Code-Making Panel 5
Public Input Report (A19)

Public Input No. 1781-NFPA 70-2017 [Global Input]

Type your content here ...Change "Physical Damage" to "Mechanical Damage"

Statement of Problem and Substantiation for Public Input

The term, "Physical damage" is not defined in Article 100, though it is used widely in the NEC. Therefore, in accordance with the Style Manual's Section 2.2.2.1 and Section 3.3.4, it should be interpreted in accordance with the standard dictionary definition rather than an "industry-specific term" or "trade terminology." The standard dictionary definition does not exclude temperature, chemicals, and other potential sources of harm. These are clearly not intended in many of the places where the term.appears, based on the requirements listed in those places for equipment subject to physical damage or severe physical damage. Mechanics is a dictionary term commonly understood to refer to the sort of forces our trade terminology has referred to by the term, "physical," to the extent that the Style Manual, in Section 3.2.55 recommends its use despite the apparent conflict with Section 3.3.4 "Mechanical damage" is used elsewhere in NP standards where the NEC uses "Physical damage."

Submitter Information Verification

Submitter Full Name: David Shapiro

Organization: Safety First Electrical

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 04 15:48:20 EDT 2017

Public Input No. 1342-NFPA 70-2017 [Global Input]

Type your content here ...Replace "listed and identified" with "listed" in all locations

Statement of Problem and Substantiation for Public Input

The use of the words "and identified" following the word "listed" is redundant and adds confusion to the NEC. If the equipment is listed, it is already "identified" based on the definition of "identified" and the informational note that follows that definition. The use of the term "listed and identified" would permit the use of a product that is not listed for the purpose to be used where the local inspection authority had "identified" that the product is suitable for the purpose. It appears to me that everywhere the code uses the term "listed" that the intent is that the product be listed for the purpose.

Submitter Information Verification

Submitter Full Name:	Don Ganiere
Organization:	none
Affilliation:	none
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Jul 26 20:35:32 EDT 2017

Public Input No. 1073-NFPA 70-2017 [Global Input]

Change all written percentages to numerical percentages.

Statement of Problem and Substantiation for Public Input

To standardize how percentages are represented in the NEC

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1071-NFPA 70-2017 [Section No. 690.8(B)(1)]	
Public Input No. 1070-NFPA 70-2017 [Section No. 690.8(B)(1)]	

Submitter Information Verification

Submitter Full Name: Kevin Nutley
Organization: Puget Sound Electrical Apprenticeship JATC
Street Address:
City:
State:
Zip:

Submittal Date: Sat Jun 24 16:11:26 EDT 2017

Public Input No. 3453-NFPA 70-2017 [Global Input]

Remove the phrase “the provisions of” throughout the entire NEC and editorial revise each segment of text as required.

Statement of Problem and Substantiation for Public Input

The phrase is unnecessary and redundant. This global public input seeks to request that each NEC Panel (technical committee) review the articles under their responsibility and remove this phrase and reword the text accordingly. The requirements are already provided in the NEC so it does not make sense to refer to provisions. In many cases the phrase should refer to a section, then state that section in accordance with the NEC Style Manual requirements.

Substantiation Examples:

90.6 Formal Interpretations. To promote uniformity of interpretation and application of the provisions of this Code, formal interpretation procedures have been established and are found
in the NFPA Regulations Governing Committee Projects.

110.3(A)Examination, Identification, Installation, Use, and Listing (Product Certification) of Equipment.
(1) Suitability for installation and use in conformity with the provisions of this Code

110.30 General. Conductors and equipment used on circuits over 1000 volts, nominal, shall comply with Part I of this article and with 110.30 through 110.41 , which supplement or modify
Part I. In no case shall the provisions of this part apply to equipment on the supply side of the service point.

110.51 General.

(A)Covered. The provisions of this p Part IV shall apply to the installation and use of high-voltage power distribution and utilization equipment that is portable, mobile, or both, such as substations, trailers, cars, mobile shovels, draglines, hoists, drills, dredges, compressors, pumps, conveyors, underground excavators, and the like.

210.13 Ground-Fault Protection of Equipment. Each branch circuit disconnect rated 1000 A or more and installed on solidly grounded wye electrical systems of more than 150 volts to ground, but not exceeding 600 volts phase-to-phase, shall be provided with ground-fault protection of equipment in accordance with the provisions of 230.95.

Exception No. 1: The provisions of this This section shall not apply to a disconnecting means for a continuous industrial process where a nonorderly shutdown will introduce additional or increased hazards.
Exception No. 2: The provisions of this This section shall not apply if ground-fault protection of equipment is provided on the supply side of the branch circuit and on the load side of any transformer supplying the branch circuit.

Section 210.60(B)

(B) Receptacle Placement. In applying the provisions of 210.52(A), the total number of receptacle outlets shall not be less than the minimum number that would comply with the
provisions of that section. These receptacle outlets shall be permitted to be located conveniently for permanent furniture layout. At least two receptacle outlets shall be readily accessible. Where receptacles are installed behind the bed, the receptacle shall be located to prevent the bed from contacting any attachment plug that may be installed or the receptacle shall be provided with a suitable guard.

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz
Organization: NECA
Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 10:12:45 EDT 2017

Copyright Assignment

Public Input No. 4317-NFPA 70-2017 [Global Input]

Each code making panel should set time aside to review the requirements under their purview to ensure that new and existing requirements are in compliance with the NEC style manual.

Statement of Problem and Substantiation for Public Input

Code making panels are responsible for ensuring that the Code text which agreed upon at the technical panel meetings comply with all requirements of the NEC style manual. It would be prudent for each code making panel to set time aside to review the requirements under their purview to ensure that not only new but existing requirements are in compliance with the requirements of the NEC style manual.

Adherence to the NEC style manual promotes consistency throughout the NEC adding to clarity to the users of the NEC. Code making panels should spend available time reviewing for such important style manual requirements as the following: (These are just some examples and not a comprehensive list of style manual requirements.)

Unenforceable Terms. The NEC shall not contain references or requirements that are unenforceable or vague. The terms contained in Table 3.2.1 of the style manual shall be reviewed in context, and, addressed if the resulting requirement is unenforceable or vague. Examples of unenforceable and Vague Terms include the following:

designed for the purpose.
good
adequate
frequent(ly)

Writing in present text. Requirements must be written in present text and not future text. A good example of this is as follows:

Correct: No conductor shall be used in such a manner that its operating temperature exceeds that designated for the type of insulated conductor involved.
Incorrect: No conductor shall be used in such a manner that its operating temperature will exceed that designated for the type of insulated conductor involved.

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 20:19:11 EDT 2017

Copyright Assignment

I, Thomas Domitrovich, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Thomas Domitrovich, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 777-NFPA 70-2017 [Global Input]

The terms “satisfactory” - "equal" - "equivalent", etc., are examples of numerous subjective terms found in the NEC where decisions of suitability fall under the purview of the AHJ. Changing or supplementing these terms to "approved" - "approved equivalent" will continue the alignment of language used throughout the NEC.

I authored a couple of such changes for the 2014 NEC that were adopted in the 2017. It was suggested to me by someone from NFPA that I submit a global input, so a committee would be appointed to locate and revise all such subjective terms to include the word "approved".

This will reduce the number of terms used to determine suitability of equipment as it applies to installation/inspection to one of the following: "Listed" - "Identified" - "Approved"

Statement of Problem and Substantiation for Public Input

I think the language in my global proposal not only states the problem, but offers a viable solution to facilitate uniformity of language throughout the NEC.

Submitter Information Verification

Submitter Full Name: Tom Pernal

Organization: Tom Pernal Electrical Seminars, LLC

Street Address:

City:

State:

Zip:

Submittal Date: Sat May 20 15:35:20 EDT 2017

Public Input No. 3198-NFPA 70-2017 [Definition: Bonding Jumper, Equipment.]

Bonding Jumper, Equipment.

The connection between two or more portions of the ~~equipment grounding conductor~~ effective ground-fault current path . (CMP-5)

Statement of Problem and Substantiation for Public Input

The equipment bonding jumper isn't always between equipment grounding conductors. For example, a 4-square (1900) box is not defined as an equipment grounding conductor, but it is a part of the effective ground-fault current path and an equipment bonding jumper might be connected to it.

Submitter Information Verification

Submitter Full Name:	Eric Stromberg
Organization:	Los Alamos National Laboratory
Affilliation:	Self
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Sep 03 18:04:13 EDT 2017

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

Bonding Jumper, Main.

The connection between the grounded circuit conductor and the equipment grounding conductor at ~~the service.~~ service equipment or supply side disconnecting means as permitted in 230.82 . (CMP-5)

Statement of Problem and Substantiation for Public Input

Add 230.82 to the definition so that it recognizes that the disconnecting means for supply side connections can also contain a main bonding jumper.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 10:58:29 EDT 2017

Public Input No. 3199-NFPA 70-2017 [Definition: Bonding Jumper, Main.]

Bonding Jumper, Main.

The connection between the grounded circuit conductor and the ~~equipment grounding conductor~~ effective ground-fault current path at the service. (CMP-5)

Statement of Problem and Substantiation for Public Input

The Main Bonding Jumper does not always connect to the equipment grounding conductor. Sometimes, the main bonding jumper is nothing more than a screw (green) that bonds the neutral bar to the enclosure. Although the raceways that connect to the enclosure are defined as equipment grounding conductors, the enclosure itself is not. The enclosure is, however, a part of the effective ground-fault current path.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3198-NFPA 70-2017 [Definition: Bonding Jumper, Equipment.]	Same issue, the EGC is only a part of the effective ground-fault current path, not the whole thing

Submitter Information Verification

Submitter Full Name: Eric Stromberg
Organization: Los Alamos National Laboratory
Affilliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 03 18:09:31 EDT 2017

Public Input No. 783-NFPA 70-2017 [Definition: Bonding Jumper, Main.]

Bonding Jumper, Main.

The connection between the grounded circuit conductor and the equipment grounding conductor at the service overcurrent device location . (CMP-5)

Statement of Problem and Substantiation for Public Input

This is were the equipment grounding conductor originates

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master electrician

Street Address:

City:

State:

Zip:

Submittal Date: Mon May 22 18:45:16 EDT 2017

Public Input No. 1096-NFPA 70-2017 [Definition: Bonding Jumper, Supply-Side.]

Bonding Jumper, Supply-Side.

A conductor(s) installed on the supply side of a, service or within a service equipment enclosure(s), feeders installed under the provisions of 240.21 (A) through (H), or for a separately derived system, that ensures the required electrical conductivity between metal parts required to be electrically connected.

Statement of Problem and Substantiation for Public Input

These conductors could be install in parallel and therefore needs to be plural, conductor(s). when installing a feeder under the requirements of 240.21 (A) through (H) the bonding conductor should be called a supply side bonding jumper and sized accordingly. other wise it is an equipment grounding conductor size to the larger breaker upstream.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: master electrician

Street Address:

City:

State:

Zip:

Submittal Date: Sat Jul 01 17:54:04 EDT 2017

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

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.

Statement of Problem and Substantiation for Public Input

Relocate definition to Article 100 since it is used in several articles in the NEC, including Articles 230, 310, 408, 450, and 694.

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submittal Date: Wed Apr 05 11:18:17 EDT 2017

Public Input No. 3200-NFPA 70-2017 [Definition: Bonding Jumper, System.]

Bonding Jumper, System.

The connection between the grounded circuit conductor and the ~~supply-side bonding jumper, or the equipment grounding conductor, or both,~~ effective ground-fault current path at a separately derived system. (CMP-5)

Statement of Problem and Substantiation for Public Input

The supply side bonding jumper and the equipment grounding conductor are both parts of the effective ground-fault current path. As is indicated in PI 3199, the bonding jumper (system in this case) may actually simply be connected to the enclosure itself and not the SSBJ or the EGC.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3198-NFPA 70-2017 [Definition: Bonding Jumper, Equipment.]	Same issue, the EGC is only a part of the effective ground-fault current path, not the whole thing
Public Input No. 3199-NFPA 70-2017 [Definition: Bonding Jumper, Main.]	

Submitter Information Verification

Submitter Full Name: Eric Stromberg

Organization: Los Alamos National Laboratory

Affilliation: Self

Street Address:

City:

State:

Zip:

Submittal Date: Sun Sep 03 18:16:25 EDT 2017

Public Input No. 3071-NFPA 70-2017 [Definition: Grounded Conductor.]

Grounded Conductor.

A system or circuit conductor that is intentionally grounded, other than an equipment grounding conductor . (CMP-5)

Statement of Problem and Substantiation for Public Input

Adding this language will make it clear that an equipment grounding conductor is not subject to the identification and connection rules of a grounded or neutral conductor.

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 31 12:32:44 EDT 2017

Public Input No. 2159-NFPA 70-2017 [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, 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; and the earth itself.~~

Statement of Problem and Substantiation for Public Input

Delete the definition entirely. The prevailing definition is "Effective Ground-Fault Current Path." The difference between Ground-Fault Current Path and Effective Ground-Fault Current Path is intention. The first is unintentional, it is simply where the current flows, including the earth. The second is intentionally constructed. This is a companion PI to a PI which changes 'ground-fault current path' to 'effective ground-fault current path' in all occurrences in 250.118, and 610.61. These are the only occurrences of 'ground-fault current path' in the Code.

Submitter Information Verification

Submitter Full Name: Eric Stromberg

Organization: Los Alamos National Laboratory

Affilliation: Self

Street Address:

City:

State:

Zip:

Submittal Date: Sun Aug 13 14:13:59 EDT 2017

Public Input No. 327-NFPA 70-2017 [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, 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; and the earth itself.

Statement of Problem and Substantiation for Public Input

This fault current can travel on the neutral back to the neutral point on a separately derived system and elsewhere in the code that allows the neutral to be used as such 250.142. A neutral normally carries current so the definition is not correct.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master Electrician

Street Address:

City:

State:

Zip:

Submittal Date: Sat Mar 04 12:46:30 EST 2017

Public Input No. 1522-NFPA 70-2017 [Definition: Grounding Conductor, Equipment (EGC).]

~~Grounding~~ Bonding Conductor, Equipment (~~EGC~~ EBC).

The conductive path(s) that provides a 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/bonding conductor also performs bonding.

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

Statement of Problem and Substantiation for Public Input

Many members of Code panel 5 know the history on how the use of the terms ground, grounded, grounding, bond, bonding, and bonded were revised, starting in 2008 Code cycle, to have the terms mean what was intended. The one 'leftover' item was the equipment grounding conductor.
The effective ground-fault current path is comprised of the main bonding jumper, equipment bonding jumper, system bonding jumper, supply side bonding jumper, and the equipment grounding conductor. All of the items that construct the EGFCP containg the word bonding, except one...
By renaming the EGC to the EBC, the Code terms used will be consistent and remove confusion, it just makes the Code intent clearer.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 01 13:46:29 EDT 2017

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

Grounding Conductor, Equipment (EGC).

~~The~~ A conductive path(s) that ~~provides~~ is a part of the 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.

Statement of Problem and Substantiation for Public Input

The definition for 'effective ground-fault current path' is an excellent definition. The Equipment Grounding Conductor is simply a part of the effective ground-fault current path. The EGC is almost never alone in its function to carry fault current back to the source. There is either a main bonding jumper or a system bonding jumper in the path. There might be a supply side bonding jumper in the path as well. By stating that the EGC is simply a part of the effective ground-fault current path, the attention is placed on the latter, where it belongs.

Submitter Information Verification

Submitter Full Name:	Eric Stromberg
Organization:	Los Alamos National Laboratory
Affilliation:	Self
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sat Aug 19 22:35:20 EDT 2017

Public Input No. 631-NFPA 70-2017 [Definition: Grounding Electrode Conductor.]

Grounding Electrode Conductor.

A single conductor used to connect the system grounded conductor or the equipment to a grounding electrode or to a point on the grounding electrode system. (CMP-5)

Statement of Problem and Substantiation for Public Input

I believe that the term "conductor" (the word being singular in nature) means one, single conductor.

The question did come up at the last technical committee meeting - whereby a person asked about a "parallel" grounding electrode conductor. A very long and arduous discussion ensued. Can this be done? What distances away from each other did the parallel grounding electrode conductors need to be? Does this provide better grounding, etc.? NO data was provided; this was all hypothetical discussion.

The Chairman then posed a question to the entire committee - "IF THIS WAS ALLOWED by the code, how many of you would actually use it?" Not a single hand went up.

I believe adding the word "single" clarifies the intent of the code that a "grounding electrode conductor" is ONE, single conductor. I believe that we don't need to reinvent the wheel, at least not yet...

Submitter Information Verification

Submitter Full Name: Nick Sasso

Organization: State of Wyoming

Street Address:

City:

State:

Zip:

Submittal Date: Mon May 01 22:15:57 EDT 2017

Public Input No. 3238-NFPA 70-2017 [Definition: Intersystem Bonding Termination.]

Intersystem Bonding Termination.

A device that provides a means for connecting intersystem bonding conductors for either communications systems or piping systems to the grounding electrode system.(CMP-16)

Statement of Problem and Substantiation for Public Input

Requirements in the National Fuel Gas Code (NFPA 54) (as well as the IRC, IFGC and UPC) require that corrugated stainless steel tubing (CSST) be bonded to the grounding electrode system. The NFPA Standards Council has ruled that the bonding requirements for gas piping systems is the responsibility of the NFPA 54 Technical Committee. The additional bonding requirements for CSST systems have been submitted for inclusion in the 2020 edition of the NEC. The traditional use of the Intersystem Bonding Termination (IBT) has been limited to communication systems. However, with the requirement in the NFPA 54 Code for additional bonding of CSST gas piping systems to the grounding electrode system, a separate piping-only IBT would provide a viable and appropriate connection for this purpose.

Adding piping systems to the definition will allow for the CSST bonding conductor to be terminated at an easily accessible point of connection. Over 6 million existing homes, built before the CSST bonding requirement went into effect (2009), are currently being updated to the latest bonding requirements. The National Association of State Fire Marshals has been actively promoting a public awareness campaign within the NFPA community to encourage retroactive installation of the CSST bonding conductor. In some states, the bonding of CSST systems can be performed by someone other than a licensed electrician. The allowance for this bonding conductor to be installed at a piping-only IBT will aid in keeping unqualified persons out of potentially hazardous situations inside an energized panel board while attempting to terminate the CSST gas piping bonding conductor.

Submitter Information Verification

Submitter Full Name: Robert Torbin

Organization: Omega Flex Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Sep 04 14:09:20 EDT 2017

Public Input No. 328-NFPA 70-2017 [Definition: Neutral Conductor.]

Neutral Conductor.

The conductor connected to the neutral point of a system that is intended to carry current under normal <u>and fault</u> conditions. (CMP-5)

Statement of Problem and Substantiation for Public Input

neutral conductors do carry fault currents as allowed in 250.142 and 250.30 ex

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master Electrician

Street Address:

City:

State:

Zip:

Submittal Date: Sat Mar 04 12:53:09 EST 2017

Public Input No. 3656-NFPA 70-2017 [Definition: Separately Derived System.]

Separately Derived System.

An electrical source, other than a service, having no direct connection(s) to ungrounded or grounded circuit conductors of any other electrical source other than ~~those established by grounding and bonding connections~~ connections established for a ground-fault current path or grounding electrode conductors . (CMP-5)

Statement of Problem and Substantiation for Public Input

A neutral is a grounded connection and could be viewed as a allowed connection between systems, listing the allowed connections based on their purpose, ground fault current see def.and grounding electrode conductor see def., is a better way to describe the allowable connections.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: master electrician

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 16:14:05 EDT 2017

Public Input No. 2626-NFPA 70-2017 [Section No. 200.1]

200.1 Scope.

This article provides requirements for the following:

(1) Identification of terminals, including terminals that are an integral part of equipment

(2) Grounded conductors in premises wiring systems

(3) Identification of grounded conductors, including grounded conductors that are an integral part of equipment

Informational Note: See Article 100 for definitions of *Grounded Conductor, Equipment Grounding Conductor,* and *Grounding Electrode Conductor* .

Statement of Problem and Substantiation for Public Input

Improper identification of conductors in the field can result in unsafe working conditions. Article 200 provides requirements for proper identification of terminals and conductors. Application of these rules provides electrical workers with a “roadmap” of which conductors are grounded. Not all product Standards apply the requirements in Article 200. While it is permissible for evaluations to product standards to relax some rules governing conductors (such as the exclusion to wiring methods and to conductors that are integral parts of equipment, as provided in Section 300.1(B) and 310.1, respectively), rules for identification of conductors should remain constant regardless of where those conductors are installed. Acceptance of this proposed revision would remove any question as to the applicability of requirements for the identification of terminals and for the identification of grounded conductors to those conductors that are an integral part of equipment.

Submitter Information Verification

Submitter Full Name: James Dollard

Organization: IBEW Local Union 98

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 22 08:12:29 EDT 2017

Public Input No. 227-NFPA 70-2017 [New Section after 200.3]

TITLE OF NEW CONTENT

Type your content here ...No grounding or bonding wire shall connect to a plumbing system in any manner. No jumper wire shall be connected to a plumbing system in any manner. This includes electrical, communications, appliances, equipment, door bells, etc.

Statement of Problem and Substantiation for Public Input

When a plumber cuts a pipe and it is separated and then there is a short or a surge then the plumber becomes the ground. Same thing when the meter has to be removed and you have a corroded cable then the plumber becomes the ground.

Submitter Information Verification

Submitter Full Name: Gary Howard

Organization: Illinois Plumbing Insp. Assoc

Street Address:

City:

State:

Zip:

Submittal Date: Thu Feb 09 13:37:58 EST 2017

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

200.3 Connection to Grounded System.

Premises wiring shall not be electrically connected to a supply system unless the latter contains, for any grounded conductor of the interior system, a corresponding conductor that is grounded. For the purpose of this section, *electrically connected* shall mean connected so as to be capable of carrying current, as distinguished from connection through electromagnetic induction.

