No. 8097-NFPA 70-2018 [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 ~~separately derived systems~~ power sources of the same type that are connected in parallel to form one system that supplies premises wiring shall be considered as a single separately derived system and shall be installed in accordance with 250.30.

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 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 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 source of 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 in Two or More Raceways.* If the ungrounded conductors are installed in parallel in two or more raceways, the grounded conductor shall also be installed in parallel. The size of the grounded conductor in each raceway shall be based on the total circular mil area of the parallel derived ungrounded conductors in the raceway as indicated in 250.30(A)(3)(a), but not smaller than 1/0 AWG.

Informational Note: See 310.10(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 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 ~~the~~ each separately derived ~~systems~~ 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 with 250.68(C)(1)

(3) The metal structural frame of the building or structure that complies 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.

~~*Exception: 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.*~~

(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 length to accommodate the number of terminations necessary for the installation. If aluminum busbars are used, the installation shall also comply 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 with 250.50. In addition, the installation shall comply 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 with 250.36 or 250.187, as applicable.

Supplemental Information

File Name	Description	Approved
Panel_5_FR-8097_250.30_leg_changes.docx	For staff use	

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
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Submittal Date: Fri Jan 12 15:36:46 EST 2018

Committee Statement

Committee Statement: The revised text in the first paragraph of 250.30 clarifies that multiple separately derived systems of the same type connected in parallel are considered to be a single separately derived system.

The Panel agrees that it is a separately derived system, however the proposed new Informational Note No. 2 was not added because it is more appropriately located in the Handbook.

The proposed new Informational Note No 4 was not added because the added text clearly explains what multiple sources are.

The exceptions to 250.30(A)(1) were not relocated because the Panel concluded that they are correctly located.

New exception 4 was added to cover multiple sources of the same type that are installed as a single separately derived system.

The words " enclosure for the" were added to 250.30(A)(2) because the supply side bonding jumper is connected to the enclosure, not the disconnecting means itself.

Language was added to 250.30(A)(3) because a grounded conductor is not required to be larger than the ungrounded conductors.

The word "each" was added to the first paragraph of 250.30(A)(6) because each separately derived system needs to be connected to the common grounding electrode conductor.

The exception to 250.30(A)(6) was relocated under the opening paragraph as Exception No. 3 as that is what it applies to.

An exception to 250.30(A)(6) (a)(1) and (b) was added to 250.30(A)(6) to permit reduced sizing of grounding electrode conductors under the conditions stated and be consistent with 250.66.

Response Message:

Public Input No. 2767-NFPA 70-2017 [Section No. 250.30(A)(2)]

Public Input No. 2124-NFPA 70-2017 [Section No. 250.30(A)(6)]

Public Input No. 4315-NFPA 70-2017 [Section No. 250.30(A)(6)]

Public Input No. 2129-NFPA 70-2017 [Section No. 250.30(A)(6)]

Public Input No. 4051-NFPA 70-2017 [Section No. 250.30]

Public Input No. 1507-NFPA 70-2017 [Section No. 250.30(A)(3)]

Public Input No. 2770-NFPA 70-2017 [Section No. 250.30(A)(6)]

Public Input No. 2141-NFPA 70-2017 [Section No. 250.30(A)]

First Revision No. 8109-NFPA 70-2018 [Section No. 250.32(D)]

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

Where 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 the provisions of~~ with 225.32, Exception No. 1 and No. 2, 700.12(D)(5), 701.12(D)(5), 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 there are no existing electrodes, the grounding electrode(s) required in Part III of this article shall be installed where 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.

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Committee Statement

Committee Statement: The phrase “the provisions of” is overused and redundant and was deleted with proper editorial revision of remaining text without affecting the Code technical requirements.
Response Message:

First Revision No. 8060-NFPA 70-2018 [Section No. 250.53]

250.53 Grounding Electrode System Installation.

(A) Rod, Pipe, and Plate Electrodes.

Rod, pipe, and plate electrodes shall meet the requirements of 250.53(A)(1) through (A)(3).

(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.

(B) Electrode Spacing.

Where 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.

(C) Bonding Jumper.

The bonding jumper(s) used to connect the grounding electrodes together to form the grounding electrode system shall be installed in accordance with 250.64(A), (B), and (E), shall be sized in accordance with 250.66, and shall be connected in the manner specified in 250.70.

(D) Metal Underground Water Pipe.

If used as a grounding electrode, metal underground water pipe shall meet the requirements of 250.53(D)(1) and (D)(2).

(1) Continuity.

Continuity of the grounding path or the bonding connection to interior piping shall not rely on water meters or filtering devices and similar equipment.

(2) Supplemental Electrode Required.

A metal underground water pipe shall be supplemented by an additional electrode of a type specified in 250.52(A)(2) through (A)(8). If the supplemental electrode is of the rod, pipe, or plate type, it shall comply with 250.53(A). The supplemental electrode shall be bonded to one of the following:

(1) Grounding electrode conductor

(2) Grounded service-entrance conductor

(3) Nonflexible grounded service raceway

(4) Any grounded service enclosure

(5) As provided by 250.32(B)

Exception: The supplemental electrode shall be permitted to be bonded to the interior metal water piping ~~at any convenient point~~ as specified in 250.68(C)(1), ~~Exception~~ .

(E) Supplemental Electrode Bonding Connection Size.

Where 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 wire.

(F) Ground Ring.

The ground ring shall be installed not less than 750 mm (30 in.) below the surface of the earth.

Supplemental Information

File Name	Description	Approved
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Submitter Information Verification

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Committee Statement

Committee Statement: This change reorganizes the section to improve clarity and usability.