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

Statement of Problem and Substantiation for Public Input

they are interactive inverters that can connect to any power supply

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master electrician

Street Address:

City:

State:

Zip:

Submittal Date: Sun Feb 05 13:21:11 EST 2017

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

200.3 Connection to Grounded System.

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

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

Statement of Problem and Substantiation for Public Input

The word interior implies that a grounded conductor is only required in the supply system if the premises wiring is located inside a building or structure. Replacing "interior" with "premises wiring" makes the language easier to understand and correlates with 250.24(C).

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 18:21:15 EDT 2017

Public Input No. 1936-NFPA 70-2017 [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.

(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.

Statement of Problem and Substantiation for Public Input

The identification requirements of 200.6 are intended to apply to grounded system conductors. Solidly grounded PV dc source/output system conductors are rarely used. The vast majority of PV dc source/output system conductors are functionally grounded as opposed to solidly grounded. See the 690.2 definition for Functional Grounded PV System and 690.41 System Grounding. Addition of the descriptor "solidly" before
"grounded conductor" would harmonize this requirement with the applicable rules of Article 690 and insure that only solidly grounded conductors are identified in this manner.

Submitter Information Verification

Submitter Full Name: David Clements

Organization: Intl Assoc Elec Insp

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 09 08:53:02 EDT 2017

Public Input No. 4141-NFPA 70-2017 [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 or gray marking at all terminations.

(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.

Statement of Problem and Substantiation for Public Input

The identification requirements of 200.6 are intended to apply to grounded system conductors. Solidly grounded PV dc source/output system conductors are rarely used. The vast majority of PV dc source/output system conductors are functionally grounded as opposed to solidly grounded. See the 690.2 definition for Functional Grounded PV System and 690.41 System Grounding. Addition of the descriptor "solidly" before "grounded conductor" would harmonize this requirement with the applicable rules of Article 690 and insure that only solidly grounded conductors are identified in this manner. This will also
coordinate with what is in 690.31(B)(1). The use of gray color is consistent as an acceptable alternative to white for identification of solidly grounded conductors.

Submitter Information Verification

Submitter Full Name: Paula Mellon

Organization: SEAC

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 15:06:40 EDT 2017

Public Input No. 746-NFPA 70-2017 [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.

(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.

Statement of Problem and Substantiation for Public Input

The identification requirements of 200.6 are intended to apply to grounded system conductors. Solidly grounded PV dc source/output system conductors are rarely used. The vast majority of PV dc source/output system conductors are functionally grounded as opposed to solidly grounded. See the 690.2 definition for Functional Grounded PV System and 690.41 System Grounding. Addition of the descriptor "solidly" before "grounded conductor" would harmonize this requirement with the applicable rules of Article 690 and insure that only solidly grounded conductors are identified in this manner.

Submitter Information Verification

Submitter Full Name: Pete Jackson

Organization: City of Bakersfield, California

Street Address:

City:

State:

Zip:

Submittal Date: Wed May 17 19:01:52 EDT 2017

Public Input No. 2775-NFPA 70-2017 [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 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~~ G rounded 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.

Statement of Problem and Substantiation for Public Input

There is no logical reason why the requirement "Where the conditions of maintenance and supervision ensure that only qualified persons service the installation" exists for re-identifying conductors of a multi-conductor cable. No such requirement exists for reidentifying conductors sized 6 AWG or smaller in 200.6(A) or for conductors sized 4 AWG or larger in 200.6(B). No such requirement exists in 200.6(D) for reidentifying conductors of different systems that are installed in a raceway, cable, box, auxiliary gutter, or other type of enclosure.
Section 210.7(C)(1), which covers the use of conductors in (multiconductor) cables with insulation that identifies them as grounded conductors, permits conductor insulations to be reidentified to indicate its use. Specific instructions are given for such reidentification. In addition, specific requirements are provided for use of reidentified conductors for switch loops. This reidentification of conductor insulation is permitted without a requirement for qualified persons in qualified occupancies.
No such requirement exists in 210.5(C) for branch circuits for "Where the conditions of maintenance and supervision ensure that only qualified persons service the installation" only qualified persons perform these identification tasks.
The identification of the grounded conductor in feeders simply refers back to 200.6 without additional requirement.
Extensive requirements exist in 215.12 for identification of equipment grounding conductors and for ungrounded conductors. No requirement exists for such tasks to be performed by only qualified persons in qualifying facilities.
General requirements for identification of conductors is found in 310.110. There is no requirement for identification "Where the conditions of maintenance and supervision ensure that only qualified persons service the installation" in Article 310.
General requirements for identifying equipment grounding conductors are found in 250.119. As found in 250.119(A), re-identification of conductors 4 AWG or larger can be performed by anyone without restriction.
Many other sections of the NEC permit or require identification. So far as this submitter can determine, 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.
A companion public input intends to correct 250.119(B).

Related Public Inputs for This Document

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

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 25 19:04:42 EDT 2017

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Public Input No. 1065-NFPA 70-2017 [Section No. 200.7(C)]

(C) Circuits of 50 Volts or More.

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

(1) If part of a cable assembly that has the insulation permanently reidentified to indicate its use as an ungrounded conductor by marking ~~tape~~ , painting, or other effective means at its termination and at each location where the conductor is visible and accessible. ~~Identification shall~~ Marking tape shall not be used for reidentification purposes. Identification shall encircle the insulation and shall be a color other than white, gray, or green. If used for single-pole, 3-way or 4-way switch loops, the reidentified conductor with white or gray insulation or three continuous white or gray stripes shall be used only for the supply to the switch, but not as a return conductor from the switch to the outlet.

(2) A flexible cord having one conductor identified by a white or gray outer finish or three continuous white or gray stripes, or by any other means permitted by 400.22, that is used for connecting an appliance or equipment permitted by 400.10. This shall apply to flexible cords connected to outlets whether or not the outlet is supplied by a circuit that has a grounded conductor.

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

Statement of Problem and Substantiation for Public Input

The use of marking tape, or black electrical tape, does not meet the permanent reidentification requirements of the code article. Electrical tape can be easily removed after installation from a grounded conductor that is being used as a ungrounded conductor. For that reason, the use of marking tapes should not be permitted.

Submitter Information Verification

Submitter Full Name: Brian Baughman
Organization: Generac Power Systems Inc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 22 11:03:05 EDT 2017

Public Input No. 1304-NFPA 70-2017 [Section No. 200.7(C)]

(C) Circuits of 50 Volts or More.

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

(1) If part of a cable assembly that has the insulation permanently reidentified to indicate its use ~~as an ungrounded~~ other than a grounded conductor by marking tape, painting, or other effective means at its termination and at each location where the conductor is visible and accessible. Identification shall encircle the insulation ~~and shall be a color other than white, gray, or green~~ . If used for single-pole, 3-way or 4-way switch loops, the reidentified conductor with white or gray insulation or three continuous white or gray stripes shall be used only for the supply to the switch, but not as a return conductor from the switch to the outlet.

(2) A flexible cord having one conductor identified by a white or gray outer finish or three continuous white or gray stripes, or by any other means permitted by 400.22, that is used for connecting an appliance or equipment permitted by 400.10. This shall apply to flexible cords connected to outlets whether or not the outlet is supplied by a circuit that has a grounded conductor.

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

Statement of Problem and Substantiation for Public Input

Let assume we have panel 480/277V, which is feeding a transformer delta-wye.

MC cable with conductors bigger than 4AWG (let it be 350-600kcmil) is used as a feeder. This is a common commercial installation for commercial at the high-rises.
MC cable has 3 ungrounded conductors (colored) , grounded conductor (white or gray) plus EGC (let it be bare aluminium).

Inside panel electrician can terminate all conductors properly (because it has all buses /connections).

The problem is to terminate such feeder inside the transformer (and follow all NEC requirements about marking, because we have no termination point for grounded conductor).

So usually electrician has choice

EITHER

leave it abandoned (just isolate with electric tape etc) what is not a good practice and can be a potential hazard later to make unintended connection to phases/wings
or make it possible to connect to EGC(ground bus) by less qualified personal (apprentice etc during construction) and have an objectionable current

OR

re-identify it with green and use as extra EGC in same cable assembly (what is defiantly more safe practice).

Section 250.119 doesn't prohibit it. But according the current sub-section 200.7(C)(1) we can not identify white with green in cable assembly.

for my opinion, if that is possible to change grounded conductor(neutral) in cable assembly and make it as ungrounded, why would not to let installation above be according the code ?

All phrase "and must be a color other than white,gray and green" for cable assembly sounds like copy-past from some

other section.
because if we are going change "white or gray" in cable assembly for anything , that's defiantly will no be again "white or gray". I can think only we may want to switch "white" with "gray" sometimes
for example, cable 200kcmil MC has black,red,blue and white as "common 120/208 colors" and we want just to go with "common 277/480" brown,orange,yellow,gray to make installation more "clear" on 480 system.

So only "green" left . But for situations like my example switch "white" with "green" can be a benefit.
You may argue on exactly language of change , but I strongly believe that we have to avoid any extra conductors in MC feeders just hanging around inside equipment because it's violation with marking "to bond" them on EGC bus.

Thank you for consideration.

Sincerely
Serhii Kryshtanovskyi.

Submitter Information Verification

Submitter Full Name:	Serhii Kryshtanovskyi
Organization:	Valley Electric
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Jul 24 23:08:38 EDT 2017

Copyright Assignment

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

200.9 Means of Identification of Terminals.

~~The~~ In devices or utilization equipment with polarized connections, t he 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.

Statement of Problem and Substantiation for Public Input

If this requirement is not limited to utilization equipment or devices with polarized connections, it could be read to apply to every grounded connection in a panelboard, switchboard, transformer or hard-wired appliances, as examples.

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 18:27:05 EDT 2017

Public Input No. 2658-NFPA 70-2017 [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 (silver) in color or by the word *white* or the letter *W* located adjacent to the identified terminal.

(2) If the terminal is not visible, the conductor entrance hole for the connection shall be colored white or marked with the word *white* or the letter *W*.

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

Statement of Problem and Substantiation for Public Input

Silver is not "substantially white" in color. It is a completely different color. Terminal screws that are substantially white are rare. Most terminal screws intended for use with the grounded conductor are silver in color.

Submitter Information Verification

Submitter Full Name: Don Ganiere
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 24 10:47:09 EDT 2017

Public Input No. 3215-NFPA 70-2017 [Section No. 250.1]

250.1 Scope.

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

(1) Systems, circuits, and equipment required, permitted, or not permitted to be grounded

(2) Circuit conductor to be grounded on grounded systems

(3) Location of grounding connections

(4) Types and sizes of grounding and bonding conductors and electrodes

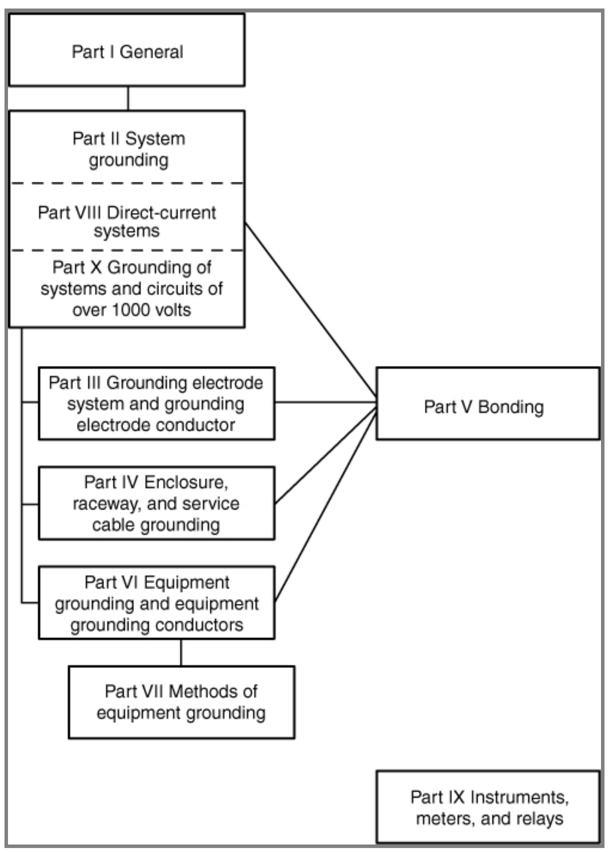
(5) Methods of grounding and bonding

(6) Conditions under which guards, isolation, or insulation may be substituted for grounding

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

<u>Informational Note 2: For information regarding grounding and bonding see IEEE 3003.2 Recommended Practice for Equipment Grounding and Bonding in Industrial and Commercial Power Systems</u>

Figure 250.1 Grounding and Bonding.



Statement of Problem and Substantiation for Public Input

The stronger the linkage between the NFPA and IEEE on electrical power technology the better. This reference simply replaces the Green Book (ANSI/IEEE 142) which appeared as a Fine Print Note in other parts of this article in previous revisions of the NEC .

IEEE 3000 Standards Collection™ is the trademarked name of the family of industrial and commercial power systems standards formerly known as IEEE Color Books. The IEEE 3000 Standards Collection overall includes the same content as the Color Books that have been referenced into previous editions of the NEC but is now organized into approximately 70 IEEE "dot" standards that cover specific technical topics. This method of development, of capturing leading practice from transactions among academic and practitioners supports the NFPA International mission of eliminating death, injury, property and economic loss due to fire, electrical and related hazards.

Submitter Information Verification

Submitter Full Name: Michael Anthony
Organization: Standards Michigan
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 04 09:54:29 EDT 2017

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

250.2 Definition.

Bonding Jumper, Supply-Side. The definitions in this section shall apply only within this article.

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.

Statement of Problem and Substantiation for Public Input

This public input is submitted on behalf of task group appointed by the NEC Correlating Committee. This task group was appointed to identify potential issues in the NEC with respect to how definitions in both Article 100 and the XXX.2 sections of this Code apply. The member of the task group are: David Hittinger, Rich Holub, Chris Hunter, Dave Williams, Chris Porter, Alan Manche, Ken Boyce, John Kovacik, Donny Cook, Dave Kendall and Jim Dollard.

Section 2.2.2.1 of the NEC Style Manual requires that in general definitions that appear in two or more articles be located in Article 100. Section 2.2.2.2 requires that where an individual article contains definition(s), they be located in the second section (XXX.2) of the article. It is extremely important to note that the style manual does not prohibit a definition in the second section of an article from applying elsewhere in the NEC. The style manual clearly states that in general definitions that appear in two or more articles shall be located in Article 100. This has confused many code users in the past. This style manual requirement is accurate and these public inputs are simply an attempt to provide needed clarity. See the example below:

344.2 Definition.
Rigid Metal Conduit (RMC). A threadable raceway of circular cross section designed for the physical protection and routing of conductors and cables and for use as an equipment grounding conductor when installed with its integral or associated coupling and appropriate fittings.

The definition of the term “rigid metal conduit” is appropriately located in the article that contains general, installation and construction specifications for this raceway. It is commonly understood that the term “rigid metal conduit” is used in more than one article. There are many articles that contain a single definition that is necessary for application of the contained requirements but will apply elsewhere in the NEC. This occurs in articles that address cable assemblies, raceways, systems and more.
This public input seeks to delete the last sentence in the first paragraph, as it is unnecessary. A new sentence is proposed to simply inform the user of the code that definitions are also found in the second section (XXX.2) of other articles.
This public input is supplemented with proposed revisions to the second section (XXX.2) of articles that contain definitions. New parent text is proposed for these sections to increase clarity and usability. There are two different scenarios that will be addressed. First, any second section (XXX.2) that contains definitions that apply only within that article will contain parent text as follows:

XXX.2 Definitions. The definitions in this section shall apply only within this article.

Second, any second section (XXX.2) that contains definitions that apply within the individual article and throughout the code will contain parent text as follows:

XXX.2 Definitions. The definitions in this section shall apply within this article and throughout the code.

In a few cases, in the second section (XXX.2) of an Article there are definitions that will apply only in that Article and some that will apply in that Article and throughout the code. New parent text and first level subdivisions are proposed to achieve clarity and usability The combination of these proposed revisions will provide necessary clarity and usability with respect to application of definitions. These actions will also achieve compliance with the NEC Style Manual.

Related Public Inputs for This Document

Related Input	Relationship

Public Input No. 1202-NFPA 70-2017 [Article 100 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: James Dollard
Organization: IBEW Local Union 98
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 21 10:02:25 EDT 2017

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Public Input No. 4069-NFPA 70-2017 [Section No. 250.2]

250.2 Definition.

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.

Neutral-to-Ground Bond

An intentional connection of the neutral conductor to earth. This connection typically occurs on the low-side of a wye-type transformer, and under certain circumstances can occur inside the main service panel.

Normally-Non-Current-Carrying Grounded Conductor

Conductors or other metallic parts, including exposed conductive metallic parts, that are not normally current current carrying.

Normally Current Carrying Conductors

Conductors that are energized and designed to carry electrical currents during normal operations, such as the phase and neutral conductors.

Fault Current Path

A low-impedance conductive path designed to safely conduct electrical fault currents back to the source transformer. This path may include exposed conductive metallic parts and normally-non-current-carrying grounding conductors.

Equipotential Bonding System

A secondary grounding system bonded directly to the grounding electrode conductor network, that is used to bond exposed conductive metallic parts to earth. These systems are commonly found in swimming pools, indsutrial settings, and high-voltage environments.

Neutral Conductor

A normally current-carrying conductor that is tied to the center point (XO) of the circuits source transformer, and bonded to ground typically at one point only; under certain circumstances the netural conductor can be bonded at a second point in the circuit, typically the main service panel. The neutral conductor is also known within Article 250 as the grounded conductor, the common conductor, and the ground-fault circuit conductor.

Normal Operating Neutral Currents

The currents that return to the transformer via the neutral conductors during normal operating conditions. This is the manner in which current is designed to flow when the circuit is not in a fault condition.

Statement of Problem and Substantiation for Public Input

Clarity is needed to help define the terminology within the code.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 13:26:14 EDT 2017

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Public Input No. 1097-NFPA 70-2017 [Section No. 250.4(A)(1)]

(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~~

and provide a potential to ground .

Informational Note No.

~~2~~

1 : See NFPA 780-2014, *Standard for the Installation of Lightning Protection Systems* , for information on installation of grounding and bonding for lightning protection systems.

Statement of Problem and Substantiation for Public Input

these are catastrophic events, the code dose not accommodate this type of circumstance and it should not be included in the performance base requirement. the real reson to ground a system is to stabilize the voltage and give a reference (potential) to ground.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master electrician

Street Address:

City:

State:

Zip:

Submittal Date: Sat Jul 01 18:13:23 EDT 2017

Public Input No. 3844-NFPA 70-2017 [New Section after 250.4]

250.5 Guiding Principle of Grounding and Bonding

The basic principles for grounding and bonding are as follows:

1. Make hazardous-live-parts, including normally current-carrying conductors (phase and neutral conductors), inaccessible to people.

2. Ground/earth all exposed conductive parts and bond them together so that there are no differences in potential, and to protect agaisnt electromagnetic disturbances.

3. Provide protection devices to automaticlly disconnect power in the event of an electrica fault (circuit breakers and/or GFCI).

4. Provide devices to automatically remove overvoltages.

Statement of Problem and Substantiation for Public Input

A clear goal-oriented objective will help people to understand the purpose of grounding and bonding.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 01:05:54 EDT 2017

Public Input No. 4142-NFPA 70-2017 [Section No. 250.6]

250.6 Objectionable Current.

All circuits are to be designed and installed for two electrical scenarios:

(1) **Normal Operating Conditions**

(2) **Electrical Fault Conditions**

During normal operating conditions, all currents are to travel to and from the tranformer on inaccassable hazardous-live-conductors (phase and neutral conductors) only. It is prohibited to allow normal operating neutral currents (objectionable currents) to travel on any exposed metallic structure, during normal operating conditions. See 250.6, 250.24(A) (5), 250.30(A)(1), 250.30(A)(5), 250.32(B)(1), and 250.142(B).

During electrical fault conditions, fault currents may travel on the grounding system and exposed metallic structures back to the source transformer. Electrical fault currents must have a dedicated low-impedance conductive metallic path back to the transformer. The earth may not be used as a conductor for either normal operating conditions or electrical fault conditions, per 250.4(A)(5) and 250.4(B)(4).

When a feed from a transformer only includes normally-current-carrying-conductors (phase and neutral conductors), the neutral conductor is doing two jobs: it is both the path for normal operating neutral currents AND the electrcial fault current path back to the transformer. In this scenario, a neutral-to-ground bond is required in the main service panel to separate the combined responsibility back into two separate functions: a neutral conductor network and a separate grounding conductor network.

(A) Arrangement to Prevent Objectionable Current.

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

(B) Alterations to Stop Objectionable Current.

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

(1) Discontinue one or more but not all of such grounding connections.

(2) Change the locations of the grounding connections.

(3) Interrupt the continuity of the conductor or conductive path causing the objectionable current.

(4) Take other suitable remedial and approved action.

(C) Temporary Currents Not Classified as Objectionable Currents.

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

(D) Limitations to Permissible Alterations.

The provisions of this section shall not be considered as permitting electronic equipment from being 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.

(E) Isolation of Objectionable Direct-Current Ground Currents.

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

Statement of Problem and Substantiation for Public Input

The neutral-to-ground bond in the panel was not invented as an advancement in electrical engineering, it was invented as a cost savings mechanism so that utility companies could save money and not run a ground wire to homes. When the expense of a ground wire has been made, the neutral-to-ground bond must NOT be installed in the panel.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 15:09:33 EDT 2017

Public Input No. 1508-NFPA 70-2017 [Section No. 250.6(D)]

(D) Limitations to Permissible Alterations.

The provisions of this section shall not be considered as permitting electronic equipment from being 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.~~

Statement of Problem and Substantiation for Public Input

Deleting this text simply removes a sentence that does not make any sense, since there is no definition for 'noise or data errors.' This rule, like other rules relating to 'noise' was added in the 1980s when we thought we knew what we were talking about... which we didn't...

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 01 12:59:05 EDT 2017

Public Input No. 624-NFPA 70-2017 [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 be connected by means of fittings designed so as to make such removal unnecessary.

Statement of Problem and Substantiation for Public Input

This Article is about ground AND bonding. Quite simply, bonding is just as important as grounding, and this rule should be applied equally for grounding and bonding. Clean surfaces are required to establish good bonding connections.

Submitter Information Verification

Submitter Full Name: Russ Leblanc

Organization: Leblanc Consulting Services

Street Address:

City:

State:

Zip:

Submittal Date: Sat Apr 29 09:30:39 EDT 2017

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

Part II. System Grounding and Bonding

Statement of Problem and Substantiation for Public Input

Edit Part title to reflect the rules in this Part. to Include Bonding.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 05 17:57:36 EDT 2017

Public Input No. 2581-NFPA 70-2017 [Section No. 250.20]

250.20 Alternating-Current Systems to Be Grounded and Bonded .

Alternating-current systems shall be grounded and bonded in accordance with 250.30 as provided for in 250.20(A), (B), (C), or (D). Other systems shall be permitted to be grounded and bonded . If such systems are grounded, they shall comply with the applicable provisions of ~~this article~~ 250 .30.

Informational Note: An example of a system permitted to be grounded is a corner-grounded delta transformer connection. See 250.26(4) for conductor to be grounded.

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

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

(1) Where supplied by transformers, if the transformer supply system exceeds 150 volts to ground

(2) Where supplied by transformers, if the transformer supply system is ungrounded

(3) Where installed outside as overhead conductors

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

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

(1) Where the system can be grounded and bonded 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

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

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

(D) Impedance Grounded Neutral Systems.

Impedance grounded neutral systems shall be grounded in accordance with 250.36 or 250.187.

Statement of Problem and Substantiation for Public Input

Add text to clarify that these systems must be grounded and bonded per 250.30.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 21 11:34:17 EDT 2017

Copyright Assignment

I, Mike Holt, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Mike Holt, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 4167-NFPA 70-2017 [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

<u>Informational Note : System grounding can impact safety of the personnel and reliability of the system. A great majority of electrical faults start as phase to ground faults escalating to line to line faults. High Impedance grouding will insert an impedance in the ground fault return path and will typically limit the ground fault to 10 amperes or beow leaving insufficient fault energy for ground fault to escalate to line to line faults thereby leaving insufficient fault energy and there by helping reduce the arc fault energy. See 250. 36 and 250.187 for detailts for high impedance grounding systems for 480- 1000 V systems and over 1000 volts systems respectively.</u>

<u>High impedance grounding will not affect arc flash energy for line- to- line and line-to-line-to line arcs.</u>

<u>See Annex O NFPA 70E Standard for Electricaal Safety in the Workplace.</u>

Statement of Problem and Substantiation for Public Input

According to NFPA 70E, Standard for Electrical Safety in the Workplace, high impedance grounding is an effective tool to reduce arc flash hazard level . Placing an informational note in 250.20(B) will highlight the safety benefits of high impedance grounding system prior to making selection for system grounding. This will also provide a road map to 250.36 and 250.187

Submitter Information Verification

Submitter Full Name: Daleep Mohla

Organization: DCM Electrical Consulting Serv

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 15:46:30 EDT 2017

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

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

(A) ~~System Grounding Connections~~ Grounding Electrode Connections .

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

(1) General.

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

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

~~(~~

(~~2) Outdoor Transformer.~~

~~Where 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 .*~~

3) Dual-Fed Services.

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

(4) Main Bonding Jumper ~~as Wire or Busbar~~ .

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

~~(~~

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

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

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

B) Main Bonding Jumper.

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

Exception No. 1: Where 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.

(C) Grounded Conductor Brought to Service Equipment.

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

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

(1) Sizing for a Single Raceway or Cable.

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

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

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(C)(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 .~~

D) 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 .~~

(E) Ungrounded System Grounding Connections.

A premises wiring system that is supplied by an ac service that is ungrounded shall have, at each service, a grounding electrode conductor connected to the grounding electrode(s) required by Part III of this article. The grounding electrode conductor shall be connected to ~~a~~ any 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~~ containing service conductors .

Statement of Problem and Substantiation for Public Input

No. 1. 250.24 Renvise the title to help the Code user realize 250.24 also contains bonding requirements.
No. 2. 250.24(A) Revise title to reflect content of rule
No. 3. 250.24(A)(1) Require the GEC connection to occure in an enclosure containing service conductors, like meter enclosure or service disconnect.
No. 4. 250.24(A)(2) Delete rule related to utility transformer, which is not within scope of NEC.
No. 5. 250.24(A)(4) Edit rule to allow the MBJ to be a screw.
No. 6. 250.24(A)(5) Delete rule unrelated to topic (GEC), this is already covered in 250.142.
No. 7. 250.24(C)(3) Delete requirement on sizing grounded conductor, this is already covered in other sections of the NEC. There is no technical reason to have it full size.
No. 8. 250.24(D) Delete text related to high impedance grounding, since a high impecance grounded system has no grounded conductor...
No. 9. Require the GEC connection to occure in an enclosure containing service conductors, like meter enclosure or service disconnect.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 21 11:38:35 EDT 2017

Public Input No. 190-NFPA 70-2017 [Section No. 250.24(A)(2)]

~~(2) Outdoor Transformer.~~

~~Where 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 .*~~

Delete section

Statement of Problem and Substantiation for Public Input

a transformer supping the service is a utility owned transformer and not within the NEC.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: master

Street Address:

City:

State:

Zip:

Submittal Date: Sun Feb 05 15:59:53 EST 2017

Public Input No. 2092-NFPA 70-2017 [Section No. 250.24(A)(2)]

~~**(2)** Outdoor Transformer.~~

~~Where 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 .*~~

Additional Proposed Changes

File Name	Description	Approved
.1502378086871		✓
230-00_02_intro.png	Service versus Feeder from Customer Tranformer	✓
230-00_01_intro.png	Service from Utility Owned Transfomer	✓

Statement of Problem and Substantiation for Public Input

This rule relates to a transformer that supplies a service. The only condition that this can occure is if the transformer is owned by the electric utility, and we all know that electric utility wiring is not within the scope of the NEC. See graphic.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

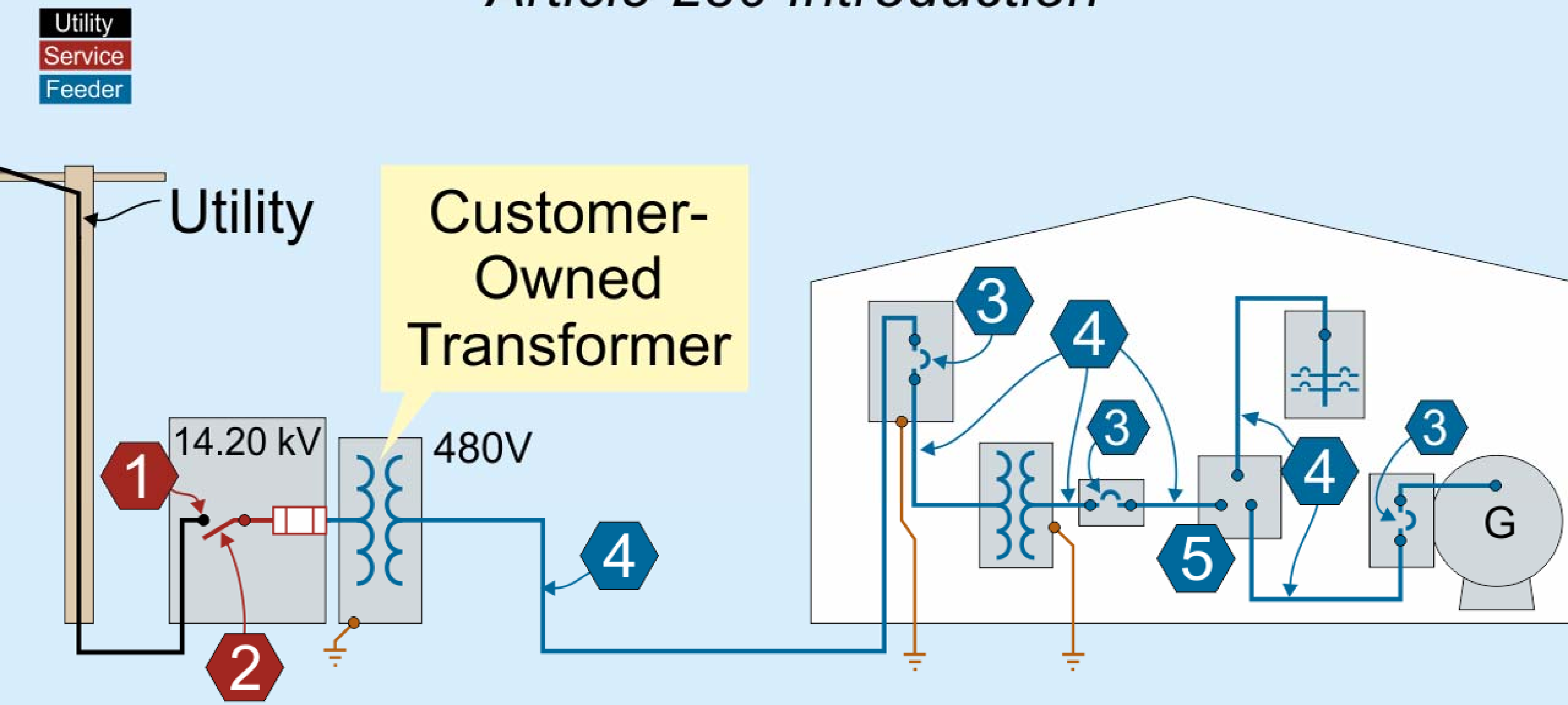
City:

State:

Zip:

Submittal Date: Thu Aug 10 11:09:16 EDT 2017

Service
Article 230 Introduction

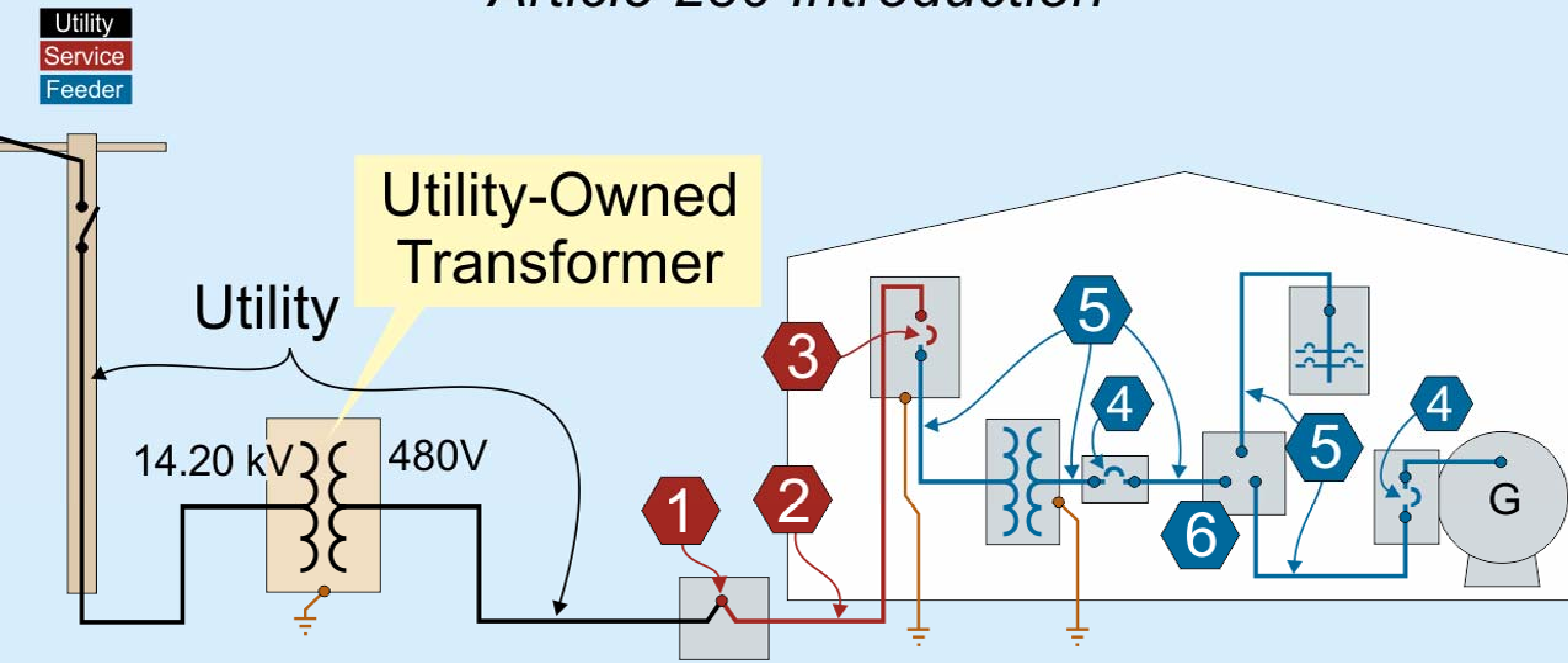


1. Service Point
2. Service Equipment

3. Feeder Disconnect
4. Feeder Conductors
5. Transfer Switch

Service

Article 230 Introduction



1. Service Point
2. Service Conductors
3. Service Equipment

4. Feeder Disconnect
5. Feeder Conductors
6. Transfer Switch

Public Input No. 191-NFPA 70-2017 [Section No. 250.24(A)(3)]

(~~3~~ 2) 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.

Statement of Problem and Substantiation for Public Input

if PI 190 is approved this needs to be renumbered

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master

Street Address:

City:

State:

Zip:

Submittal Date: Sun Feb 05 16:02:05 EST 2017

Public Input No. 2094-NFPA 70-2017 [Section No. 250.24(A)(4)]

(4) Main Bonding Jumper ~~as Wire or Busbar~~ .

Where the main bonding jumper ~~specified~~ is installed 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~~ accordance with 250.24(B) , 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.

Additional Proposed Changes

File Name	Description	Approved
250-24B0_01.png	250.24(B) Main Bonding Jumper Example	✓

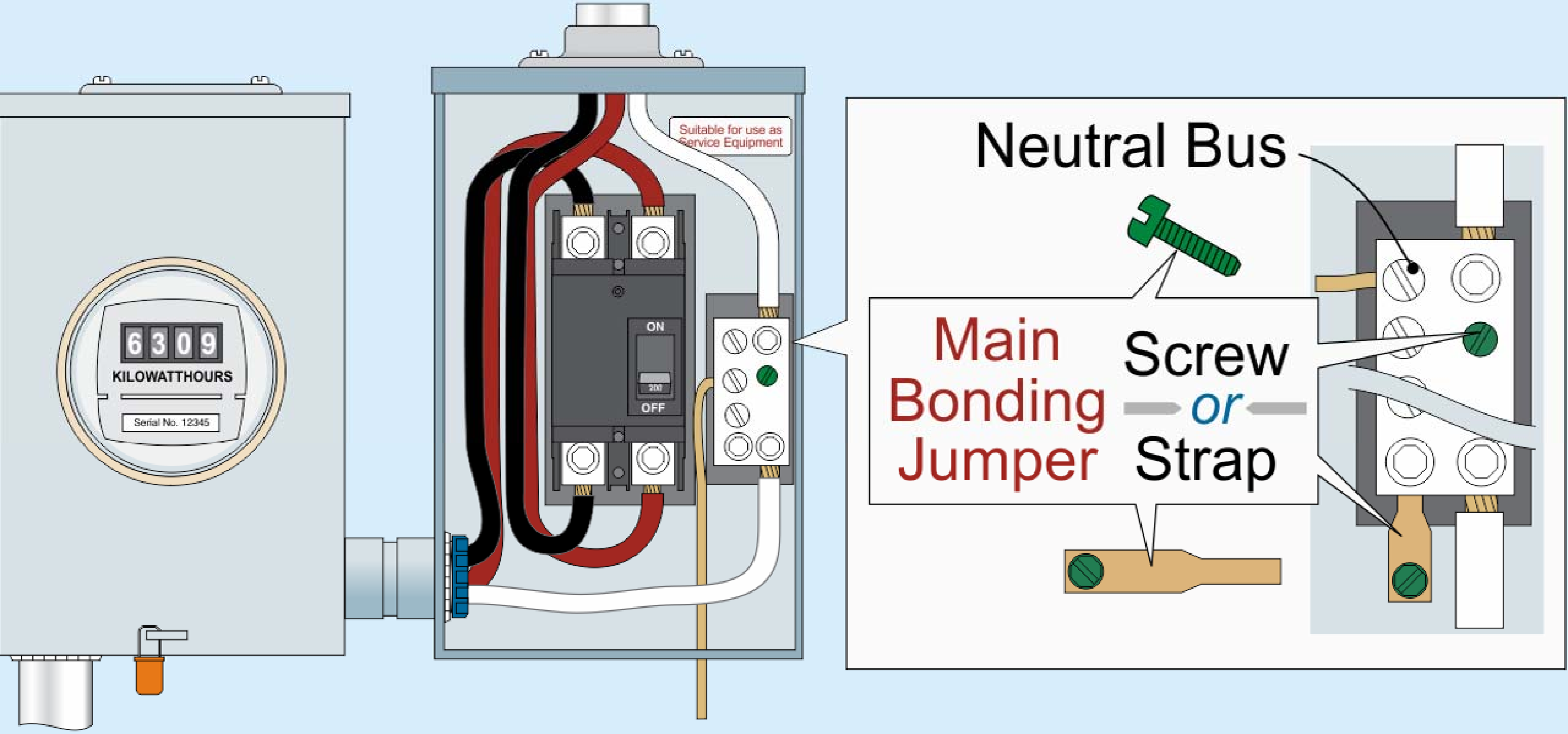
Statement of Problem and Substantiation for Public Input

Revise title to reflect change of Code reference.
The reference should be to 250.24(B), which is the primary requirement and references 250.28.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 10 11:22:54 EDT 2017

Main Bonding Jumper
250.24(B)



A main bonding jumper is required to connect the neutral conductor to the equipment grounding conductor within the service disconnecting means.

Public Input No. 192-NFPA 70-2017 [Sections 250.24(A)(4), 250.24(A)(5)]

Sections 250.24(A)(4), 250.24(A)(5)

(~~4~~ 3) Main Bonding Jumper as Wire or Busbar.

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

(~~5~~ 4) 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.

Statement of Problem and Substantiation for Public Input

if PI 190 is approved this need to be renumberd

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: master
Street Address:
City:
State:
Zip:
Submittal Date: Sun Feb 05 16:04:24 EST 2017

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

(5) Load-Side Grounding Connections.

A grounded conductor shall not be connected to normally non–current-carrying metal parts of equipment, to equipment grounding conductor(s), or be reconnected to ground on the load side of the service disconnecting means <u>or supply side disconnecting means as permitted in 230.82,</u> 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.

Statement of Problem and Substantiation for Public Input

Additional text to clarify that grounded conductors are not permitted to be connected or reconnected to the equipment grounding conductor on the load side of supply side disconnects as permitted by 230.82.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 10:46:43 EDT 2017

Public Input No. 882-NFPA 70-2017 [Section No. 250.24(A)(5)]

(5) Load-Side Grounding Connections.

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

Exception: It shall be permitted to have the grounded conductor connected to metal parts of equipment and to the equipment grounding conductor(s), when bonding a meter or metering equipment enclosure when all the enclosures are immediately adjacent to the service disconnecting means

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

Statement of Problem and Substantiation for Public Input

this is currently in 250.142 B exception 2 and is confusing. PI 881 has been submitted to delete 250.142,. we need to address this ground to neutral connection in this section when it makes sense. the load side of the service disco is a feeder needing an EGC section 250.142 does not recognize this and uses the neutral as the return ground fault path so what happens to the EGC.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master electrician

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jun 01 14:30:02 EDT 2017

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

(B) Main Bonding Jumper.

For a grounded system, an unspliced main bonding jumper shall be used to connect the equipment grounding conductor(s) and the service-disconnect enclosure or supply side disconnecting means as permitted in 230.82, to the grounded conductor within the enclosure for each ~~service~~ disconnect in accordance with 250.28 .

Exception No. 1: Where more than one service disconnecting means or or supply side disconnecting means as permitted in 230.82, 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.

Statement of Problem and Substantiation for Public Input

Including "or supply side disconnecting means as permitted in 230.82," allows this rule apply to supply side disconnects containing service conductors, which is necessary per 250.24.

Related Public Inputs for This Document

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

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 10:51:44 EDT 2017

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

Where an ac system operating at 1000 volts or less is grounded at any point, the grounded conductor(s) shall be routed with the ungrounded conductors to each service disconnecting means or supply side disconnecting means as permitted in 230.82 and shall be connected to each disconnecting means grounded conductor(s) terminal or bus. A main bonding jumper shall connect the grounded conductor(s) to each ~~service~~ disconnecting means enclosure. The grounded conductor(s) shall be installed in accordance with 250.24(C)(1) through 250.24(C)(4).

Exception: Where two or more service disconnecting means or supply side disconnecting means as permitted in 230.82 are located in a single ~~assembly~~ listed ~~for use as~~ service ~~equipment~~ rated assembly, 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.