The Panel removes the phrase “at any convenient point” and the word “Exception” from end of the sentence clarify that the supplemental electrode is bonded in compliance with 250.68(C)(1).

Response Message:

Public Input No. 1318-NFPA 70-2017 [Section No. 250.53(D)(2)]

Public Input No. 3394-NFPA 70-2017 [Section No. 250.53(A)]

First Revision No. 7898-NFPA 70-2018 [Sections 250.64(B)(2), 250.64(B)(3)]

(2) Exposed to Physical Damage.

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

(3) Smaller Than 6 AWG.

Grounding electrode conductors smaller than 6 AWG shall be protected in RMC, IMC, Schedule 80 PVC, RTRC-XW, EMT, or cable armor.

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Committee Statement

Committee Statement: The revision clarifies that Schedule 80 is required when PVC conduit is used for protection from physical damage.
Response Message:

Public Input No. 346-NFPA 70-2017 [Sections 250.64(B)(2), 250.64(B)(3)]

First Revision No. 8110-NFPA 70-2018 [Section No. 250.96(B)]

(B) Isolated Grounding Circuits.

Where installed for the reduction of electrical noise (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 ~~provisions of~~ 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.

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Submitter Full Name: NEC-CMP Panel 05
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Committee Statement

Committee Statement: The phrase “the provisions of” is overused and redundant and was deleted with proper editorial revision of remaining text without affecting the Code technical requirements.
Response Message:

First Revision No. 8111-NFPA 70-2018 [Section No. 250.102(B)]

(B) Attachment.

Bonding jumpers shall be attached in the manner specified ~~by the applicable provisions of~~ in 250.8 for circuits and equipment and ~~by~~ in 250.70 for grounding electrodes.

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Committee Statement

Committee Statement: The phrase “the provisions of” is overused and redundant and was deleted with proper editorial revision of remaining text without affecting the Code technical requirements.
Response Message:

First Revision No. 8031-NFPA 70-2018 [Section No. 250.104(A)(1)]

(1) General.

Metal water piping system(s) installed in or attached to a building or structure shall be bonded to any of the following:

(1) Service equipment enclosure

(2) Grounded conductor at the service

(3) Grounding electrode conductor, if of sufficient size

(4) One or more grounding electrodes used, if the grounding electrode conductor or bonding jumper to the grounding electrode is of sufficient size

The bonding jumper(s) shall be installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible. The bonding jumper(s) shall be sized in accordance with Table 250.102(C)(1) except that it shall not be required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum and except as permitted in 250.104(A)(2) and 250.104(A)(3).

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Committee Statement

Committee Statement: The change that was made as a result of changing the reference from Table 250.66 to Table 250.102(C)(1) in the 2017 cycle resulted in an inadvertent increase in the bonding conductor size.

Response Message:

Public Input No. 3203-NFPA 70-2017 [Section No. 250.104(A)(1)]

First Revision No. 8033-NFPA 70-2018 [Section No. 250.104(A)(3)]

(3) ~~Multiple~~ Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s).

The metal water piping system(s) installed in or attached to a building or structure shall be bonded to any of the following:

(1) Building or structure disconnecting means enclosure where located at the building or structure

(2) Equipment grounding conductor run with the supply conductors

(3) One or more grounding electrodes used

The bonding jumper(s) shall be sized in accordance with ~~Table 250.102(C)(1)~~ , 250.102(D) ~~based on the size of the feeder or branch-circuit conductors that supply the building or structure~~ . The bonding jumper shall not be required to be larger than the largest ungrounded feeder or branch-circuit conductor supplying the building or structure.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 12 00:09:10 EST 2018

Committee Statement

Committee Statement: The word “multiple” is removed because it is not needed.

The changes clarify the requirements for bonding the metal water piping system when a building or structure is supplied by a feeder or branch circuit. The reference to 250.102(D) provides the appropriate requirements for sizing and installation of this bonding conductor.

Response Message:

Public Input No. 2830-NFPA 70-2017 [Section No. 250.104(A)(3)]

Public Input No. 3204-NFPA 70-2017 [Section No. 250.104(A)(3)]

Public Input No. 944-NFPA 70-2017 [Section No. 250.104(A)(3)]

First Revision No. 8034-NFPA 70-2018 [Section No. 250.104(C)]

(C) Structural Metal.

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

(1) Service equipment enclosure

(2) Grounded conductor at the service

(3) Disconnecting means for buildings or structures supplied by a feeder or branch circuit

(4) Grounding electrode conductor, if of sufficient size

(5) One or more grounding electrodes used, if the grounding electrode conductor or bonding jumper to the grounding electrode is of sufficient size

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

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
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Street Address:
City:
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Submittal Date: Fri Jan 12 00:22:31 EST 2018

Committee Statement

Committee Statement: The change that was made as a result of changing the reference from Table 250.66 to Table 250.102(C)(1) in the 2017 cycle resulted in an inadvertent increase in the bonding conductor size.

Response Message:

Public Input No. 945-NFPA 70-2017 [Section No. 250.104(C)]

First Revision No. 8035-NFPA 70-2018 [Sections 250.104(D)(1), 250.104(D)(2)]

(1) Metal Water Piping System(s).

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

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

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

(2) Structural Metal.

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

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

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

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
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City:
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Submittal Date: Fri Jan 12 00:26:54 EST 2018

Committee Statement

Committee Statement: The change that was made as a result of changing the reference from Table 250.66 to Table 250.102(C)(1) in the 2017 cycle resulted in an inadvertent increase in the bonding conductor size.