Statement of Problem and Substantiation for Public Input

Including "or supply side disconnecting means as permitted in 230.82," makes this rule apply to supply side disconnects containing service conductors.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 10:54:37 EDT 2017

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

(4) High Impedance.

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

Statement of Problem and Substantiation for Public Input

This proposal provides improved accuracy in relation to all that is actually required in 250.36. There are many more “installation-related” criteria addressed in 250.36 in addition to just the “grounding” of such systems.

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz
Organization: NECA
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 03 11:41:36 EDT 2017

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

(D) Grounding Electrode Conductor.

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

High-impedance grounded neutral system connections shall be made as covered in 250.36.

Statement of Problem and Substantiation for Public Input

The NEC Style Manual in 3.3.4 indicates that "If" is to be used to indicate a condition.

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 25 18:31:03 EDT 2017

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

250.26 Conductor to Be Grounded — Grounded Alternating-Current Systems.

For ac premises wiring systems that are grounded , 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

Statement of Problem and Substantiation for Public Input

Some systems are required to be grounded while others are permitted to be grounded and some are prohibited from being grounded.
The changes to this section make it clear that the conductor to be grounded applies to those electrical systems that are grounded.

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 25 18:25:04 EDT 2017

Public Input No. 4060-NFPA 70-2017 [New Section after 250.26]

250.27 Termination of Grounding Electrode Conductors and Equipment Grounding Conductors in Service Panels

Grounding electrode conductors, equipment grounding conductors, bonding jumpers and other normally-non-current-carrying grounded conductors shall be bonded to a dedicated grounding bar located within the service panel and/or electrical enclosure. The termination of normally-non-current-carrying grounded conductors to the neutral bar is prohibited except as allowed under 250.28.

The grounding terminal within the serice panel and/or electrical enclosure shall be large enough to accomicate the anticiapted number of conductors that are to be terminated in the enclosure, including those conductors as required under 250.52(A), 250.52(A)(3), 250.53(D), 250.68(C), 250.94, 250.104, 250.104(A), 250.104(B), 250.104(D)(1), 250.106, 830 and 840.

Statement of Problem and Substantiation for Public Input

Ground wires should not be connected to the neutral bar under any circumstance. Only the single neutral-to-ground bond should be applied, and only in the single circumstance it is allowable under.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 13:14:28 EDT 2017

Public Input No. 4099-NFPA 70-2017 [Section No. 250.28]

250.28 Main Bonding Jumper and System Bonding Jumper.

For a grounded system, under certain circumstances, a main bonding jumper (neutral-to-ground) bond is required at both the wye-tranformer and at the main service panel. The main bonding jumper must NOT be installed if it allows normal operating neutral currents (objectionable currents) to travel on the grounding system and other exposed conductive metallic parts, in violation of 250.6, 250.24(A)(5), 250.30(A)(1), 250.30(A)(5), 250.32(B)(1), and 250.142(B).

An ohm-meter shall be used to measure the resistance between the source transformer and the structure being supplied.

When to install a neutral-to-ground bond in the main service panel:

(1) For single-phase circuits: when a 3-wire feed consisting of only phase and neutral conductors (no grounding conductors or other metallic path between the structure and the transformer exists, whether intentional or unintentional).

(2) For three-phase circuits: when a 4-wire feed consisting of only phase and neutral conductors (no grounding conductors or other metallic paths between the structure and the transformer exists, whether intentional or unintentional).

(3) The transformer is located greater than 16-ft horizontally or 8-ft vertaically from the structure in accordance with 250.194.

(4) An ohm-meter has measured a resistance greater than 201 ohms between the case of the transformer and the structure being supplied.

When NOT to install a neutral-to-ground in the main service panel:

(1) Any service feed that includes a normally-non-current-carrying conductor or other metallic path, such as grounding conductors, metalic conducit, sturcutural steel, steel rebar in concrete foundations, etc., whether these conductors are intentional or unitentional. This includes single-phase 4-wire feeds and 3-phase 5-wire feeds.

(2) When an ohm-meter measures a resistance of less than 200 ohms between the transformer and the structure being supplied by the service, a grounding electrode conductor in compliance with 250.66 is required in the circuit, regardless of the distance or ownership of the transformer.

For a grounded system, main bonding jumpers and system bonding jumpers shall be installed as follows:

(A) Material.

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

(B) Construction.

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

(C) Attachment.

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

(D) Size.

Main bonding jumpers and system bonding jumpers shall be sized in accordance with 250.28(D)(1) through (D)(3).

(1) General.

Main bonding jumpers and system bonding jumpers shall not be smaller than specified in Table 250.102(C)(1).

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

Where a service consists of more than a single enclosure as permitted in 230.71(A), the main bonding jumper for each enclosure shall be sized in accordance with 250.28(D)(1) based on the largest ungrounded service conductor serving that enclosure.

(3) Separately Derived System with More Than One Enclosure.

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

Statement of Problem and Substantiation for Public Input

Many electrical engineers, electricians and even inspectors currently interpret 250.28 to mandate a neutral-to-ground bond in all first service electrical panels, even in 5-wire systems where a ground wire has been pulled. This has resulted in numerous deaths of persons as it allows normal operating neutral currents to flow on the grounding system and exposed metallic parts. Clarification on this topic is extremely important.

Frankly, the neutral-to-ground bond should ONLY be applied in a single scenario, and that is when the transformer is located outside of the structure, outside of touch voltage (reach) range, has an earth resistance between the structure and transformer greater than 200-ohms, and has not had a ground conductor or other metallic path routed to the structure from the transformer.

The code reads as if this is the normal scenario, when in fact it is not. Any transformer/circuit located within the structure should have the neutral-to-ground bond ONLY in the transformer. This is should be made very clear in the code.

Transformers in campus environments, such as universities, industrial centers, high-voltage environments, etc. often have equipotential bonding grids that connect all of the structures and transformers together. In these scenarios (5-wire systems), the ONLY place for neutral-to-ground bonds is in the transformer.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 14:03:38 EDT 2017

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

(A) Material.

Main bonding jumpers and system bonding jumpers shall be of copper, aluminum, or 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.

Additional Proposed Changes

File Name	Description	Approved
.1503941981337		✓

Statement of Problem and Substantiation for Public Input

The materials do not correspond with table 250.102(C)(1) conductor requirements.

Submitter Information Verification

Submitter Full Name: Mark Rochon

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 28 13:36:55 EDT 2017

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

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

Where a service consists of more than a single enclosure as permitted in 230.71(A) and/ or supply side disconnecting means as permitted in 230.82 , the main bonding jumper for each enclosure shall be sized in accordance with 250.28(D)(1) based on the largest ungrounded service conductor serving that enclosure.

Statement of Problem and Substantiation for Public Input

Including "or supply side disconnecting means as permitted in 230.82," makes this rule apply to supply side disconnects containing service conductors.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 10:59:46 EDT 2017

Public Input No. 2582-NFPA 70-2017 [Section No. 250.30]

250.30 Grounding and Bonding Grounded Separately Derived Alternating-Current Systems.

~~In addition to complying with 250.30(A) for grounded systems, or as provided in 250.30(B) for ungrounded systems, separately derived systems shall comply with 250.20 , 250.21 , 250.22 , or 250.26 , as applicable. Multiple separately derived systems that are connected in parallel shall be installed in accordance with 250.30 .~~

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) through (

~~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.~~

H).

Multiple separately derived systems that are connected in parallel shall be installed in accordance with 250.30 .

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

(~~1~~ A) System Bonding Jumper.

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

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

Exception No. 2: If a building or structure is supplied by a feeder from an outdoor separately derived system, a system bonding jumper at both the source and the first disconnecting means shall be permitted if doing so does not establish a parallel path for the grounded conductor. If a grounded conductor is used in this manner, it shall not be smaller than 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).

(~~2~~ B) Supply-Side Bonding Jumper.

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

(a) A supply-side bonding jumper of the wire type shall comply with 250.102(C), based on the size of the derived ungrounded conductors.

(b) A supply-side bonding jumper of the bus type shall have a cross-sectional area not smaller than a supply-side bonding jumper of the wire type as determined in 250.102(C).

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

(~~3~~ C) Grounded Conductor.

If a grounded conductor is installed and the system bonding jumper connection is not located at the source, 250.30(~~A~~ C)(~~3)(~~ a) through (~~A~~ C)(~~3)(~~ d) shall apply.

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

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

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

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

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

(~~4~~ D) Grounding Electrode.

(1) Inside Buildings or Structures. The building or structure grounding electrode system shall be used as the grounding electrode for the separately derived system.

(2) Outside Buildings or Structures. If ~~located outdoors, the grounding electrode shall be in accordance with 250.30(C)~~ **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** .

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~~ E) 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 with250.30(A)(4), or as permitted in 250.68(C)(1) and (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~~ F) Grounding Electrode Conductor, Multiple Separately Derived Systems.

A common grounding electrode conductor for multiple separately derived systems shall be permitted. If installed, the common grounding electrode conductor shall be used to connect the grounded conductor of the separately derived systems to the grounding electrode as specified in 250.30(~~A~~ D)~~(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~~ 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.

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

(2) A conductor of the wire type not smaller than 3/0 AWG copper or 250 kcmil aluminum

(3) A metal water pipe that complies with 250.68(C)(1)

(4) 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

(e) *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: 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.

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

(7) A connector listed as grounding and bonding equipment.

(8) Listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide (1⁄4 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) .

(9) 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~~ G) Installation.

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

(~~8~~ H) 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 (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.*~~

Statement of Problem and Substantiation for Public Input

No. 1. Add text to help the Code user realize that 250.30 also applies to the bonding requirements.
No. 2. Remove (B) Ungrounded systems into a new 250.31
No. 3. Relocated the text for (C) Outside Building rules into a more appropiate location.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 21 11:36:51 EDT 2017

Public Input No. 4051-NFPA 70-2017 [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~~ Multiple power sources of the same type that are connected in parallel to form one system that then connects to the premises wiring shall be considered as a single separate 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.

Informational Note No. 3: Examples of multiple sources that may be connected in parallel forming a single system include but are not limited to two or more engine generators, two or more inverters from photovoltaic or wind generators, two or more fuel cells, two or more energy storage systems.

(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 (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).

(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 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.

~~*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 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.

- ~~*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.~~

Exception No. 4: If the separately derived system consists of multiple sources of the same type that are connected in parallel, the grounding and bonding connections shall be permitted to be installed at the paralleling switchgear, switchboard or other paralleling connection point without regard to the presence of local disconnection means located at each separate source.

(2) *Supply-Side Bonding Jumper.*

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

(a) A supply-side bonding jumper of the wire type shall comply with 250.102(C), based on the size of the derived ungrounded conductors.

(b) A supply-side bonding jumper of the bus type shall have a cross-sectional area not smaller than a supply-side bonding jumper of the wire type as determined in 250.102(C).

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

(3) *Grounded Conductor.*

If a grounded conductor is installed and the system bonding jumper connection is not located at the source, 250.30(A)(3)(a) through (A)(3)(d) shall apply.

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

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

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

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

(d) Impedance Grounded System. The grounded conductor of an impedance 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 with250.30(A)(4), or as permitted in 250.68(C)(1) and (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 separately derived systems to the grounding electrode as specified in 250.30(A)(4). A grounding electrode conductor tap shall then be installed from each separately derived system to the common grounding electrode conductor. Each tap conductor shall connect the grounded conductor of the separately derived system to the common grounding electrode conductor. This connection shall be made at the same point on the separately derived system where the system bonding jumper is connected.

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.

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

(2) *A conductor of the wire type not smaller than 3/0 AWG copper or 250 kcmil aluminum*

(3) *A metal water pipe that complies with 250.68(C)(1)*

(4) *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*

(e) *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: 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.

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

(7) *A connector listed as grounding and bonding equipment.*

(8) *Listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide (1⁄4 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) .*

(9) *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 (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.

Statement of Problem and Substantiation for Public Input

The present text regarding multiple separately derived systems being connected in parallel is unclear and confusing. By definition, sources like engine generators connected in parallel are no longer individual separately derived systems since each source has direct electrical connection to the other source(s). The issue is that there are many sources like engine generators, inverters, fuel cells, etc., as noted in the new informational note 3, that can be connected in parallel to form a new single “system” that is then ultimately connected by some means to the premises wiring. The revised text clarifies that it is dealing with multiple sources connected in parallel to form a single separately derived system.

For the system bonding jumper requirements in 250.30(A)(1), the list items (a) and (b) as published in the 2017 NEC are after the exceptions, but the exceptions actually apply to the requirements indicated in list items (a) and (b). The present location is confusing and these requirements get lost in the present format. These list items should be relocated to just after the charging text in 250.30(A)(1) that references the list items and then the exceptions should follow the completed requirement.

A new exception 4 is added to deal with where there are multiple sources making up a single separate derived system. The requirement would have the system bonding jumper and the grounding electrode conductor installed at the source or first disconnect. Many times, like with engine generators, fuel cells or inverters each equipment is supplied with a main disconnect and that would then require the system bonding jumper and grounding electrode conductor for system grounding at each source. This is problematic for some paralleling controls as it causes undesirable circulating currents between the source units. These undesirable currents can cause some heating issues as well as interference in operation of the automatic paralleling equipment. The exception would allow the multiple sources to be considered as one separately derived system and that the system grounding and bonding connections could be made at a single point in the switchgear, switchboard or other equipment where the paralleling of the sources is accomplished.

Submitter Information Verification

Submitter Full Name: Charles Mello

Organization: Cdcmello Consulting Llc

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 13:02:20 EDT 2017

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Public Input No. 4337-NFPA 70-2017 [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 that are connected in parallel 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~~ neutral 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~~ neutral-to-ground bond .

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.~~ Neutral-to-Ground Bond

An unspliced ~~system bonding jumper~~ neutral-to-ground bond shall comply with 250.28(A) through (D). This connection shall be made at any single point on the separately derived system from the source to the first system disconnecting means or overcurrent device, or it shall be made at the source of a separately derived system that has no disconnecting means or overcurrent devices, in accordance with 250.30(A)(1)(a) or (b). The ~~system bonding jumper~~ neutral-to-ground bond shall remain within the enclosure where it originates. If the source is located outside the building or structure supplied, a ~~system bonding jumper~~ neutral-to-ground bond 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~~ neutral-to-ground bond to the tie point of the ~~grounded~~ neutral 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~~ neutral-to-ground bond 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~~ neutral conductor. See 250.6, 250.24(A)(5), 250.30(A)(1), 250.30(A)(5), 250.32(B)(1), and 250.142(B). If a neutral conductor is used in this manner, it shall not be smaller than the size specified for the ~~system bonding jumper~~ EGC but shall not be required to be larger than the ungrounded (phase) 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~~ neutral-to-ground bond 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 (phase) conductors and shall not be smaller than 14 AWG copper or 12 AWG aluminum.

(a) *Installed at the Source.* The ~~system bonding jumper~~ neutral-to-ground bond shall connect the ~~grounded~~ neutral conductor to the ~~supply-side bonding jumper~~ equipment grounding conductor (EGC) and the normally non–current-carrying metal enclosure.

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

(2) ~~Supply-Side Bonding Jumper.~~ Equipment Grounding Conductor (EGC)

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

(a) ~~A supply-side bonding jumper~~ An EGC of the wire type shall comply with 250.102(C), based on the size of the derived ungrounded (phase) conductors.

(b) ~~A supply-side bonding jumper~~ An EGC of the bus type shall have a cross-sectional area not smaller than ~~a supply-side bonding jumper~~ an EGC of the wire type as determined in 250.102(C) and Table 250 .122.

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

(3) ~~Grounded~~ Neutral Conductor.

If a ~~grounded~~ neutral conductor is installed and the ~~system bonding jumper connection~~ neutral-to-ground bond is not located at the source, 250.30(A)(3)(a) through (A)(3)(d) shall apply.

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

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

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

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

(d) *Impedance Grounded System.* The ~~grounded~~ neutral 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 (GEC) , Single Separately Derived System.

A grounding electrode conductor (GEC) for a single separately derived system shall be sized in accordance with 250.66 for the derived ungrounded (phase) conductors. It shall be used to connect the ~~grounded~~ neutral conductor of the derived system to the grounding electrode in accordance with250.30(A)(4), or as permitted in 250.68(C)(1) and (2). This connection shall be made at the same point on the separately derived system where the ~~system bonding jumper~~ neutral-to-ground bond is connected, if any .

Exception No. 1: If the ~~system bonding jumper~~ neutral-to-ground bond 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 (GEC) , Multiple Separately Derived Systems.

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

Exception No. 1: If the ~~system bonding jumper~~ neutral-to-ground bond 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~~ neutral 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.

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

(2) A conductor of the wire type not smaller than 3/0 AWG copper or 250 kcmil aluminum

(3) A metal water pipe that complies with 250.68(C)(1) or dedicated copepr ground bar as listed below

(4) 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

(e) *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: 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.

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

(7) A connector listed as grounding and bonding equipment.

(8) Listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide ($^1/_4$ 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) .

(9) 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 (phase) conductor(s) or set of derived ungrounded (phase) 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 (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~~ An equipment grounding conductor (EGC) 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.

Additional Proposed Changes

File Name	Description	Approved
Neutral_to_ground_flow_chart_Jan-2016.pdf	A flow chart for when to install neutral-to-ground bonds.	✓
List_of_NEC_Illustrations_with_Errors.pdf	Numerous illustrations in the handbook show neutral-to-ground errors.	✓

Statement of Problem and Substantiation for Public Input

This entire section needs to be re-written. You may not install neutral-to-ground bonds in every single instance! That is highly dangerous. Only when the source transformer is located greater than 16-ft horizontally or 8-ft vertically outside of the building or structure, there is no metallic path (intentional or unintentional), there is a 200-ohm resistance between the transformer and the structure, and there is no equipment grounding conductor routed, may you install a neutral-to-ground bond. You must warn persons about objectionable currents and normally operating neutral currents being placed on the grounding system. Frankly, if you simply mandate a grounding wire from all transformers, half these issues are gone.

The terminology in this section is horrible. Neutral wires need to be called neutrals. Equipment grounding conductors need to be called EGC's and not "jumpers".

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 22:02:27 EDT 2017

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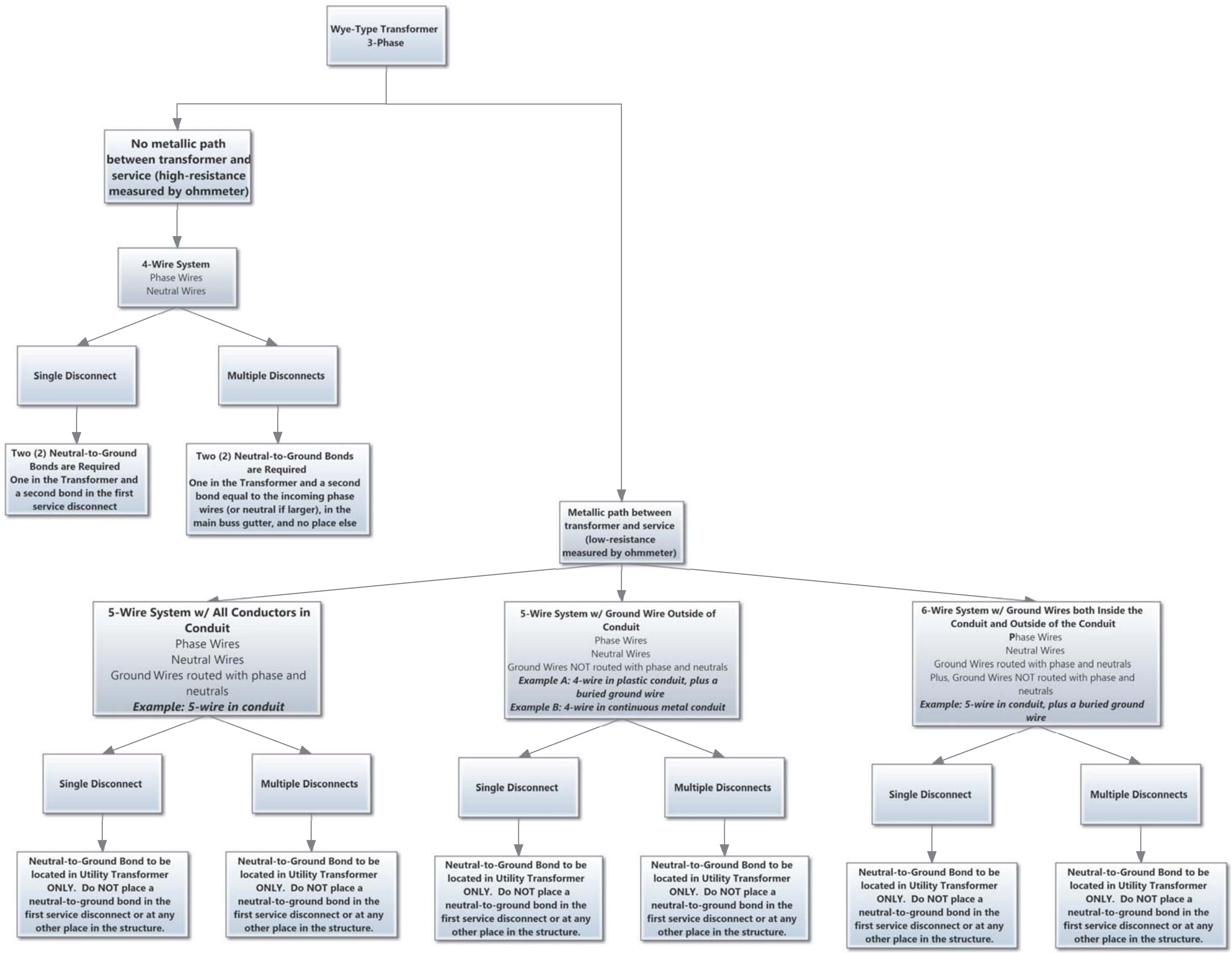
Wye-Type Transformer 3-Phase
No metallic path between transformer and service (high-resistance measured by ohmmeter)
4-Wire System
Phase Wires
Neutral Wires
Single Disconnect
Multiple Disconnects
Two (2) Neutral-to-Ground Bonds are Required One in the Transformer and a second bond in the first service disconnect
Two (2) Neutral-to-Ground Bonds are Required One in the Transformer and a second bond equal to the incoming phase wires (or neutral if larger), in the main buss gutter, and no place else
Metallic path between transformer and service (low-resistance measured by ohmmeter)
5-Wire System w/ All Conductors in Conduit
Phase Wires
Neutral Wires
Ground Wires routed with phase and neutrals
Example: 5-wire in conduit
5-Wire System w/ Ground Wire Outside of Conduit
Phase Wires
Neutral Wires
Ground Wires NOT routed with phase and neutrals
Example A: 4-wire in plastic conduit, plus a buried ground wire
Example B: 4-wire in continuous metal conduit
6-Wire System w/ Ground Wires both Inside the Conduit and Outside of the Conduit
Phase Wires
Neutral Wires
Ground Wires routed with phase and neutrals
Plus, Ground Wires NOT routed with phase and neutrals
Example: 5-wire in conduit, plus a buried ground wire
Single Disconnect
Multiple Disconnects
Single Disconnect
Multiple Disconnects
Single Disconnect
Multiple Disconnects
Neutral-to-Ground Bond to be located in Utility Transformer ONLY. Do NOT place a neutral-to-ground bond in the first service disconnect or at any other place in the structure.
Neutral-to-Ground Bond to be located in Utility Transformer ONLY. Do NOT place a neutral-to-ground bond in the first service disconnect or at any other place in the structure.
Neutral-to-Ground Bond to be located in Utility Transformer ONLY. Do NOT place a neutral-to-ground bond in the first service disconnect or at any other place in the structure.
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Neutral-to-Ground Bond to be located in Utility Transformer ONLY. Do NOT place a neutral-to-ground bond in the first service disconnect or at any other place in the structure.
Neutral-to-Ground Bond to be located in Utility Transformer ONLY. Do NOT place a neutral-to-ground bond in the first service disconnect or at any other place in the structure.

List of NEC Illustrations with Neutral-to-Ground Bond Errors

07-SEP-2017

Primary Goal: Prevent currents from traveling on exposed metal components (normally non-current carrying) during normal operating conditions.

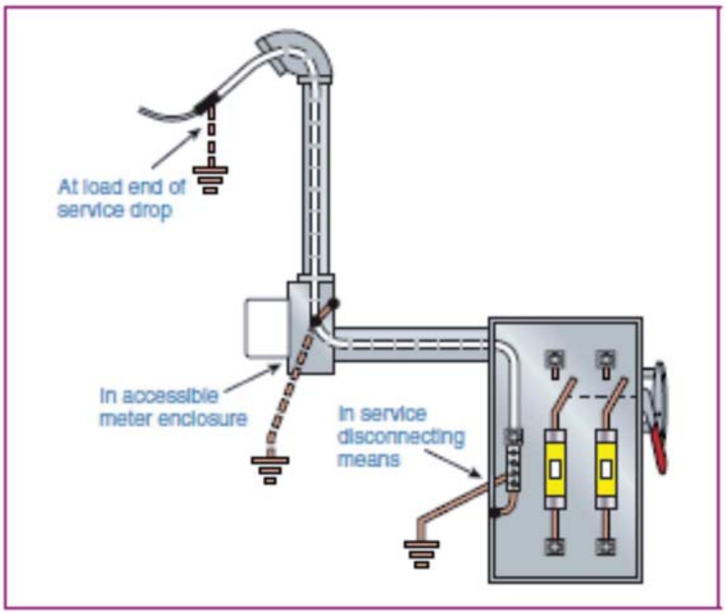


***EXHIBIT 250.8** Three locations where the grounding electrode conductor is permitted to be connected to the grounded service conductor.*

This illustration needs to make it clear that only one of the above may be used and ONLY if there is no grounding conductor routed to the service, or other metallic path, accidental of intentional. A ohm meter should be used between the structure and the transformer to measure the resistance and ensure that the resistance is greater than 200 ohms.

Unknown if a neutral-to-ground (NTG) connection is here in this illustration, however in Exhibit 250.12 and 250.34 they are shown bonded.

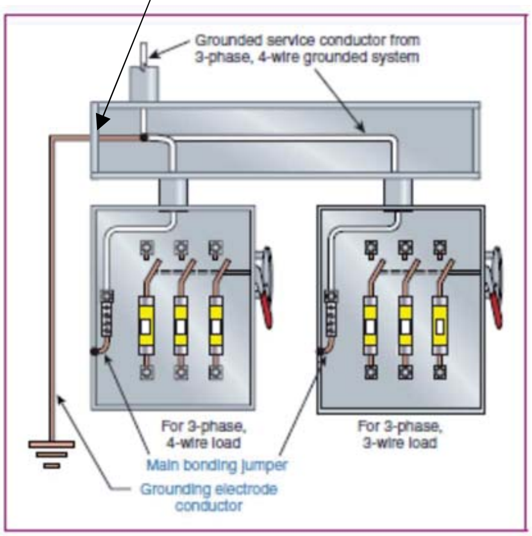


EXHIBIT 250.10 A grounded system in which the grounded service conductor is bonded to the enclosure supplying 3-phase, 4-wire service loads and to the enclosure supplying 3-phase, 3-wire loads.

Exhibit 250.10 shows two (2), and possibly three, neutral-to-ground connections in this illustration. In this setup, neutral currents have a choice of returning through the neutral wire, or through the metal cabinetry

Not shown in the illustration are the two (2) neutral wires coming back up from the load and into the disconnects neutral bars. Because there is a neutral-to-ground bond in both disconnects, the neutral currents have a choice of either going through the neutral wires, or through the metal enclosure over to one of the other neutral connections. This should NOT be allowed.

Unknown if a neutral-to-ground (NTG) connection is here in this illustration.

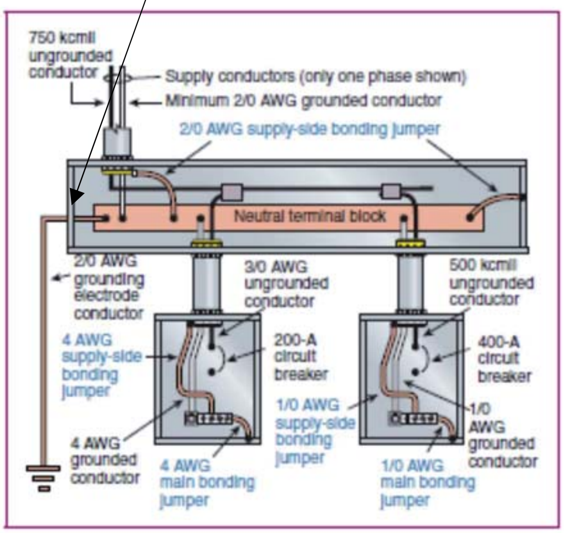


EXHIBIT 250.12 *An example of the bonding requirements for service equipment.*

Exhibit 250.11 actually shows four (4), and possibly five, neutral-to-ground connections in this illustration. In this setup, neutral currents have a choice of returning through the neutral wire, or through the metal cabinetry

Not shown in the illustration are the two (2) neutral wires coming back up from the load and into the disconnects neutral bars. Because there is a neutral-to-ground bond in both disconnects, the neutral currents have a choice of either going through the neutral wires, or through the metal enclosure over to one of the other neutral connections. This should NOT be allowed.

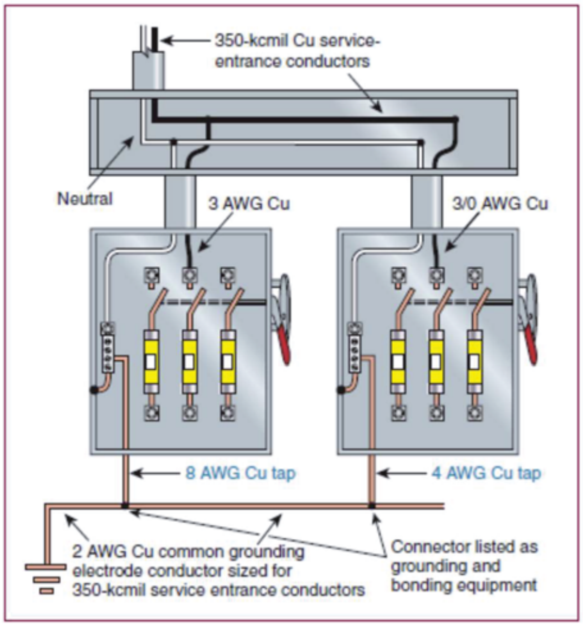


***EXHIBIT 250.27** The tap method of connecting the grounding electrode conductor to multiple service disconnecting means enclosures.*

Exhibit 250.27 shows two (2) neutral-to-ground connections in this illustration. In this setup, neutral currents have a choice of returning through the neutral wire, or through the metal cabinetry

Not shown in the illustration are the two (2) neutral wires coming back up from the load and into the disconnects neutral bars. Because there is a neutral-to-ground bond in both disconnects, the neutral currents have a choice of either going through the neutral wires, or through the metal enclosure over to one of the other neutral connections. This should NOT be allowed.

Unknown if a neutral-to-ground (NTG) connection is here in this illustration.

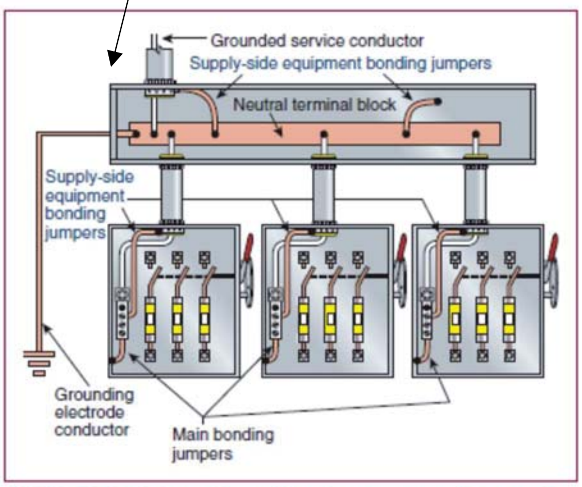


EXHIBIT 250.34 *Grounding and bonding arrangement for a service with three disconnecting means.*

Exhibit 250.34 actually shows five (4), and possibly six, neutral-to-ground connections in this illustration. In this setup, neutral currents have a choice of returning through the neutral wire, or through the metal cabinetry

Not shown in the illustration are the three (3) neutral wires coming back up from the load and into the disconnects neutral bars. Because there are neutral-to-ground bond in all of the disconnects, the neutral currents have a choice of either going through the neutral wires, or through the metal enclosure over to one of the other neutral connections. This should NOT be allowed.

Public Input No. 2902-NFPA 70-2017 [Section No. 250.30 [Excluding any Sub-Sections]]

In addition to complying with 250.30(A) for grounded systems, or as provided in 250.30(B) for ungrounded systems, separately derived systems shall comply with 250.20, 250.21, 250.22, or 250.26, as applicable. Multiple separately derived systems that are connected in parallel shall be installed in accordance with 250.30.

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:~~ 2: An ac transformer located on the premises side of the service point and having a high voltage wye primary and under 1000 volt wye secondary configuraton where HO and XO are tied together internally or with a bonding jumper and having a grounded conductor on the seconday side but no grounded conductor on the primary side is another example of a separately derived system.

Informational Note No. 3: See 445.13 for the minimum size of conductors that carry fault current.

Additional Proposed Changes

File Name	Description	Approved
Transformer_Label_-Wye_Primary_and_Wye_Secondary.pdf		✓

Statement of Problem and Substantiation for Public Input

Adding a new Informational Note No. 2 to address ac transformers with a Wye connected primary and a Wye connected secondary having HO and XO bonded together but not having a grounded conductor on the primary side, will go a long way towards clarifying these systems that have a secondary grounded conductor but no grounded conductor on the primary side are separately derived systems.

These systems are extremely common on industrial sites where the service points have been reestablished for whatever reason and what was formally utility owned is now premises wiring. In many cases the transformers that were utility owned and operated are now owned by the customer or are being leased from the utility company. Because XO and HO are tied together in the secondary compartment of the transformer enclosure and the secondary compartment is the only part being looked at, the fact there is no grounded conductor on the primary side is often overlooked. Therefore, the system is looked at as being nonseparately derived when in fact, in accordance with the definition of a separately derived system in Article 100, it is actually a separately derived system. A document has been attached to this public input with photos to show the XO and HO bonding connections in the secondary compartment and the transformer nameplate information which describes the typical configuration with no HO terminal in the primary compartment.

Former Informational Note No. 2 has been renumbered as Information Note No. 3 buy this public input in an effort to keep the two information notes with examples of separately derived systems together.

Submitter Information Verification

Submitter Full Name: Mark Hilbert

Organization: Mr Hilbert Electrical Inspections and Training

Street Address:

City:

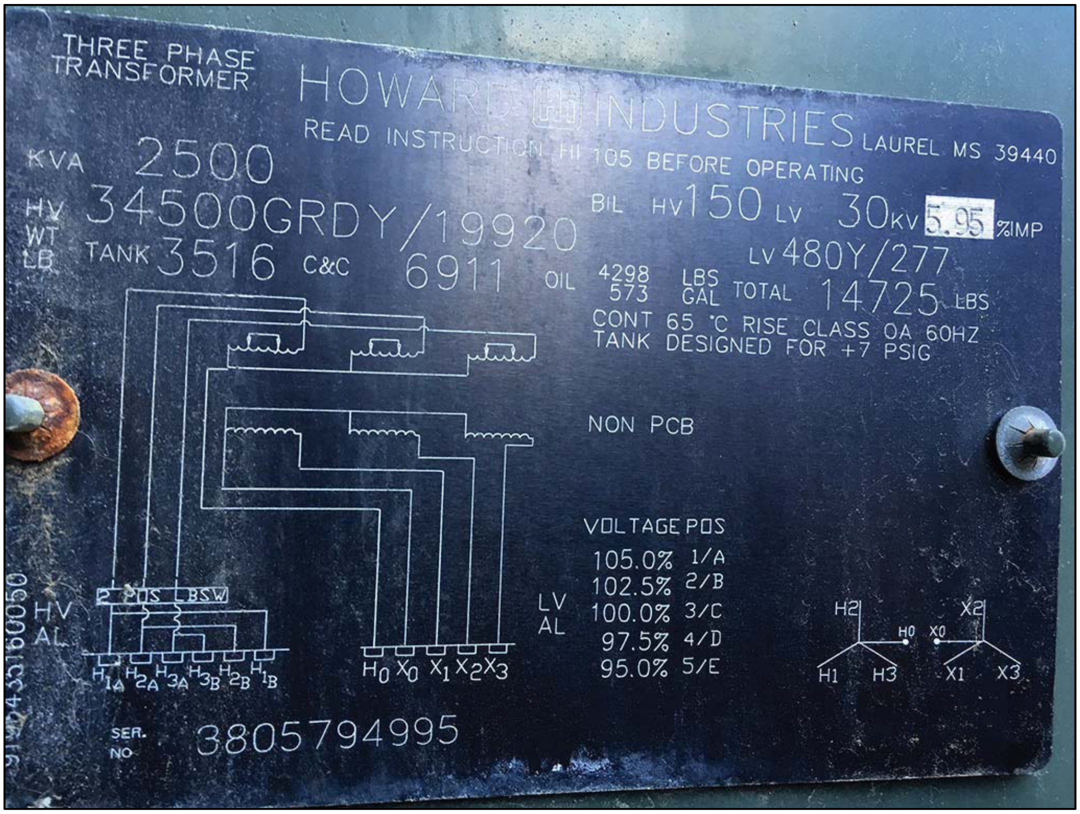
State:

Zip:

Submittal Date: Mon Aug 28 21:14:41 EDT 2017

Copyright Assignment

The below photos are of a transformer name plate showing the wye primary and wye secondary connections and of the HO and XO bonding connections.   HO and XO are bonded together in and to the secondary compartment but there is no HO terminal in the primary compartment.



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

(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 (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).

(2) Supply-Side Bonding Jumper.

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

(a) A supply-side bonding jumper of the wire type shall comply with 250.102(C), based on the size of the derived ungrounded conductors.

(b) A supply-side bonding jumper of the bus type shall have a cross-sectional area not smaller than a supply-side bonding jumper of the wire type as determined in 250.102(C).

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

(3) Grounded Conductor.

If a grounded conductor is installed and the system bonding jumper connection is not located at the source, 250.30(A)(3)(a) through (A)(3)(d) shall apply.

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

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

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

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

(d) *Impedance Grounded System.* The grounded conductor of an impedance 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 with250.30(A)(4), or as permitted in 250.68(C)(1) and (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 separately derived systems to the grounding electrode as specified in 250.30(A)(4). A grounding electrode conductor tap shall then be installed from each separately derived system to the common grounding electrode conductor. Each tap conductor shall connect the grounded conductor of the separately derived system to the common grounding electrode conductor. This connection shall be made at the same point on the separately derived system where the system bonding jumper is connected.

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:

(2) A conductor of the wire type not smaller than 3/0 AWG copper or 250 kcmil aluminum

(3) A metal water pipe that complies with 250.68(C)(1)

(4) 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

(e) *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: 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.~~

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

(7) A connector listed as grounding and bonding equipment.

(8) Listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide (**1**⁄**4** 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) .

(9) 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).

Statement of Problem and Substantiation for Public Input

The exception appears to apply to (6). The relocation will provide additional clarity and meet the NEC Style Manual requirements for placement of exceptions.

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz

Organization: NECA

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 11 15:00:41 EDT 2017

Public Input No. 2507-NFPA 70-2017 [Section No. 250.30(A)(1)]

(1) System Bonding Jumper.

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

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

Exception No.

~~*2: If a building or structure is supplied by a feeder from an outdoor separately derived system, a system bonding jumper at both the source and the first disconnecting means shall be permitted if doing so does not establish a parallel path for the grounded conductor. If a grounded conductor is used in this manner, it shall not be smaller than 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:*~~

2: 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).

Statement of Problem and Substantiation for Public Input

In 2008, Code panel 5 deleted the exception in 250.32(B) that allowed for the re-bonding of a panel at a structure fed by a feeder. The substantiation for this deletion is that the exception depended on there being no other metallic paths between the structures.
The exception in 250.30(A)(1) is identical to the issue in 250.32(B). The only difference is that 250.32(B) deals with Feeders or Branch Circuits and 250.30 deals with transformer secondary conductors.

This deletion brings these two Code sections into alignment.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2503-NFPA 70-2017 [Section No. 550.32]	applicability to mobile home connections in RV parks

Submitter Information Verification

Submitter Full Name: Eric Stromberg

Organization: Los Alamos National Laboratory

Affiliation: Self

Street Address:

City:

State:

Zip:

Submittal Date: Sat Aug 19 17:58:59 EDT 2017

Copyright Assignment

I, Eric Stromberg, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Eric Stromberg, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 2965-NFPA 70-2017 [Section No. 250.30(A)(1)]

(1) System Bonding Jumper.

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

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

Exception No. ~~*2: If a building or structure is supplied by a feeder from an outdoor separately derived system, a system bonding jumper at both the source and the first disconnecting means shall be permitted if doing so does not establish a parallel path for the grounded conductor. If a grounded conductor is used in this manner, it shall not be smaller than 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).

Statement of Problem and Substantiation for Public Input

There is no reason to allow the grounded conductor to serve as the effective ground-fault current path.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 16:30:24 EDT 2017

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

(2) Supply-Side Bonding Jumper.

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

(a) A supply-side bonding jumper of the wire type shall comply with 250.102(C), based on the size of the derived ungrounded conductors.

(b) A supply-side bonding jumper of the bus type shall have a cross-sectional area not smaller than a supply-side bonding jumper of the wire type as determined in 250.102(C).

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

Statement of Problem and Substantiation for Public Input

The additional words add clarity to the requirement. The supply side must connect to the enclosure and not to the disconnecting means itself.

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 25 18:48:06 EDT 2017

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

(3) Grounded Conductor.

If a grounded conductor is installed and the system bonding jumper connection is not located at the source, 250.30(A)(3)(a) through (A)(3)(d) shall apply. 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(H) for grounded conductors connected in parallel.

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

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

Statement of Problem and Substantiation for Public Input

I think we can all agree that this is a good idea... that the grounded conductor never has to be larger than the ungrounded conductors.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 01 11:48:11 EDT 2017

Public Input No. 4359-NFPA 70-2017 [Section No. 250.30(A)(3)]

(3) Grounded Conductor.

If a grounded conductor is installed and the system bonding jumper connection is not located at the source, 250.30(A)(3)(a) through (A)(3)(d) shall apply.

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

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

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

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

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

Statement of Problem and Substantiation for Public Input

There is no grounded conductor (neutral) in a 3-phase, 3-wire, delta system.

Submitter Information Verification

Submitter Full Name: Jeffrey Drummond
Organization: E&S Grounding Solutions
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 08 00:31:00 EDT 2017

Public Input No. 2096-NFPA 70-2017 [Section No. 250.30(A)(5)]

(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 with250.30(A)(4), or as permitted in 250.68(C)(1) and (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~~

and *shall be permitted to*

~~connect the grounding electrode conductor~~

terminate 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~~ 1 : 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~~ 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 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.

Additional Proposed Changes

File Name	Description	Approved
250-30_Special_05A_INDOOR_SDS_Trans.png	250.30(A)(5) SBJ and GEC termination www.MikeHolt.com	✓

Statement of Problem and Substantiation for Public Input

Incorporate the permission contained in the exception to the general requirements, since the condition of the exception is a common practice when the SBJ is installed at the first disonnect and the GEC terminates to the EGC bar at this disconnect.