Response Message:

Public Input No. 2323-NFPA 70-2017 [Section No. 250.104(D)(1)]

Public Input No. 946-NFPA 70-2017 [Section No. 250.104(D)(1)]

Public Input No. 947-NFPA 70-2017 [Section No. 250.104(D)(2)]

First Revision No. 8038-NFPA 70-2018 [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-~~2014~~ 2017 , *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-~~2014~~ 2017 , *Standard for the Installation of Lightning Protection Systems*.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
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Street Address:
City:
State:
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Submittal Date: Fri Jan 12 06:23:32 EST 2018

Committee Statement

Committee Statement: The Panel updates the reference of NFPA 780-2014 to NFPA 780-2017.
Response Message:

First Revision No. 8039-NFPA 70-2018 [Section No. 250.112(K)]

(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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
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Committee Statement

Committee Statement: The words “Wire type equipment grounding conductors” were added because those are the only types that are sized by 250.122.

Response Message:

Public Input No. 2822-NFPA 70-2017 [Section No. 250.112(K)]

First Revision No. 8040-NFPA 70-2018 [Section No. 250.114]

250.114 Equipment Connected by Cord and Plug.

~~Under any of the conditions described in~~ 250.114 ~~(1) through (4), exposed~~ 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) shall not be required to be connected to an equipment grounding conductor where 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 operated at over 150 volts to ground

Exception No. 1 to (2): Motors, where 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, 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, 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, ~~or~~ 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 supplied through an isolating transformer with an ungrounded secondary of not over 50 volts.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05

First Revision No. 8041-NFPA 70-2018 [Section No. 250.118]

250.118 Types of Equipment Grounding Conductors.

The 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, ~~and~~ 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, ~~an~~ a wire-type equipment grounding conductor 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 ⅜ 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 ~~trade sizes~~ metric designators 12 through 16 (trade sizes ⅜ through ½) in the effective ground-fault current path.

d. The combined length of flexible metal conduit, ~~and~~ 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, ~~an~~ a wire-type equipment grounding conductor shall be installed.

(7) Flexible metallic tubing where 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, ~~and~~ 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: For a definition of ~~*Effective Ground-Fault Current Path*~~ *effective ground-fault current path* , see Article 100.

Supplemental Information

File Name	Description	Approved
70_FR8041_250.118.docx	For staff use	

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 12 06:53:09 EST 2018

Committee Statement

Committee Statement: Adding “effective” and “wire type” adds clarity.
Response Message:

Public Input No. 2515-NFPA 70-2017 [Section No. 250.118]

Public Input No. 2823-NFPA 70-2017 [Section No. 250.118]

First Revision No. 8043-NFPA 70-2018 [Section No. 250.119(B)]

(B) Multiconductor Cable.

~~Where the conditions of maintenance and supervision ensure that only qualified persons service the installation, one~~ 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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
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City:
State:
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Submittal Date: Fri Jan 12 07:26:24 EST 2018

Committee Statement

Committee Statement: The Panel edits the text. Many other sections of the NEC permit or require identification. There is no requirement similar to "Where the conditions of maintenance and supervision ensure that only qualified persons service the installation" to perform such identification.

Response Message:

Public Input No. 2784-NFPA 70-2017 [Section No. 250.119(B)]

First Revision No. 8066-NFPA 70-2018 [Section No. 250.120(B)]

(B) Aluminum and Copper-Clad Aluminum Conductors.

Equipment grounding conductors of bare, covered, or insulated aluminum or copper-clad aluminum ~~shall be permitted.~~ shall comply with the following:

(1) Bare conductors shall not ~~come~~ be installed where subject to corrosive conditions or be installed in direct contact with masonry or the earth ~~or where subject to corrosive conditions~~ .

(2) Terminations made within listed enclosures identified for outdoor use shall be permitted within 450 mm (18 in.) of the earth. If open bottom enclosures are installed on a concrete pad, the concrete shall not be considered as earth.

(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 insulated . The termination shall be listed as a sealed wire-connector system.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
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City:
State:
Zip:
Submittal Date: Fri Jan 12 09:49:41 EST 2018

Committee Statement

Committee Statement: The section was formatted into a list format for improved clarity and usability and to clarify that terminations located in the interior of the listed equipment are separated from the earth. The requirement for sealed wire connector systems was added as another option for terminating aluminum conductors.

Response Message:

Public Input No. 2797-NFPA 70-2017 [Section No. 250.120(B)]

Public Input No. 2857-NFPA 70-2017 [Section No. 250.120(B)]

Public Input No. 2861-NFPA 70-2017 [Section No. 250.120(B)]

Public Input No. 3179-NFPA 70-2017 [Section No. 250.120(B)]

Public Input No. 3778-NFPA 70-2017 [Section No. 250.120(B)]

First Revision No. 7544-NFPA 70-2018 [Section No. 250.121]

250.121 ~~Use~~ Prohibited 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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 08 12:53:09 EST 2018

Committee Statement

Committee Statement: This section is being reorganized to include the concepts in the existing last sentence of 250.136(A). Changes in subsection (B) are made to clarify that this requirement applies to all equipment. See also FR #7542.

Response Message:

First Revision No. 8114-NFPA 70-2018 [Section No. 250.122]

250.122 Size of Equipment Grounding Conductors.

(A) General.

Copper, aluminum, or copper-clad aluminum equipment grounding conductors of the wire type shall not be smaller than shown in Table 250.122~~, but in no case~~ . The equipment grounding conductor shall ~~they~~ not be required to be larger than the circuit conductors supplying the equipment. ~~Where~~ If a cable tray, a raceway, or a cable armor or sheath is used as the equipment grounding conductor, as provided in 250.118 and 250.134(A), it shall comply with 250.4(A)(5) or (B)(4).