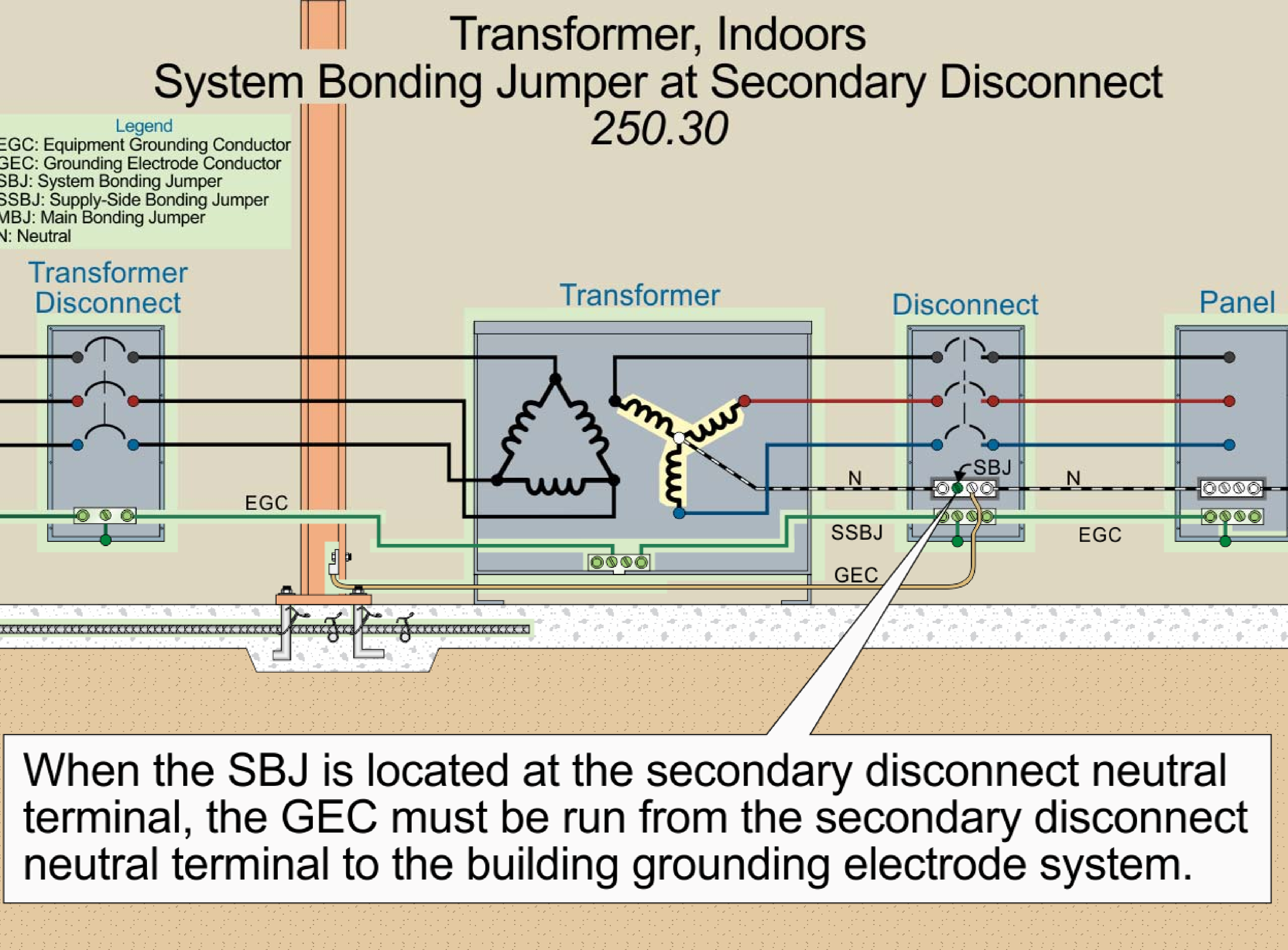
Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 10 11:32:59 EDT 2017

Copyright Assignment

I, Mike Holt, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Mike Holt, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature



Transformer, Indoors
System Bonding Jumper at Secondary Disconnect
250.30
Legend
EGC: Equipment Grounding Conductor
GEC: Grounding Electrode Conductor
SBJ: System Bonding Jumper
SSBJ: Supply-Side Bonding Jumper
MBJ: Main Bonding Jumper
N: Neutral
Transformer Disconnect
Transformer
Disconnect
Panel
EGC
SBJ
N
N
SSBJ
EGC
GEC
When the SBJ is located at the secondary disconnect neutral terminal, the GEC must be run from the secondary disconnect neutral terminal to the building grounding electrode system.

Public Input No. 2097-NFPA 70-2017 [Section No. 250.30(A)(5)]

(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 with250.30(A)(4), or as permitted in 250.68(C)(1) and (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~~

connected *shall be permitted to*

~~connect the grounding electrode conductor~~

terminate 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.

Statement of Problem and Substantiation for Public Input

Incorporate the permission contained in the exception to the general requirements, since the condition of the exception is a common practice when the SBJ is installed at the first disonnect and the GEC terminates to the EGC bar at this disconnect.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2096-NFPA 70-2017 [Section No. 250.30(A)(5)]	

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 10 11:50:45 EDT 2017

Copyright Assignment

I, Mike Holt, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Mike Holt, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 1098-NFPA 70-2017 [Section No. 250.30(A)(6)]

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

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

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.

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

(2) A conductor of the wire type not smaller than 3/0 AWG copper or 250 kcmil aluminum

(3) A metal water pipe that complies with 250.68(C)(1)

(4) 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

(e) *~~Tap~~ Supply Side equipment bonding Conductor Size.* Each ~~tap~~ conductor shall be sized in accordance with 250.~~66~~ 102 based on the derived ungrounded conductors of the separately derived system it serves.

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.

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

(7) A connector listed as grounding and bonding equipment.

(8) Listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide ($\frac{1}{4}$ 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).

(9) The exothermic welding process.

~~Tap~~ supply side equipment bonding 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.

Statement of Problem and Substantiation for Public Input

these conductors are ahead of the OCD an therefore are supply side equipment bonding conductors

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master electrician

Street Address:

City:

State:

Zip:

Submittal Date: Sat Jul 01 18:30:02 EDT 2017

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

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

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

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.

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

(2) A conductor of the wire type not smaller than 3/0 AWG copper or 250 kcmil aluminum

(3) A metal water pipe that complies with 250.68(C)(1)

(4) 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

(e) *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) : A common grounding electrode conductor that is connected to any grounding electrode type specified in 250.66(A), (B), or (C) shall not be required to be larger than the maximum size grounding electrode conductors specified in 250.66(A), (B) or (C) where it meets the specific requirements in each of those sections. The grounding electrode conductor taps addressed in (b) shall not be required to be larger than the common grounding electrode conductor sized according to this exception.

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.

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

(7) A connector listed as grounding and bonding equipment.

(8) Listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide ($^1/_4$ 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) .

(9) 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.

Statement of Problem and Substantiation for Public Input

There are no current allowances to recognize the grounding electrode conductor sizing relief offered in 250.66(A),(B), or (C) for a common grounding electrode conductor and grounding electrode conductor tap, where the grounding electrodes are only the types specified in 250.66(A),(B), or (C) . Even though the Code does not restrict the use of these subdivisions, it is currently silent on the issue. The additional text will help clarify.

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz

Organization: NECA

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 11 09:44:29 EDT 2017

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

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

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

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:

(2) A conductor of the wire type not smaller than 3/0 AWG copper or 250 kcmil aluminum

(3) A metal water pipe that complies with 250.68(C)(1)

(4) 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

(e) *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: 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.~~

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

(7) A connector listed as grounding and bonding equipment.

(8) Listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide ($\frac{1}{4}$ 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).

(9) 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.

Statement of Problem and Substantiation for Public Input

The exception appears to apply to (6). The relocation will provide additional clarity and meet the NEC Style Manual requirements for placement of exceptions.

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz

Organization: NECA

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 11 10:02:07 EDT 2017

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

(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.

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

(2) A conductor of the wire type not smaller than 3/0 AWG copper or 250 kcmil aluminum

(3) A metal water pipe that complies with 250.68(C)(1)

(4) 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

(e) *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: 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.

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

(7) A connector listed as grounding and bonding equipment.

(8) Listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide (1/4 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).

(9) 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.

Statement of Problem and Substantiation for Public Input

The words added in the opening paragraph of 250.30(A)(6) add clarity to the section.
The underlining was voluntarily added by TerraView in 250.30(A)(6)(a)(1), (a)(2), (a)(3), in the exception to (b) and in (c)(1), (c)(2), and (c)(3). No changes were proposed to these subsections by this submitter.

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 25 18:52:30 EDT 2017

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

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

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

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.

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

(2) A conductor of the wire type not smaller than 3/0 AWG copper or 250 kcmil aluminum . If the only grounding electrode available is one of the electrodes listed in 250.66(A), (B), or (C) then The common Grounding electrode conductor may be sized according to 250.66 (A), (B), or (C).

(3) A metal water pipe that complies with 250.68(C)(1)

(4) 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

(e) *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: 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.

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

(7) A connector listed as grounding and bonding equipment.

(8) Listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide ($\frac{1}{4}$ 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) .

(9) 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.

Statement of Problem and Substantiation for Public Input

None of these electrodes would be able to dissipate enough energy to require a 3/0 grounding conductor. Attaching a 3/0 grounding conductor required by 250.6(a)1 to the # 4 that would be required to connect to a concrete encased electrode in 250.66 can create a choke point for high current and actually diminish the functionality of the electrode system. I encountered this exact scenario when we added a second transformer to a block building with only the rebar mat as an available electrode.

Submitter Information Verification

Submitter Full Name: James Ingle
Organization: ibew1205
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 20:09:11 EDT 2017

Public Input No. 4339-NFPA 70-2017 [New Section after 250.30]

250.31 Emergency Generators and Automatic Transfer Switches (ATS)

All emergency generators shall have dedicated grounding electrodes installed in accordance with 250.50, 250.52, and 250.53, regardless of transfer switch type.

Three-pole transfer switches maintain the neutral, therefore there shall NOT be a neutral-to-ground bond located in the emergency generator, as it is already located in the panel.

Four-pole transfer switches break the neutral, therefor there must be a neutral-to-ground bond located in each emergency generator.

If mulitple generators are installed, they must be of the same type (all 3-pole or all 4-pole). Mixing 3-pole and 4-pole tranfer switches is prohibited. When using 4-pole transfer switches, each generator must have its own transfer switch. Ganged generators using 4-pole systems is prohibited.

Additional Proposed Changes

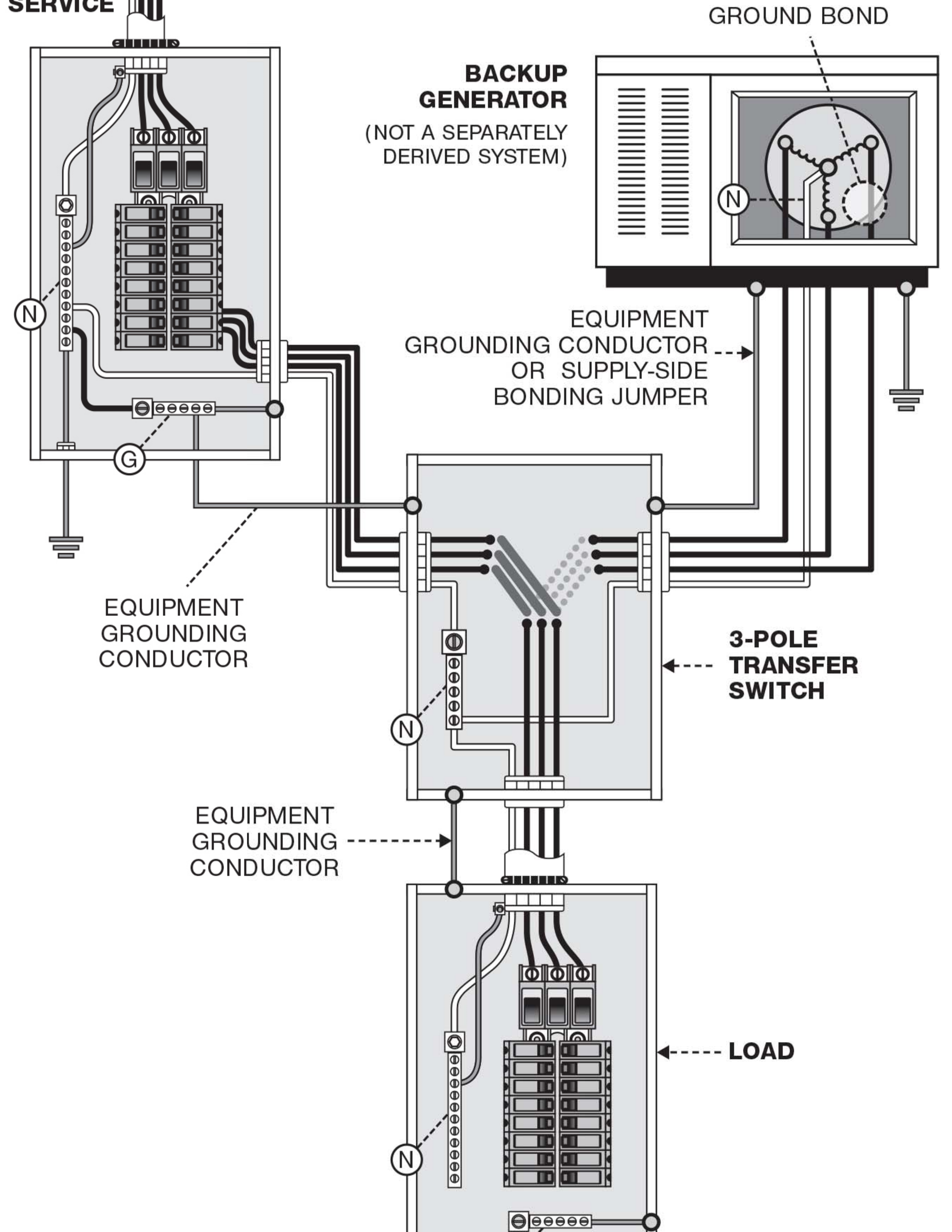
File Name	Description	Approved
250-11_FINAL_300dpi.jpg	3-pole ATS	✓
250-11_FINAL_300dpi.jpg	4-pole ATS	✓

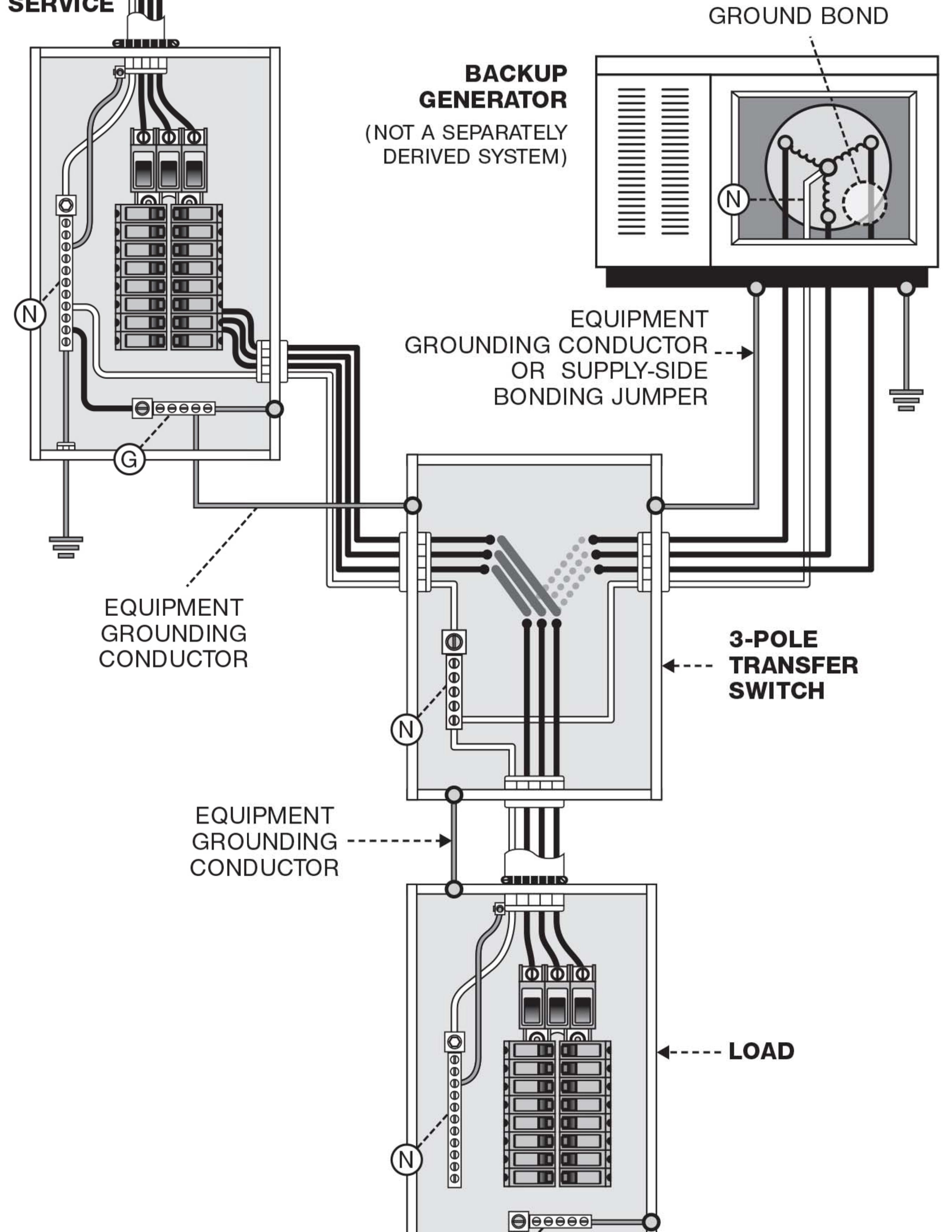
Statement of Problem and Substantiation for Public Input

There is a great deal of confusion regarding 3-pole vs. 4-pole ATS systems. The handbook does a good job clarifying the issue, but the code itself needs to address this issue far better.

Submitter Information Verification

Submitter Full Name: David Stockin
Organization: E S Groundiing Solutions
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 22:32:10 EDT 2017


SERVICE
GROUND BOND
BACKUP GENERATOR
(NOT A SEPARATELY DERIVED SYSTEM)
N
EQUIPMENT GROUNDING CONDUCTOR OR SUPPLY-SIDE BONDING JUMPER
N
G
EQUIPMENT GROUNDING CONDUCTOR
3-POLE TRANSFER SWITCH
N
EQUIPMENT GROUNDING CONDUCTOR
LOAD
N



SERVICE
BACKUP GENERATOR
(NOT A SEPARATELY DERIVED SYSTEM)
GROUND BOND
N
EQUIPMENT GROUNDING CONDUCTOR OR SUPPLY-SIDE BONDING JUMPER
N
G
EQUIPMENT GROUNDING CONDUCTOR
N
3-POLE TRANSFER SWITCH
EQUIPMENT GROUNDING CONDUCTOR
LOAD
N

Public Input No. 2954-NFPA 70-2017 [New Section after 250.32]

250.31 Grounding and Bonding of 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).

(A) Grounding Electrode Conductor.

(1) Inside Building or Structure. 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(E) or (F), as applicable. This connection shall be made at any point on the separately derived system from the source to the first system disconnecting means.

(2) Outdoor Building or Structure. 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.

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

(C) Supply-Side Bonding Jumper. 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(B).

Statement of Problem and Substantiation for Public Input

Relocate text for Ungrounded systems [250.30(B)] to new 250.31, and copy 250.30(C) into this new section. Purpose is to make it easierto apply the NEC.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 29 15:55:20 EDT 2017

Public Input No. 2986-NFPA 70-2017 [Section No. 250.32]

250.~~32~~ 36 Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s).

(A) Grounding Electrode.

Building(s) or structure(s) supplied by 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.

(B) Grounded Systems.

(1) Supplied by a Feeder or Branch Circuit.

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

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

(1) An equipment grounding conductor is not run with the supply to the building or structure.

(2) There are no continuous metallic paths bonded to the grounding system in each building or structure involved.

(3) Ground-fault protection of equipment has not been installed on the supply side of the feeder(s).

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

(1) That required by 220.61

(2) That required by 250.122

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

(2) Supplied by Separately Derived System.

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

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

(C) Ungrounded Systems.

(1) Supplied by a Feeder or Branch Circuit.

An equipment grounding conductor, as described in 250.118, shall be installed with the supply conductors and be connected to the building or structure disconnecting means and to the grounding electrode(s). The grounding electrode(s) shall also be connected to the building or structure disconnecting means.

(2) Supplied by a Separately Derived System.

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

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

(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 225.32, Exception No. 1 and No. 2, 700.12(B)(6), 701.12(B)(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.

(E) Grounding Electrode Conductor.

The size of the grounding electrode conductor to the grounding electrode(s) shall not be smaller than given in 250.66, based on the largest ungrounded supply conductor. The installation shall comply with Part III of this article.

Statement of Problem and Substantiation for Public Input

Relocate 250.32 to 250.36. I PI that there be a 250.31 for Ungrounded Separately Derived systems. With this relocation, 250.30 is for SD Grounded Systems, 250.31 applies to SD Ungrounded Systems, 250.34 Portable Generators, 250.35 Permanently Installed Generators, and relocate 250.36 to 250.36.
This relocation simply places all 'like' rules together.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2985-NFPA 70-2017 [Section No. 250.36]	

Submitter Information Verification

Submitter Full Name:	Mike Holt
Organization:	Mike Holt Enterprises Inc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Aug 30 08:26:00 EDT 2017

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Public Input No. 456-NFPA 70-2017 [Section No. 250.32]

250.32 Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s).