Equipment grounding conductors shall be permitted to be sectioned within a multiconductor cable, provided the combined circular mil area complies with Table 250.122.

~~**(B)** Increased in Size.~~

~~Where ungrounded conductors are increased in size from the minimum size that has sufficient ampacity for the intended installation, wire-type equipment grounding conductors, where installed, shall be increased in size proportionately, according to the circular mil area of the ungrounded conductors.~~

(B) Multiple Circuits.

~~Where a~~ A single equipment grounding conductor ~~is~~ shall be ~~run with~~ permitted to be installed for multiple circuits that are installed in the same raceway, cable, or cable tray.~~, it~~ It shall be sized from Table 250.122 for the largest ~~overcurrent device protecting~~ circuit conductors in the raceway, cable, or cable tray. Equipment grounding conductors installed in cable trays shall meet the minimum requirements of 392.10(B)(1)(c).

(C) Motor Circuits.

Equipment grounding conductors for motor circuits shall be sized in accordance with (~~D~~ C)(1) or (~~D~~ C)(2).

(1) General.

The equipment grounding conductor size shall not be smaller than determined by Table 250.122 ~~250.122(A)~~ based on the ~~rating~~ size of the branch-circuit short-circuit ~~and ground-fault protective device~~ or feeder conductor .

(2) Instantaneous-Trip Circuit Breaker and Motor Short-Circuit Protector.

~~Where~~ 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 Table 250.122~~250.122(A)~~ using the ~~maximum permitted rating of a dual element time-delay fuse selected for~~ size of the branch-circuit ~~short-circuit and ground-fault protection in accordance with 430.52(C)(1) , Exception No. 1~~ conductor .

(D) 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.

(E) 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(E)(1) or (E) (2). Equipment grounding conductors that are not smaller than that provided in Table 250.122 shall be permitted to be connected in parallel for circuit conductors that are connected in parallel.

(1) Conductor Installations in Raceways, Auxiliary Gutters, or Cable Trays.

(a) *Single Raceway or Cable Tray, Auxiliary Gutter , or Cable Tray*. ~~If~~ Equipment grounding conductors for circuit conductors that are ~~installed~~ connected in parallel in the same raceway, auxiliary gutter, or cable tray~~, a single wire-type conductor~~ shall be ~~permitted as the~~ installed in compliance with one of the following:

(1) An equipment grounding conductor shall be installed with each set of circuit conductors that are connected in parallel . The wire-type equipment grounding conductor for each set shall be sized in accordance with Table 250.122 . ~~250.122~~

(2) ~~based on the overcurrent protective device for the feeder or branch circuit. Wire~~ A single wire -type equipment grounding conductor~~s installed in cable trays shall meet the minimum requirements of 392.10(B)(1) (c). 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~~ s s hall be installed and sized in accordance with Table 250.122 , based on the total circular mil area of the largest set of circuit conductors for any phase that is connected in parallel. Where the total area does not result in a standard size conductor, the next larger conductor shall be selected from Chapter 9, Table 8 .

(b) *Multiple Raceways*. If conductors are installed in parallel in multiple raceways, wire-type equipment grounding conductors, where used, shall be installed in parallel in each raceway. The equipment grounding conductor installed in each raceway shall be sized in compliance with 250.122 based on the ~~overcurrent protective device for the feeder or branch~~ largest circuit conductor in the raceway . 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.

(c) *Wire-Type Equipment Grounding Conductors.* Wire-type equipment grounding conductors installed in cable trays shall meet the minimum requirements of 392.10(B)(1)(c).

(d) *Metal Raceways, Auxiliary Gutters, or Cable Trays.* Metal raceways or auxiliary gutters in accordance with 250.188 or cable trays complying with 392.60(B) shall be permitted as the equipment grounding conductor.

(2) Multiconductor Cables.

(a) If circuit conductors of multiconductor cables are ~~installed~~ connected in parallel, the equipment grounding conductor(s) in each cable shall be connected in parallel.

(b) ~~If multiconductor cables are installed in parallel in the same raceway, auxiliary gutter, or cable tray, a single~~ The equipment grounding conductor ~~that is~~ in each multiconductor cable shall be sized in ~~accordance~~ compliance with ~~250.122~~ Table 250.122 ~~shall be permitted in combination with the equipment grounding conductors provided within the multiconductor cables and shall all be connected together~~ .

(c) 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.

(c) ~~Except as provided in 250.122(F)(2)(b) 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.~~

(F) Feeder Taps.

Equipment grounding conductors ~~run~~ installed with feeder taps shall not be smaller than shown in Table 250.122 based on the ~~rating~~ size of the ~~overcurrent device~~ feeder conductor on the supply side ahead of the ~~feeder~~ 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

Rating or Setting of Automatic Overcurrent Device in Circuit Ahead of Equipment, Conduit, etc., Not Exceeding (Amperes) Size of Largest Ungrounded Circuit Conductor (AWG or kcmil)		Smallest Size of Equipment Grounding Conductor (AWG or kcmil)	
Copper	Aluminum or Copper-clad Aluminum	Copper	Aluminum or Copper-~~Clad~~ clad Aluminum*
~~15~~ 14	12	14	12
~~20~~ 12	10	12	10
~~60~~ 10–8	8–6	10	8
~~100~~ 6–3	4–1	8	6
~~200~~ 2–3/0	1/0–4/0	6	4
4/0– 300	250–450	4	2
~~400~~ 350–550	500–800	3	1
~~500~~ 600–800	900–1300	2	1/0
~~600~~ 900–1300	1400–2000	1	2/0
~~800~~ 1400–2000	–	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~~	~~1200~~
~~6000~~		~~800~~	~~1200~~

~~Note~~ Notes :

1. ~~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.