(A) Grounding Electrode.

Building(s) or structure(s) supplied by 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 size of the grounding electrode conductor(s) shall not be ~~connected~~ smaller than given in ~~accordance with~~ 250.32(B) ~~or (C). Where~~ 250.66, bed on the largest ungrounded supply conductor. Th installation shall complywith Part III of this article, and 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.

(B) Grounded Systems.

(1) Supplied by a Feeder or Branch Circuit.

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

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

(1) An equipment grounding conductor is not run with the supply to the building or structure.

(2) There are no continuous metallic paths bonded to the grounding system in each building or structure involved.

(3) Ground-fault protection of equipment has not been installed on the supply side of the feeder(s).

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

(1) That required by 220.61

(2) That required by 250.122

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

(2) Supplied by Separately Derived System.

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

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

(C) Ungrounded Systems.

(1) Supplied by a Feeder or Branch Circuit.

An equipment grounding conductor, as described in 250.118, shall be installed with the supply conductors and be connected to the building or structure disconnecting means and to the grounding electrode(s). The grounding electrode(s) shall also be connected to the building or structure disconnecting means.

(2) Supplied by a Separately Derived System.

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

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

(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 225.32, Exception No. 1 and No. 2, 700.12(B)(6), 701.12(B)(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.

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

~~The size of the grounding electrode conductor to the grounding electrode(s) shall not be smaller than given in 250.66 , based on the largest ungrounded supply conductor. The installation shall comply with Part III of this article.~~

Statement of Problem and Substantiation for Public Input

Subsection (A) points to either (B) or (C) for the installation of the grounding electrode system, but (B) and (C) address only the EGC, hence my suggestion of deleted text. The added text in (A) is just relocated from (E), and (E) is deleted as a result. This results in (A) containing all of the rules for the GEC and grounding electrode system. These changes should be viewed as editorial only.

Submitter Information Verification

Submitter Full Name: Ryan Jackson

Organization: Ryan Jackson

Street Address:

City:

State:

Zip:

Submittal Date: Fri Mar 31 14:50:26 EDT 2017

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

(A) Grounding Electrode.

Building(s) or structure(s) supplied by 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.

Statement of Problem and Substantiation for Public Input

Delete "The grounding electrode conductor(s) shall be connected in accordance with 250.32(B) or (C).", since neither (B) or (C) are related to the grounding electrode conductor!

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 29 16:18:17 EDT 2017

Public Input No. 2962-NFPA 70-2017 [Section No. 250.32(B)(1)]

(1) Supplied by a Feeder or Branch Circuit.

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

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

(1) An equipment grounding conductor is not run with the supply to the building or structure.

(2) There are no continuous metallic paths bonded to the grounding system in each building or structure involved.

(3) Ground-fault protection of equipment has not been installed on the supply side of the feeder(s).

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

(1) That required by 220.61

(2) That required by 250.122

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

Statement of Problem and Substantiation for Public Input

Edit the text for clarity, and deleted exception 2. I submitted PI to delete 250.30(A)(1) Ex. 2.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 29 16:20:57 EDT 2017

Public Input No. 4117-NFPA 70-2017 [Section No. 250.32(B)(1)]

(1) Supplied by a Feeder or Branch Circuit.

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

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

(1) An equipment grounding conductor is not run with the supply to the building or structure.

(2) There are no continuous metallic paths bonded to the grounding system in each building or structure involved.

(3) Ground-fault protection of equipment has not been installed on the supply side of the feeder(s).

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

(1) That required by 220.61

(2) That required by 250.122

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

Statement of Problem and Substantiation for Public Input

The revised text clarifies that the equipment grounding conductor is not functioning as a grounding electrode conductor. It brings this section in line with Part III of Article 250, referenced in section 250.32(A).
The change eliminates confusion that results from the language as presently written, regarding what conductor is connected to the grounding electrode(s) and how to size it.

Submitter Information Verification

Submitter Full Name: Peter Noval Jr

Organization: Self

Affiliation: None

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 14:36:50 EDT 2017

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Public Input No. 4323-NFPA 70-2017 [Section No. 250.32(B)(1)]

(1) Supplied by a Feeder or Branch Circuit.

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

Exception No. 1: ~~For installations~~ Only when approved by the local regulating authority, and when proper signage has been installed warning against future installations with conductive metllic paths, installations made in compliance with previous editions of this Code that permitted such connection, the ~~grounded~~ neutral conductor run with the supply to the building or structure shall be permitted to serve as the ground-fault return path if all of the following requirements continue to be met:

(1) An equipment grounding conductor is not run with the supply to the building or structure.

(2) There are no continuous metallic paths bonded to the grounding system in each building or structure involved, and signage has been installed warning against all future installations to the structure that might establish a metallic path .

(3) Ground-fault protection of equipment has not been installed on the supply side of the feeder(s).

(4) Special approval has been obtained from the local regulatory authority.

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

(1) That required by 220.61

(2) That required by 250.122

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

Statement of Problem and Substantiation for Public Input

Re-grounding of the neutral wire should only be made under serious and extreme conditions and only with permission of the local regulatory authority. Local electricians should not have the authority to choose not to install a grounding conductor to save a few dollars, thereby establishing a future electrical hazard when some unfortunate person in the future installs a conductive metal path between the structures (such as CATV). Warning signs, regulatory approval and other means will make it far more costly to the electrician than the 2 dollars they could save by not running the grounding wire.

Also, it is a NEUTRAL CONDUCTOR. No one knows it as the grounded conductor. Please make a global change so that everyone knows what you are talking about. Terms such as common conductor, grounded conductor, and ground-fault circuit conductor need to be removed.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 20:58:44 EDT 2017

Copyright Assignment

Public Input No. 2970-NFPA 70-2017 [Section No. 250.32(B)(2)]

(2) Supplied by Separately Derived System.

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

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

Statement of Problem and Substantiation for Public Input

Delete " and to the grounding electrode(s)" since this adds no value. It's taken care of by 250.32(A).

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 29 16:33:20 EDT 2017

Public Input No. 1100-NFPA 70-2017 [New Section after 250.32(B)(2)]

(3) Supplied by a Non-Separately Derived System

(a) if overcurrent protection is provided where the conductors orginate the installation shall comply with 250.32 (B) (1)

(b) if **no** overcurrent protection is provided where the conductors originate a supply side equipment bonding conductor shall be installed from the systems equipment grounding conductor or metallic encloser to the first overcurrent device.

Informational note; Not all transformers are separately dervied it is common for Medium and High voltage transformers to have HO and XO connected internally for system design purposes. An equipment grounding conductor exist on the primary side however the secondary is required to have a supply side equipment grounding conductor.

Statement of Problem and Substantiation for Public Input

Many building are supplied by Med/High voltage transformers that are not separately derived. When the feeders from this type of installation supplies a building there is no equipment grounding conductor on the transformer secondary conductors side even though it is non-separately derived. this new section address this and calls for a supply side equipment bonding conductor to be installed.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master electrician

Street Address:

City:

State:

Zip:

Submittal Date: Sat Jul 01 19:03:47 EDT 2017

Public Input No. 2971-NFPA 70-2017 [Section No. 250.32(C)]

(C) Ungrounded Systems.

(1) Supplied by a Feeder or Branch Circuit.

An equipment grounding conductor, as described in 250.118, shall be installed with the supply conductors and be connected to the building or structure disconnecting means ~~and to the grounding electrode(s)~~ . The grounding electrode(s) shall also be connected to the building or structure disconnecting means.

(2) Supplied by a Separately Derived System.

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

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

Statement of Problem and Substantiation for Public Input

Deleted "and to the grounding electrode(s)" for ease of use, this is already taken care of by other requirements.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 29 16:35:41 EDT 2017

Public Input No. 2910-NFPA 70-2017 [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 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 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,or 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. Where the system conductor that is required to grounded by 250.26 is connected to the generator frame, and a portable, vechicle-mounted or trailer-mounted generator is utilized as a temporary source of power in accordance with 700.3(F) or as an optional stanby system in accordnace with 702.7(C), the connection to the premise wiring system shall be made in accordance with 250.6.

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

Statement of Problem and Substantiation for Public Input

The addition of trailer-mounted generators to 250.34(B) brings clarity that the requirements for vehicle-mounted generators also apply to trailer-mounted generators. Vehicle is typically defined as something used to transport people or goods and portable is typically defined as able to be easily carried or moved, especially because of being a lighter and smaller version than usual. These definitions do not define a trailer mounted generator, which can be up to 2 megawatt in size. The additional language to 250.34(C) provides clarity that when any bonded neutral generator is utilized as a temporary source of power as permitted elsewhere in the code, the connection cannot create objectionable current paths within the premise wiring system.

Submitter Information Verification

Submitter Full Name: Brian Baughman

Organization: Generac Power Systems Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 29 09:16:23 EDT 2017

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Public Input No. 252-NFPA 70-2017 [Section No. 250.34(C)]

(C) Grounded Conductor Bonding.

A system conductor that is required to be grounded by 250.26 shall be connected to the generator frame where the generator is a component of a separately derived system. Where a bonded neutral portable generator is connected to a premise wiring system and utilized as an optional standby system in accordnace with 702.7(C), the connection to the premise wiring system shall be in made in accordnace with 250.6.

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

Statement of Problem and Substantiation for Public Input

The vast majority of portable generators are designed for use as a separately derived system and have the neutral factory bonded to the generator frame. When these bonded neutral generators are connected to a premise wiring system through a cord and power inlet box, objectionable current will be introduced into the electrical system. The proposed code language brings clarity that there needs to be an alteration with the connection to the premise wiring system that discontinues one and not all grounding connections. This could be accomplished through the use of a manual transfer switch that contains a switching action in the grounded conductor.

Submitter Information Verification

Submitter Full Name: Brian Baughman

Organization: Generac Power Systems Inc

Street Address:

City:

State:

Zip:

Submittal Date: Thu Feb 16 15:04:28 EST 2017

Public Input No. 2824-NFPA 70-2017 [Section No. 250.34(C)]

(C) Grounded Conductor Bonding.

~~A~~ For electrical systems that are required to be grounded by 250.20, the system conductor that is required to be grounded by 250.26 shall be connected to the generator frame ~~where~~ if the generator is a component of a separately derived system. This connection shall also apply to portable generators rated 15 kW or smaller that have receptacles rated 125-volts or 125/250-volts if the generator is used in stand-alone operation.

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

Statement of Problem and Substantiation for Public Input

The conductor of electrical systems that are required to be grounded by 250.20 and 250.26 and that are produced by portable generators must be required to be connected to the frame of portable generators. This requirement must be applied to portable generators that are a component of a separately derived system or that are used in a stand-alone function. Without such a connection, a ground-fault cannot be cleared by an overcurrent device. In addition, a ground-fault circuit-interrupter cannot function because there is no complete circuit that is required for current to flow in.
Section 445.20(A) and (B) requires ground-fault circuit-interrupter protection of 125-volt, 15- and 20-ampere receptacles for electrical systems supplied by portable generators rated 15 kW or smaller. These GFCI receptacles can only provide the critically important personnel protection from electric shock if the conductor that is a neutral or grounded conductor is connected to the frame of the portable generator.

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Sun Aug 27 18:37:06 EDT 2017

Public Input No. 253-NFPA 70-2017 [Section No. 250.35]

250.35 Permanently Installed Generators.

A conductor that provides an effective ground-fault current path shall be installed with the supply conductors from a permanently installed generator(s) field wiring terminals to the first disconnecting mean(s), parallel gear, or transfer equipment in accordance with (A) or (B). Where a single generator set is connected to multiple transfer switches, the installation shall be arranged to prevent objectionable current in accordance with 250.6.

(A) Separately Derived System.

If the generator is installed as a separately derived system, the requirements in 250.30 shall apply.

(B) Nonseparately Derived System.

If the generator is installed as a nonseparately derived system, and overcurrent protection is not integral with the generator assembly, a supply-side bonding jumper shall be installed between the generator equipment grounding terminal and the equipment grounding terminal, bar, or bus of the disconnecting mean(s). It shall be sized in accordance with 250.102(C) based on the size of the conductors supplied by the generator.

Statement of Problem and Substantiation for Public Input

The propose changes brings clarity that many generators manufactured today are factory equipped with readily accessible disconnecting means in accordance with 445.18, and that a conductor that provides a ground fault return path shall be installed with the generator feeder conductors from the generator field wiring terminals to disconnecting means, paralleling gear, or transfer switch. A common installation practice is the installation of a single generator set to provide power to multiple buildings on a property with each building having its own electrical service. In this type of installation the generator should be installed as a separately derived system and each transfer switch shall contain a switching action in the grounded conductor to prevent the creation objectionable current paths.

Submitter Information Verification

Submitter Full Name: Brian Baughman

Organization: Generac Power Systems Inc

Street Address:

City:

State:

Zip:

Submittal Date: Thu Feb 16 15:29:31 EST 2017

Public Input No. 3352-NFPA 70-2017 [Section No. 250.35(B)]

(B) Nonseparately Derived System.

If the generator is installed as a nonseparately derived system, and overcurrent protection is not integral with the generator assembly, a supply-side bonding jumper shall be installed between the generator equipment grounding terminal and the equipment grounding terminal, bar, or bus of the disconnecting mean(s). It shall be sized in accordance with 250.102(C) based on the size of the conductors supplied by the generator.

<u>Where the generator is supplying any of the following, the system shall be installed as a separately derived system, the requirements in 250.30 shall apply</u>

<u>(1) 3 wires loads and no grounded conductor</u>

<u>(2) 4 wires load that during the generator running would have insufficient grounded conductor to safely carry the generator's fault current</u>

Statement of Problem and Substantiation for Public Input

The two proposals are to address a fundamental problem with nonseparately derived system that does not facilitate a safe disconnection of the generator power.
(1) With 3 wires load, during the generator's operation, a fault current would not have a path back to the neutral point at the generator to close the short circuit and then trip the overcurrent protection device.
(2) When the majority of loads are 3 wires, no grounded conductors, except for one or two small loads, a fault current during generator's operation will travel down stream to the main service switch(es) and back thru the main bonding jumper at service equipment to the undersized grounded conductor (the only 4 wire load) to the standby generator's neutral point, such arrangement will cause such grounded conductor to overheat and probably melt.

For the above reasons, a nonseparately derived system grounding arrangement does not work, and the overcurrent protection devices protecting the standby system and feeder may not open under fault conditions.

Submitter Information Verification

Submitter Full Name: MATHHER ABBASSI
Organization: NYC DEPARTMENT OF BUILDINGS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 05 16:16:50 EDT 2017

Public Input No. 2316-NFPA 70-2017 [Section No. 250.36]

250.36 High-Impedance Grounded Neutral Systems.

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~~ , without disconnecting the main, 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 250.36(A) through (G).

(A) Location.

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

(B) Conductor Insulation and Ampacity.

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

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

(C) System Grounding Connection.

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

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

(D) Conductor Routing.

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

(E) Equipment Bonding Jumper.

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

(F) Grounding Electrode Conductor Connection Location.

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

(G) Equipment Bonding Jumper Size.

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

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

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

Statement of Problem and Substantiation for Public Input

Although implicitly stated, The main need not be disconnected as in 230.95. Adding the statement that the Main need not be isolated removes the ambiguity

Submitter Information Verification

Submitter Full Name:	Sergio Panetta
Organization:	I Gard Corp
Affilliation:	I Gard Corp
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Wed Aug 16 12:38:34 EDT 2017

Copyright Assignment

Public Input No. 2319-NFPA 70-2017 [Section No. 250.36]

250.36 High-Impedance Grounded Neutral Systems.

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.

<u>Exception:</u>

<u>(1) Equipment and wiring for supply authority metering on impedance grounded systems shall comply with</u>

<u>the requirements of the supply authority.</u>

<u>(2) Where a neutral point reference conductor is required for metering on impedance grounded systems, the</u>

<u>reference conductor shall be</u>

<u>(a) insulated for the nominal system voltage;</u>

<u>(b) isolated from ground throughout its entire length; and</u>

<u>(c) permitted to be in the same raceway or cable assembly as the consumer's service conductors and to</u>

<u>be carried through or extended from the consumer's service box to the metering equipment.</u>

High-impedance grounded neutral systems shall comply with the provisions of 250.36(A) through (G).

(A) Location.

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

(B) Conductor Insulation and Ampacity.

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

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

(C) System Grounding Connection.

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

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

(D) Conductor Routing.

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

(E) Equipment Bonding Jumper.

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

(F) Grounding Electrode Conductor Connection Location.

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

(G) Equipment Bonding Jumper Size.

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

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

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

Statement of Problem and Substantiation for Public Input

This will facilitate the revenue metering for Utilities. The same Pts can be used from Phase to neutral that are presently used from phase to ground in solidly grounded systems.

Submitter Information Verification

Submitter Full Name: Sergio Panetta
Organization: I Gard Corp
Affilliation: I Gard Corp
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 16 13:11:46 EDT 2017

Public Input No. 2973-NFPA 70-2017 [Section No. 250.36]

250.36 High-Impedance Grounded Neutral Systems.

High-impedance grounded neutral systems in which a ~~grounding~~ fault impedance device , 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 250.36(A) through (G).

(A) Location.

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

(B) Conductor Insulation and Ampacity.

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

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

(C) System Grounding Connection.

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

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

(D) ~~Conductor~~ Conducttor Routing.

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

(E) ~~Equipment~~ System Bonding Jumper.

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

(F) Grounding Electrode Conductor Connection Location.

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

(G) – ~~Equipment~~ System Bonding Jumper Size.

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

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

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

Statement of Problem and Substantiation for Public Input

Edits are not intended to change any requirement, just update the text to reflect terms that the Code user can understand.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 29 16:46:31 EDT 2017

Public Input No. 2985-NFPA 70-2017 [Section No. 250.36]

250.~~36~~ 32 High-Impedance Grounded Neutral Systems.

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 250.36(A) through (G).

(A) Location.

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

(B) Conductor Insulation and Ampacity.

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

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

(C) System Grounding Connection.

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

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

(D) Conductor Routing.

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

(E) Equipment Bonding Jumper.

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

(F) Grounding Electrode Conductor Connection Location.

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

(G) Equipment Bonding Jumper Size.

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

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

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

Statement of Problem and Substantiation for Public Input

Relocate 250.36 High-Impedance Grounding System to 250.32. I PI that there be a 250.31 for Ungrounded Separately Derived systems. With this relocation, 250.30 is for SD Grounded Systems, 250.31 applies to SD Ungrounded

Systems, 250.34 Portable Generators, 250.35 Permanently Installed Generators, and relocate 250.32 Remote Structures to 250.36.
This relocation simply places all 'like' rules together.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2986-NFPA 70-2017 [Section No. 250.32]	

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:

Submittal Date: Wed Aug 30 08:21:54 EDT 2017

Public Input No. 3430-NFPA 70-2017 [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 250.36(A) through (G).

Informational Note 1 System grounding through an impedance that is now permitted in Section 250.36 will yield an early warning signal that a power delivery component is about to fail and thereby reduce the frequency of use of the second source. The impedance grounded system will, in most cases, permit the system to deliver power until a scheduled outage thereby reducing risk to occupants. Impedance grounded systems also reduce incident energy exposure by dramatically by diverting fault current through a resistor. With incident energy reduced, maintenance may be undertaken more safely reducing the risk of more forced outages. System reliability is an essential characteristic of a power system.

Informational Note 2: For more information, see IEEE 3003.2 Recommended Practice for Equipment Grounding and Bonding in Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

This proposal is another in a series to raise the visibility of system reliability as an essential characteristic and to convey information about how short circuit, incident energy, system grounding methods and reliability are all related. This proposal responds to the recommendation made by CMP-1 during the 2017 revision cycle.

Submitter Information Verification

Submitter Full Name: Michael Anthony

Organization: Standards Michigan

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 07:46:10 EDT 2017

Public Input No. 3921-NFPA 70-2017 [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.

Informational Note: A great majority of electricca faults are of the phase-to-groundtype. High impedance grounding will insert an impedance in the ground return path and will typially limit the ground fault current to 10 amperes or below leaving insufficient fault energy and thereby helping reduce the arc flash hazard level. High imedance groundingwill not affect arc flash energy for line to line or line - to-line-to line arcs.

See Annex O NFPA 70E Standard for Electrical Safety in the Workplace for details.

High- impedance grounded neutral systems shall comply with the provisions of 250.36(A) through (G).

Statement of Problem and Substantiation for Public Input

This informational note is proposed to advise users the reduction in arc flash hazard by use of High Impedance grounded systems.

Submitter Information Verification

Submitter Full Name: Daleep Mohla
Organization: DCM Electrical Consulting Serv
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 09:16:02 EDT 2017

Public Input No. 2163-NFPA 70-2017 [Section No. 250.36(B)]

(B) Conductor Insulation and Ampacity.

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

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

This conductor shall have an insulation color that is other than White, Gray, or Green.

Statement of Problem and Substantiation for Public Input

This conductor should not be considered a 'grounded' conductor. On a 480 volt system, during ground fault conditions, this conductor will be at a voltage of 277 volts. There should never be a case where a 'grounded' conductor can be at 277 volts. Calling the conductor 'grounded' gives a false sense of security that the conductor is at ground potential. Furthermore, the conductor should not be identified as either a Grounded or Grounding conductor. It is correctly identified as a circuit conductor, or simply conductor.

In addition, this same conductor is referred to in 250.36(D) as "the conductor connecting the neutral point of the transformer or generator to the grounding impedance..."
There is no mention of the conductor being a grounded conductor.