2. If the equivalent area of the largest ungrounded circuit conductor is larger than 2000 kcmil in a single raceway, auxiliary gutter, or cable tray, the equipment grounding conductor shall have an area not less than 12 ½ percent of the equivalent area of the largest ungrounded conductor.

*See installation restrictions in 250.120.

Supplemental Information

File Name	Description	Approved
Replacement_text_for_250.122.docx	Replacement Text for 250.122-clean version. For staff use	
Panel_5_FR-8114_250.122_leg_changes.docx	For staff use	

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Fri Jan 12 18:03:40 EST 2018

Committee Statement

Committee Statement: This revision changes the method for sizing equipment grounding conductors in Table 250.122 from being based on the rating of the overcurrent device on the supply side of the circuit to being based on the size of the ungrounded circuit conductors. The technical basis for this change is found in Table 6.2 from UL 1569, the safety standard for Metal-Clad Cables and an identical Table 8.2 from UL-1277, the safety standard for Tray Cables. Both tables were developed using the rating of the overcurrent device that would reasonably be expected to supply the circuit conductors. Both tables are based on the sizing of circuit conductors for terminations rated at 75°C.

This is consistent with basing the size of supply-side bonding jumpers and grounded conductors that carry fault current on circuit conductors in Table 250.102(C)(1).

The sizes of equipment grounding conductors in the proposed Table 250.122 were compared with the sizes in existing Table 250.122 and found to be the same based on the overcurrent device.

Additionally, this change will simplify and increase the usability of the Code by removing any ambiguous language for increasing the size of the equipment grounding conductor under differing conditions and make it easier for the AHJ to enforce compliance.

Because the size of the circuit conductor that is installed is used in Table 250.122 to determine the size of the equipment grounding conductor, there is no need for increasing the size of the equipment grounding conductor based on an increase in the size of an ungrounded conductor. It will automatically be maintained in proper proportion.

Editorial changes are made to 250.122(B) (formerly (C)).

Editorial changes are also made to (C) (formerly (D)).

A change is being made to 250.122(E) (formerly (F)) for parallel circuits. A clarification is made for equipment grounding conductors that are sized according to Table 250.122 are permitted to be connected in parallel.

This revised method for sizing the equipment grounding conductor for parallel circuits based on the size of the ungrounded circuit conductors is consistent with other parts of the Code. This practice is currently used in sizing the supply side bonding jumpers and grounded conductors in two or more raceways or cables brought to service equipment and the secondary of separately derived systems.. Since the conductors on the supply side of the service have only overload protection in accordance with 230.90, it is critical that the paralleled grounded conductors are capable of carrying fault current for the length of time the current flows. If the supply side conductors are large enough to perform this function safely, it is reasonable to conclude the same approach is adequate on the load side of the overcurrent device where the premises wiring overcurrent protective device is established by code requirements.

Circuit conductors are permitted to share current when connected in parallel. It is reasonable to conclude that equipment grounding conductors will also share the current when connected in parallel.

In the unlikely event that the equivalent area of the multiple circuit conductors exceeds 2000 kcmil in a single raceway, and the installer chooses to use a single equipment grounding conductor, the 12½ percent application from Table 250.102(C)(1) is applied conservatively.

Editorial changes are made to 250.122(F) (formerly (G)) to base the size of the equipment grounding conductor for feeder taps on the size of the feeder conductors on the supply side of the tap. The equipment grounding conductor is not required to be larger than the tap circuit conductors. This mirrors the existing concept in this section.

Other sections of Article 250 and other sections that reference Table 250.122 have been updated to reflect this proposed change.

The new table includes ungrounded conductors through 1000 kcmil as common installation practice use parallel circuit conductors for installations requiring conductors larger than 1000 kcmil.

Response Message:

Public Input No. 943-NFPA 70-2017 [Section No. 250.122(B)]

Public Input No. 3291-NFPA 70-2017 [Section No. 250.122(B)]

Public Input No. 1660-NFPA 70-2017 [Section No. 250.122(A)]

Public Input No. 226-NFPA 70-2017 [Section No. 250.122(G)]

Public Input No. 573-NFPA 70-2017 [Section No. 250.122(B)]

Public Input No. 3443-NFPA 70-2017 [Section No. 250.122(F)(2)]

Public Input No. 3909-NFPA 70-2017 [Section No. 250.122(C)]

Public Input No. 2795-NFPA 70-2017 [Section No. 250.122(B)]

Public Input No. 545-NFPA 70-2017 [Section No. 250.122(F)(1)]

Public Input No. 3914-NFPA 70-2017 [Section No. 250.122(F)]

Public Input No. 1661-NFPA 70-2017 [Section No. 250.122(F)(1)]

Public Input No. 4292-NFPA 70-2017 [Section No. 250.122(G)]

Public Input No. 3896-NFPA 70-2017 [Section No. 250.122(B)]

Public Input No. 2831-NFPA 70-2017 [Section No. 250.122(F)(1)]

Public Input No. 3142-NFPA 70-2017 [Section No. 250.122(B)]

First Revision No. 7541-NFPA 70-2018 [Section No. 250.134]

250.134 Equipment Fastened in Place or Connected by Permanent Wiring Methods (Fixed) ~~— Grounding~~ .

Unless ~~grounded by connection~~ connected to the grounded circuit conductor as permitted by 250.32, 250.140, and 250.142, non–current-carrying metal parts of equipment, raceways, and other enclosures, if grounded, shall be connected to an equipment grounding conductor by one of the following methods: ~~specified in 250.134(A) or (B).~~

(1) By connecting to any of the equipment grounding conductors permitted by 250.118 (2) through (14) ~~.~~

(2) By connecting to an equipment grounding conductor of the wire type that is contained within the same raceway, contained within the same cable, or otherwise run with the circuit conductors~~.~~

Exception No. 1: As provided in 250.130(C), the equipment grounding conductor shall be permitted to be run separately from the circuit conductors.

Exception No. 2: For dc circuits, the equipment grounding conductor shall be permitted to be run separately from the circuit conductors~~.~~

Informational Note No. 1: See 250.102 and 250.168 for equipment bonding jumper requirements.

Informational Note No. 2: See 400.10 for use of flexible cords and flexible cables for fixed equipment.

~~**(A)** Equipment Grounding Conductor Types.~~

~~**(A)** With Circuit Conductors.~~

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 08 12:38:18 EST 2018

Committee Statement

Committee Statement: Editorial improvements are made for clarity. Revisions to 250.134(A) and (B) clarify the types of equipment grounding conductors permitted to be used. Language is added to Informational Note No. 2 to include applicable topics in Article 400.

Response Message:

Public Input No. 1837-NFPA 70-2017 [Section No. 250.134]

Public Input No. 427-NFPA 70-2017 [Sections 250.134(A), 250.134(B)]

First Revision No. 7654-NFPA 70-2018 [Section No. 250.146]

250.146 Connecting Receptacle Grounding Terminal to ~~Box~~ an Equipment Grounding Conductor .

An equipment bonding jumper shall be used to connect the grounding terminal of a grounding-type receptacle to a ~~grounded~~ metal box ~~unless grounded~~ 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 ~~based on the rating of the overcurrent device protecting the circuit conductors~~ .

(A) Surface-Mounted Box.

~~Where the~~ If a metal box is mounted on the surface, the direct metal-to-metal contact between the device yoke ~~and~~ or strap to the box ~~or a contact yoke or device that complies with 250.146(B)~~ shall be permitted to provide the required effective ground ~~the receptacle to the box~~ fault current path . At least one of the insulating washers shall be removed from receptacles that do not have a contact yoke or device ~~that complies with 250.146(B)~~ to ensure direct metal-to-metal contact. ~~This provision shall not apply~~ Direct metal-to-metal contact for providing continuity applies to cover-mounted receptacles ~~unless~~ if the box and cover combination are listed as providing satisfactory ~~ground~~ continuity between the box and the receptacle. A listed exposed work cover shall be permitted to be the grounding and bonding means ~~when~~ 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 ~~and~~

(2) The cover mounting holes are located on a flat non-raised 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 ~~ground~~ continuity between the box and the device shall be permitted.

(D) Isolated Ground Receptacles.

Where installed for the reduction of electrical noise (electromagnetic interference) on the equipment grounding ~~circuit~~ 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 installed in accordance with ~~the provisions of~~ 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 grounding the raceway system and outlet box.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:

Submittal Date: Tue Jan 09 12:30:29 EST 2018

Committee Statement

Committee Statement: Edits are made in terminology to improve readability and provide consistency with other parts of the Code, and to account for nonmetallic boxes. The last phrase of 250.146 is removed as unnecessary wording.

The phrase “the provisions of” is overused and redundant and was deleted with proper editorial revision of remaining text without affecting the Code technical requirements.

Response Message:

Public Input No. 1846-NFPA 70-2017 [Section No. 250.146(C)]

Public Input No. 3305-NFPA 70-2017 [Section No. 250.146(A)]

Public Input No. 1845-NFPA 70-2017 [Section No. 250.146(A)]

Public Input No. 247-NFPA 70-2017 [Section No. 250.146(A)]

Public Input No. 3303-NFPA 70-2017 [Section No. 250.146 [Excluding any Sub-Sections]]

Public Input No. 2798-NFPA 70-2017 [Section No. 250.146]

First Revision No. 8115-NFPA 70-2018 [Section No. 250.148]

250.148 Continuity ~~and Attachment~~ of Equipment Grounding Conductors and Attachment to Metal 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 together within the box or to the box ~~with devices suitable for the use~~ in accordance with 250.8 and 250.148(A) through (~~E~~ 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 .

Connections and splices shall be made in accordance with 110.14(B) 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, ~~luminaire,~~ or other device fed from the box does not ~~interfere with or~~ interrupt the ~~grounding continuity~~ 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 ~~one or more equipment grounding conductors and a metal box by means of a grounding screw that shall be used for no other purpose, equipment listed for grounding, or a listed grounding device~~ metal box and the equipment grounding conductor(s) in accordance with 250.8 .

(D) Nonmetallic Boxes.

One or more equipment grounding conductors brought into a nonmetallic outlet box shall be arranged such that a connection can be made to any fitting or device in that box requiring connection to an equipment grounding conductor .

~~**(E)** Solder.~~

~~Connections depending solely on solder shall not be used.~~

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
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Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 12 18:11:00 EST 2018

Committee Statement

Committee Statement: Editorial changes are made to improve readability and clarify when equipment grounding conductors within a box are intended to be connected together and bonded to a metal box or device.

Section 250.148(E) is deleted because it is already required by 250.8(B).

Response Message:

Public Input No. 3399-NFPA 70-2017 [Section No. 250.148]

Public Input No. 450-NFPA 70-2017 [Section No. 250.148]

Public Input No. 3312-NFPA 70-2017 [Section No. 250.148(E)]

Public Input No. 1408-NFPA 70-2017 [Section No. 250.148 [Excluding any Sub-Sections]]

Public Input No. 3216-NFPA 70-2017 [Section No. 250.148 [Excluding any Sub-Sections]]

First Revision No. 8112-NFPA 70-2018 [Section No. 250.168]

250.168 Direct-Current System Bonding Jumper.

For direct-current systems that are to be grounded, an unspliced bonding jumper shall be used to connect the equipment grounding conductor(s) to the grounded conductor at the source or to the first system disconnecting means where the system is grounded. The size of the bonding jumper shall not be smaller than the system grounding electrode conductor specified in 250.166 and shall comply with ~~the provisions of~~ 250.28(A), (B), and (C).

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 12 17:53:48 EST 2018

Committee Statement

Committee Statement: The phrase “the provisions of” is overused and redundant and was deleted with proper editorial revision of remaining text without affecting the Code technical requirements.
Response Message:

First Revision No. 8113-NFPA 70-2018 [Section No. 250.180]

250.180 General.

~~Where~~ If systems over 1000 volts are grounded, they shall comply with all applicable ~~provisions~~ requirements of ~~the preceding sections of this article~~ 250.1 through 250.178 and with 250.182 through 250.194, which supplement and modify the preceding sections.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 12 17:54:53 EST 2018

Committee Statement

Committee Statement: The phrase “the provisions of” is overused and redundant and was deleted with proper editorial revision of remaining text without affecting the Code technical requirements.

The term "where" is changed to "if" per the NEC Style Manual 3.3.4.

Response Message:

First Revision No. 7820-NFPA 70-2018 [Section No. 250.187]

250.187 Impedance Grounded ~~Neutral~~ Systems.

Impedance grounded ~~neutral~~ systems in which a grounding impedance, usually a resistor, limits the ground-fault current shall be permitted where 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 ~~neutral~~ systems shall comply with ~~the provisions of~~ 250.187(A) through (D).

(A) Location.

The grounding impedance shall be inserted in the grounding electrode conductor between the grounding electrode of the supply system and the neutral point of the supply transformer or generator.

(B) ~~Identified and~~ Insulated.

The ~~neutral conductor shall comply with both of the following:~~ grounding system conductor shall be insulated for the maximum neutral voltage.

(0) ~~The neutral conductor shall be identified.~~

(0) ~~The neutral conductor shall be insulated for the maximum neutral voltage.~~

Informational Note: The maximum neutral voltage in a ~~three~~ 3 -phase wye system is 57.7 percent of the phase-to-phase voltage.

(C) Grounded System ~~Neutral~~ Conductor Connection.

The system ~~neutral~~ grounded conductor shall not be connected to ground, except through the ~~neutral~~ grounding impedance.

(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.

Supplemental Information

File Name	Description	Approved
Panel_5_FR-7820_250.187_leg_changes.docx	For staff use	

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 12:40:10 EST 2018

Committee Statement

Committee The conductor from the neutral point of a transformer to the grounding impedance device does not

Statement: meet the definition of neutral conductor in Article 100 since it is not intended to carry current during normal operation. The reference to identified conductors isn't needed because it is covered in Article 200.

The phrase "the provisions of" is overused and redundant and was deleted with proper editorial revision of remaining text without affecting the Code technical requirements.

Response Message:

Public Input No. 785-NFPA 70-2017 [Sections 250.187(B), 250.187(C)]

First Revision No. 8116-NFPA 70-2018 [Sections 280, 285]

~~**Article 280** Surge Arresters, Over 1000 Volts~~

Part I. General

280.1 Scope.

This article covers general requirements, installation requirements, and connection requirements for surge arresters installed on premises wiring systems over 1000 volts.

280.3 Number Required.

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

280.4 Surge Arrester Selection.

The surge arresters shall comply with 280.4(A) and (B).

(A) Rating.

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

(1) Solidly Grounded Systems.

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

(2) Impedance or Ungrounded System.

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

(B) Silicon Carbide Types.

The rating of a silicon carbide-type surge arrester shall be not less than 125 percent of the rating specified in 280.4(A) .

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

Part II. Installation

280.11 Location.

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

280.12 Uses Not Permitted.

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

280.14 Routing of Surge Arrester Grounding Conductors.

The conductor used to connect the surge arrester to line, bus, or equipment and to a grounding conductor connection point as provided in 280.21 shall not be any longer than necessary and shall avoid unnecessary bends.

Part III. Connecting Surge Arresters

280.21 Connection.

The arrester shall be connected to one of the following:

(0) Grounded service conductor

(0) Grounding electrode conductor

(0) Grounding electrode for the service

(0) Equipment grounding terminal in the service equipment

280.23 Surge-Arrester Conductors.

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

280.24 Interconnections.

The surge arrester protecting a transformer that supplies a secondary distribution system shall be interconnected as specified in 280.24(A) , (B), or (C).

(A) Metal Interconnections.

A metal interconnection shall be made to the secondary grounded circuit conductor or the secondary circuit grounding electrode conductor, if, in addition to the direct grounding connection at the surge arrester, the following occurs:

(1) Additional Grounding Connection.

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

(2) Multigrounded Neutral System Connection.

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

(B) Through Spark Gap or Device.

Where the surge arrester grounding electrode conductor is not connected as in 280.24(A) , or where the secondary is not grounded as in 280.24(A) but is otherwise grounded as in 250.52 , an interconnection shall be made through a spark gap or listed device as required by 280.24(B)(1) or (B)(2).

(1) Ungrounded or Unigrounded Primary System.

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

(2) Multigrounded Neutral Primary System.

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

(C) By Special Permission.

An interconnection of the surge-arrester ground and the secondary neutral conductor, other than as provided in 280.24(A) or (B), shall be permitted to be made only by special permission.

280.25 Grounding Electrode Conductor Connections and Enclosures.

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

Article 285 Surge-Protective Devices (SPDs), 1000 Volts or Less

Part I. General

285.1 Scope.

This article covers general requirements, installation requirements, and connection requirements for surge-protective devices (SPDs) permanently installed on premises wiring systems of 1000 volts or less.

Informational Note: Surge arresters 1000 volts or less are also known as Type 1 SPDs.

285.3 Uses Not Permitted.

An SPD device shall not be installed in the following:

(0) Circuits over 1000 volts

(0) On ungrounded systems, impedance grounded systems, or corner grounded delta systems unless listed specifically for use on these systems

(0) Where the rating of the SPD is less than the maximum continuous phase-to-ground voltage at the power frequency available at the point of application

285.4 Number Required.

Where used at a point on a circuit, the SPD shall be connected to each ungrounded conductor.

285.6 Listing.

An SPD shall be a listed device.

285.7 Short-Circuit Current Rating.

The SPD shall be marked with a short-circuit current rating and shall not be installed at a point on the system where the available fault current is in excess of that rating. This marking requirement shall not apply to receptacles.

Part II. Installation

285.11 Location.

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

285.12 Routing of Connections.

The conductors used to connect the SPD to the line or bus and to ground shall not be any longer than necessary and shall avoid unnecessary bends.

285.13 Type 4 and Other Component Type SPDs.

Type 4 component assemblies and other component type SPDs shall only be installed by the equipment manufacturer.

Part III. Connecting SPDs

285.21 Connection.

Where an SPD device is installed, it shall comply with 285.23 through 285.28 .

285.23 Type 1 SPDs.

Type 1 SPDs shall be installed in accordance with 285.23(A) and (B).

(A) Installation.

Type 1 SPDs shall be installed as follows:

(0) Type 1 SPDs shall be permitted to be connected to the supply side of the service disconnect as permitted in 230.82 (4), or

(0) Type 1 SPDs shall be permitted to be connected as specified in 285.24 .

~~**(B)** At the Service.~~

~~When installed at services, Type 1 SPDs shall be connected to one of the following:~~

(0) ~~Grounded service conductor~~

(0) ~~Grounding electrode conductor~~

(0) ~~Grounding electrode for the service~~

(0) ~~Equipment grounding terminal in the service equipment~~

~~**285.24** Type 2 SPDs.~~

~~Type 2 SPDs shall be installed in accordance with 285.24(A) through (C).~~

~~**(A)** Service-Supplied Building or Structure.~~

~~Type 2 SPDs shall be connected anywhere on the load side of a service disconnect overcurrent device required in 230.91 , unless installed in accordance with 230.82 (8).~~

~~**(B)** Feeder-Supplied Building or Structure.~~

~~Type 2 SPDs shall be connected at the building or structure anywhere on the load side of the first overcurrent device at the building or structure.~~

~~**(C)** Separately Derived System.~~

~~The SPD shall be connected on the load side of the first overcurrent device in a separately derived system.~~

~~**285.25** Type 3 SPDs.~~

~~Type 3 SPDs shall be permitted to be installed on the load side of branch-circuit overcurrent protection up to the equipment served. If included in the manufacturer's instructions, the Type 3 SPD connection shall be a minimum 10 m (30 ft) of conductor distance from the service or separately derived system disconnect.~~

~~**285.26** Conductor Size.~~

~~Line and grounding conductors shall not be smaller than 14 AWG copper or 12 AWG aluminum.~~

~~**285.27** Connection Between Conductors.~~

~~An SPD shall be permitted to be connected between any two conductors — ungrounded conductor(s), grounded conductor, equipment grounding conductor, or grounding electrode conductor. The grounded conductor and the equipment grounding conductor shall be interconnected only by the normal operation of the SPD during a surge.~~

~~**285.28** Grounding Electrode Conductor Connections and Enclosures.~~

~~Except as indicated in this article, SPD grounding connections shall be made as specified in Article 250 , Part III. Grounding electrode conductors installed in metal enclosures shall comply with 250.64(E) .~~

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 12 18:21:02 EST 2018

Committee Statement

Committee Overvoltage protection and surge protection are presently addressed in two short articles, one for 1000

Statement: volts and below (285) and one for above 1000 volts (280). Combining the two articles improves clarity and usability. This First Revision simply deletes Articles 280 and 285, which are combined in new article 242 (see separate FR) with only one minor change to existing requirements into. The new article 242 will increase usability for the code user.

Response Message:

Public Input No. 1896-NFPA 70-2017 [Article 280]

Public Input No. 2371-NFPA 70-2017 [Section No. 280.14]

Public Input No. 1897-NFPA 70-2017 [Article 285]

First Revision No. 9007-NFPA 70-2018 [Detail]

[250.2, MOVE TO 100] Bonding Jumper, Supply-Side.

A conductor installed on the supply side of a service or within a service equipment enclosure(s), or for a separately derived system, that ensures the required electrical conductivity between metal parts required to be electrically connected. (CMP-5)

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 05
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Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 30 14:44:05 EST 2018

Committee Statement and Meeting Notes

Committee Statement: The Panel relocates the definition of Supply-Side Bonding Jumper from 250.2 to Article 100. The term Supply-Side Bonding Jumper appears in Articles 230, 250, 310, 408, 450, and 694. The definition is currently in 250.2 but should be relocated to Article 100 to comply with Section 2.2.2.1 of the NEC Style Manual.

Response Message:

Public Input No. 490-NFPA 70-2017 [Definition: Bonding Jumper, Supply-Side.]

Public Input No. 1207-NFPA 70-2017 [Section No. 250.2]