Submitter Information Verification

Submitter Full Name:	Eric Stromberg
Organization:	Los Alamos National Laboratory
Affilliation:	Self
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Aug 13 21:14:48 EDT 2017

Public Input No. 3408-NFPA 70-2017 [Section No. 250.50]

250.50 Grounding Electrode System.

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

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

Statement of Problem and Substantiation for Public Input

Rebar in concrete slabs should always be grounded for safety. Not coordinating with the concrete construction is not an excuse to not bond the slab. Concrete can be broken, the rebar bonded, and then the concrete repaired, if necessary.

Submitter Information Verification

Submitter Full Name: Jeffrey Drummond

Organization: E&S Grounding Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Tue Sep 05 20:04:06 EDT 2017

Public Input No. 4203-NFPA 70-2017 [Section No. 250.50]

250.50 Grounding Electrode System.

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

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

Statement of Problem and Substantiation for Public Input

This is a human safety issue and will save lives and help prevent fires. Steel rebar in concrete must be bonded to the grounding system.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 16:24:50 EDT 2017

Public Input No. 4033-NFPA 70-2017 [New Section after 250.52(A)(1)]

Cathodically Protected Underground Piping

NEC Article 250.52.(A)(1) (a). Metal underground water piping incorporating active cathodic protection shall not be connected directly to the electrical grounding system. A solid state decoupler (or other engineer approved method) must be installed between active cathodically protected underground piping and the facility grounding (and grounding electrode) system.

Type your content here ...

Statement of Problem and Substantiation for Public Input

Substantiation: An active cathodic protection system injects (DC) current onto the underground water piping to prevent corrosion. Once connected to the grounding electrode system, a cathodically protected underground water piping system's current would introduce objectionable currents on the grounding electrodes and grounding system. Having a constant source of current on the grounding electrode or grounding system violates NEC article 250.6.

It's been my experience that electrical contractors refuse to use active cathodically protected underground metal pipes as grounding electrodes but there is currently not an exception in the NEC that allows them to disregard the requirements of 250.50 nor is there adequate knowledge within the industry to provide the proper isolation. Unless a means is provided to isolate the DC voltage and current from cathodic protection any metal (building steel, rebar, underground metal pipes, etc.) in close proximity to a grounding electrode conductor which is connected directly to a cathodically protected system will become a sacrificial anode and will corrode at an accelerated rate.

Solid state decouplers have ratings for AC fault current and lightning, and the ability to pass steady-state AC current. These devices outperform other technologies such as metal oxide varistors, gapped arrestors, and polarization cells. Solid state decouplers have been successfully used throughout large industrial facilities for many years.

Submitter Information Verification

Submitter Full Name: Eric Bunce

Organization: The RMH Group

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 12:41:44 EDT 2017

Public Input No. 1517-NFPA 70-2017 [Section No. 250.52(A)(1)]

~~**(1)** Metal Underground Water Pipe.~~

~~A metal underground water pipe in direct contact with the earth for 3.0 m (10 ft) or more (including any metal well casing bonded to the pipe) and electrically continuous (or made electrically continuous by bonding around insulating joints or insulating pipe) to the points of connection of the grounding electrode conductor and the bonding conductor(s) or jumper(s), if installed.~~

Statement of Problem and Substantiation for Public Input

Since the underground metal water pipe system must be supplemented by an additional electrode, then clearly the underground metal water pipe system is not a suitable electrode. Relocate to new 250.52(C).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3253-NFPA 70-2017 [New Section after 250.52(B)]	

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 01 13:30:29 EDT 2017

Public Input No. 3255-NFPA 70-2017 [Section No. 250.52(A)(2)]

(2) Metal In-ground Support Structure(s).

One or more metal in-ground support structure(s) having 400 sq. in. or more in direct contact with the earth ~~vertically~~ for ~~3~~ 1 .0 m (~~10 ft~~ 3 ft) or more, with or without concrete encasement. If multiple metal in-ground support structures are present at a building or a structure, it shall be permissible to bond only one into the grounding electrode system.

Informational Note: Metal in-ground support structures include, but are not limited to, pilings, casings, and other structural metal.

Statement of Problem and Substantiation for Public Input

The purpose of the electrode is to make direct contact to the earth is sufficient area. NEC permits two ground rods sized 1/2 x 8' (96 inches) = 151 sq. in. x 2 = 302 sq in. of direct earth contact or rebar 1/2" x 20' (240 inches) = 377 sq. in. of direct earth contact There is no logical reason to require 10' of building steel in direct contact. My PI is to require 400 sq. in. of direct earth contact. Let's have this rule make sense.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3256-NFPA 70-2017 [Section No. 250.52(A)(4)]	

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Sep 04 20:32:55 EDT 2017

Public Input No. 216-NFPA 70-2017 [Section No. 250.52(A)(3)]

(3) Concrete-Encased Electrode.

A concrete-encased electrode shall consist of at least 6.0 m (20 ft) lineal meter (foot) lenght of either (1) or (2):

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

(2) Bare copper conductor not smaller than 4 AWG.

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

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

Statement of Problem and Substantiation for Public Input

can I zig zag the rebar to achieve the 20 feet? adding the word lineal means in shall run in a straight line for 20 feet, as far as the foundation is concerned why limit this to a foundation some southern States only have slabs with no foundations, and the reference to a vertical or horizontal orientation of the concrete is not relevant.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Master electrician
Street Address:
City:
State:
Zip:
Submittal Date: Tue Feb 07 14:36:49 EST 2017

Public Input No. 3385-NFPA 70-2017 [Section No. 250.52(A)(3)]

(3) Concrete-Encased Electrode.

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

(1) One or more bare or zinc galvanized or other electrically conductive coated steel reinforcing bars or rods of not less than 13 mm (½ in.) in diameter, installed in one continuous 6.0 m (20 ft) length, or if in multiple pieces connected together by the usual steel tie wires, exothermic welding, welding, or other effective means to create a 6.0 m (20 ft) or greater length~~; or~~ . An additional rebar section that is connected to the concrete rebar electrode, in accordance with 250.8, extended from its location within the concrete to an accessible location that is not subject to corrosion shall be permitted for connection of grounding electrode conductors and bonding jumpers. The rebar extension shall not be exposed to contact with the earth without corrosion protection.

(2) Bare copper conductor not smaller than 4 AWG having a length of at least 6.0 m (20 ft).

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

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

Statement of Problem and Substantiation for Public Input

Relocate the the rule from 250.68(C)(3) to this section, and required the extending rebar to be bonded to the concrete encased electrode in accordance with 250.8.

When I had a garage recently built, I used this rule for my electrode. During the pour of concrete, the contractor removed all upright rebar to make it easier to pour, then they reinstalled the rebars (by pressing them into the concrete). There is no way for the AHJ to know if the rebar sticking out is actually part of the concrete encased electrode.
I agree that a concrete encased rebar is an excellent electrode and should be used when 'available' but let's make sure the 'extention rebar' is bonded to the concrete encased electrode with fittings specifically identified for this application, not tie wire...

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Sep 05 18:06:04 EDT 2017

Copyright Assignment

I, Mike Holt, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Mike Holt, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 4191-NFPA 70-2017 [Section No. 250.52(A)(3)]

(3) Concrete-Encased Electrode ~~.~~ <u>or Steel Rebar in Concrete Foundations</u>

A concrete-encased electrode <u>or steel rebar in concrete foundations</u> shall consist of at least 6.0 m (20 ft) of either (1) or (2):

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

(2) Bare copper conductor not smaller than 4 AWG

(3) <u>Epoxy coated or plastic coated steel rebar may not be used as an electrode. It must however be bonded to the electrical system to ensure that no hazardous differences in potential exist that could cause electrocutions to persons.</u>

(4) <u>Steel rebar in concrete shall be made electrically continous throughout the structure, weather or not it has been epoxy coated or a vapor barrier has been installed. Hand ties at 5-ft intervals or welded connections are considered acceptable</u>

(5) <u>The transition point where a copper conductor enters/exists concrete shall have a mechanical strain releif in the form of a nonmetllaic protective sleeve, ground bolting plate, or other listed device suitable for the purpose of reducing sheer-forces on the copper bonding conductor(s). See Exhibit 250.23 in the NEC Handbook.</u>

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

<u>The steel rebar in concrete SHALL be bonded to the structures grounding system, no exceptions. Concrete shall be excavated to make this mandatory connection regardless of esthetics. This connection shall occur at the following locations:</u>

(1) <u>The main service panel. A clear and direct connection from the main electrical panels grounding bar shall be made, weather or not the steel rebar is coated or there has been a vapor barrier installed.</u>

(2) <u>At the corners of the structure where structural steel building supports are installed, and at 100-ft intervals around the perimeter of the strucutre. There shall be a direct physical connection between the steel rebar in the concrete foundation and the structural building steel.</u>

(3) <u>Where expansion joints in the concrete have broken the electrical conductivity of the steel rebar in concrete, buidling steel or other listed flexible conductors may be used to make the system electrically continuous.</u>

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

Statement of Problem and Substantiation for Public Input

The concrete foundation is the primary safety mechanism for preventing electrical shock to persons. While it may sound counter-intuitive, during electrical fault scenarios or lightning strikes, ensuring that a persons feet is at the same potential as their hands will save lives. It also reduces electromagnetic interference in electronic equipment located within the structure.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 16:08:05 EDT 2017

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Public Input No. 4358-NFPA 70-2017 [Section No. 250.52(A)(3)]

(3) Concrete-Encased Electrode.

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

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

(2) Bare copper conductor not smaller than 4 AWG

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

Informational Note: Concrete installed with insulation, vapor barriers, films or similar items separating the concrete from the earth is not considered to be in “direct contact” with the earth. However, the steel reinforcing bars in concrete slabs with vapor barriers shall still be bonded to the grounding electrode system to equalize voltages and remove induced currents.

Statement of Problem and Substantiation for Public Input

1. Some engineers and electricians are unclear that bonding the rebar in concrete slabs is required. This is to clarify that steel reinforcing bars are the same as the common name, rebar.
2. Even if there is an vapor barrier, the rebar should still be bonded to the grounding system. This will help equalize voltages along the concrete slab (e.g. for step and touch potentials) and in relation to building steel, etc. Also, the currents and voltages induced in the steel rods can be removed.

Submitter Information Verification

Submitter Full Name: Jeffrey Drummond
Organization: E&S Grounding Solutions
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 08 00:01:17 EDT 2017

Public Input No. 3256-NFPA 70-2017 [Section No. 250.52(A)(4)]

(4) Ground Ring.

A ~~ground ring encircling the building or structure,~~ copper conductor not smaller than 2 AWG, having a length of fourty feet or more in direct contact with the earth~~, consisting of at least 6~~ .~~0 m (20 ft) of bare copper conductor not smaller than 2 AWG.~~

Statement of Problem and Substantiation for Public Input

The purpose of the electrode is to make direct contact to the earth is sufficient area. NEC permits two ground rods sized 1/2 x 8' (96 inches) = 151 sq. in. x 2 = 302 sq in. of direct earth contact or rebar 1/2" x 20' (240 inches) = 377 sq. in. of direct earth contact There is no logical reason to require a copper ground ring to encircle a building . My PI is to require 400 sq. in. of direct earth contact. surface area of the side of a cyliner is the circumference times the height or 3.14 x diameter x length. Note: This would require fourty feet of 2 AWG.

So any conductor larger will give more surface contact to the earth.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3255-NFPA 70-2017 [Section No. 250.52(A)(2)]	

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Sep 04 21:17:41 EDT 2017

Public Input No. 3584-NFPA 70-2017 [Section No. 250.52(A)(4)]

(4) Ground Ring.

A ground ring encircling the building or structure, in direct contact with the earth, consisting of at least 6.0 m (20 ft) of bare copper conductor not smaller than 2 AWG or 6 .0 m (20 ft) of listed ground electrode.

Statement of Problem and Substantiation for Public Input

NEC 250.52(A) allows a wide variety of ground electrode types, including a variety of materials and many unlisted types. This includes: Metal water pipe (1), metal in-ground structures (2), reinforcing steel (3), rod and pipe electrodes (5), plate electrodes (7), and other metal underground structures (8).
It seems reasonable that any listed ground electrode that can provide 6.0 m (20 ft) of length should be acceptable for a ground ring. The added stipulation that the ground electrode be listed ensures that the requirement is consistent with 250.52(A) and equivalently safe.

Submitter Information Verification

Submitter Full Name: Ward Judson

Organization: Pentair plc

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 14:15:27 EDT 2017

Public Input No. 3468-NFPA 70-2017 [Section No. 250.52(A)(5)]

(5) Rod and Pipe Electrodes.

Rod and pipe electrodes shall not be less than 2.44 m (8 ft) in length and shall consist of the following materials.

(a) Grounding electrodes of pipe or conduit shall not be smaller than metric designator 21 (trade size ¾) and, where of steel, shall have the outer surface galvanized or otherwise metal-coated for corrosion protection.

(b) Rod-type grounding electrodes of stainless steel and copper or zinc coated steel shall be at least 15.87 mm (~~5⁄8~~ 0.625 in.) ~~in~~ in diameter, unless listed.

Statement of Problem and Substantiation for Public Input

0.625 in. better defines the minimum dimension of a ground rod before listing is required. This removes a possible confusion of using the currently stated 5/8 in. as a Trade Size. Product Standard NEMA GR-1 references a Trade Size "5/8 in" for grounding rods with a minimum diameter less than 0.625 in.

Submitter Information Verification

Submitter Full Name: David Kendall

Organization: Thomas Betts Corporation

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 11:04:36 EDT 2017

Public Input No. 4207-NFPA 70-2017 [Section No. 250.52(A)(5)]

(5) Rod and Pipe Electrodes.

Rod and pipe electrodes shall not be less than 2.44 m (8 ft) in length and shall consist of the following materials.

(a) Grounding electrodes of pipe or conduit shall not be smaller than metric designator 21 (trade size ¾) and, where of steel, shall have the outer surface galvanized or otherwise metal-coated for corrosion protection.

(b) Rod-type grounding electrodes of stainless steel and copper or zinc coated steel shall be at least 15.87 mm (⅝ in.) in diameter, unless listed.

(c) <u>8-ft ground rods must be completly buried below-grade with the top of the rod below permanant moisture level in accordance with 250.53(A)(1).</u>

(d) <u>10-ft ground rods must be installed so as not extend above-grade greater than 6-inches. Complete burial below permanent moisture level per 250.53(A)(1) is prefered. Ground boxes should be considered to prevent damage to the grounding electrode conductor termination on the rod and to prevent tripping hazards.</u>

Statement of Problem and Substantiation for Public Input

If the desire is to have 8-ft of electrode in direct contact with the earth below moisture level, then an 8-ft rod must be completely buried to qualify.

Please note that a 8-ft rod has a sphere of influence that will utilize 2560 cubic feet of soil to dissipate objectionable currents, where a 10-ft ground rod has double the volume at 5000 cubic feet! You may want to consider eliminating the 8-ft rod all together and going with 10-ft.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 16:27:23 EDT 2017

Public Input No. 4157-NFPA 70-2017 [Section No. 250.52(B)]

(B) Not Permitted for Use as Grounding Electrodes.

The following systems and materials shall not be used as grounding electrodes:

(1) Metal underground gas piping systems

(2) Aluminum

(3) The structures and structural reinforcing steel described in 680.26(B)(1) and (B)(2)

(4) Water pipes conveying drinking water to custmers premises may NOT be used as grounding electrodes in accordance with AWWA regulations dated May 22, 1966, reaffirmed on January 24, 1971, revised June 14 2003, January 25, 2009 and January 19, 2014. Water pipes are to bonded in a similiar manner to gas pipes.

(5) Above-grade structural steel in accordance with 250.52(A)(2).

(6) Concrete-encased electrodes (steel rebar in concrete foundations) that has a vapor barrier or is epoxy coated, per 250.52(A)(3). Concrete-encased electrodes (steel rebar in concrete foundations) that have vapor barriers or are epoxy coated must be bonded to the grounding system in a similiar manner to gas pipes.

Informational Note: See 250.104(B) for bonding requirements of gas piping.

Statement of Problem and Substantiation for Public Input

There are numerous other items that are commonly used as electrodes, that do not qualify under the code.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 15:34:05 EDT 2017

Public Input No. 3253-NFPA 70-2017 [New Section after 250.52(B)]

(C) Metal Underground Water Pipe. Metal underground water pipe in direct contact with the earth for 3.0 m (10 ft) or more (including any metal well casing bonded to the pipe) and electrically continuous (or made electrically continuous by bonding around insulating joints or insulating pipe) shall be bonded to the grounding electrode system .

Statement of Problem and Substantiation for Public Input

The water pipe is not suitable as a grounding electrode, that's why we supplement it with additional electrode; see my PI to delete it as electrode.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1517-NFPA 70-2017 [Section No. 250.52(A)(1)]	

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 04 20:02:58 EDT 2017

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

(A) Rod, Pipe, and Plate Electrodes.

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

(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.

<u>(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.</u>

<u>(5) Plate Electrode. Plate electrodes shall be installed not less than 750 mm (30 in.) below the surface of the earth.</u>

Statement of Problem and Substantiation for Public Input

Relocate the requirements for rod and plate electrodes from 250.53(G) and (H) to (A). This allows these rules to be logically placed.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:

Submittal Date: Tue Sep 05 18:51:36 EDT 2017

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Public Input No. 4165-NFPA 70-2017 [Section No. 250.53(A)(1)]

(1) Below Permanent Moisture Level.

If practicable, rod, pipe, and plate electrodes shall be embedded below permanent moisture level. <u>Unless known or regulated, permanent moisture level is 18 inches below-grade.</u> Rod, pipe, and plate electrodes shall be free from nonconductive coatings such as paint or enamel.

Additional Proposed Changes

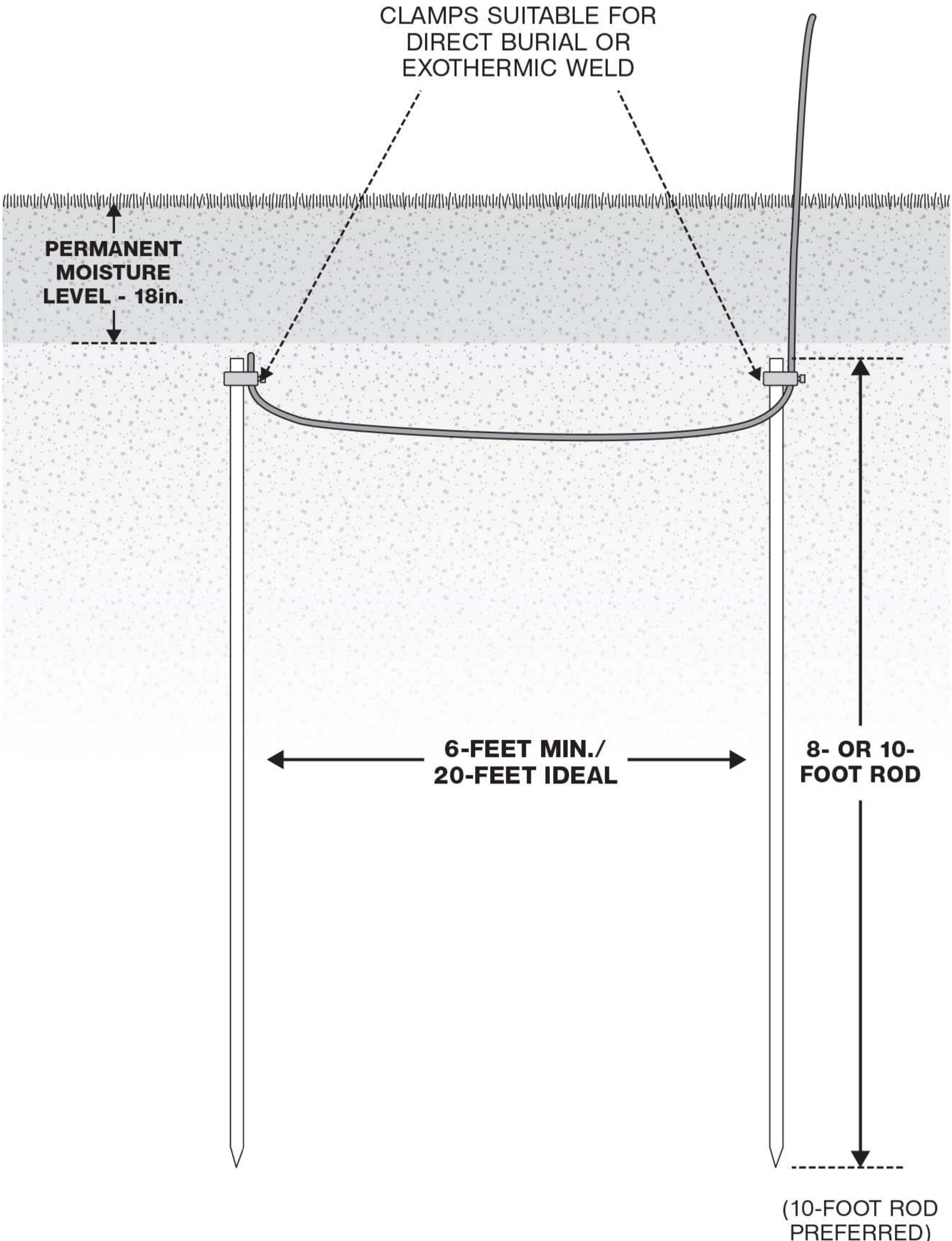
File Name	Description	Approved
250-24A_FINAL_300dpi.jpg	Ground rods below permanent moisture level	✓
250-24B_FINAL_300dpi.jpg	10-ft ground rod with 8-ft of rod below permanent moisture level	✓

Statement of Problem and Substantiation for Public Input

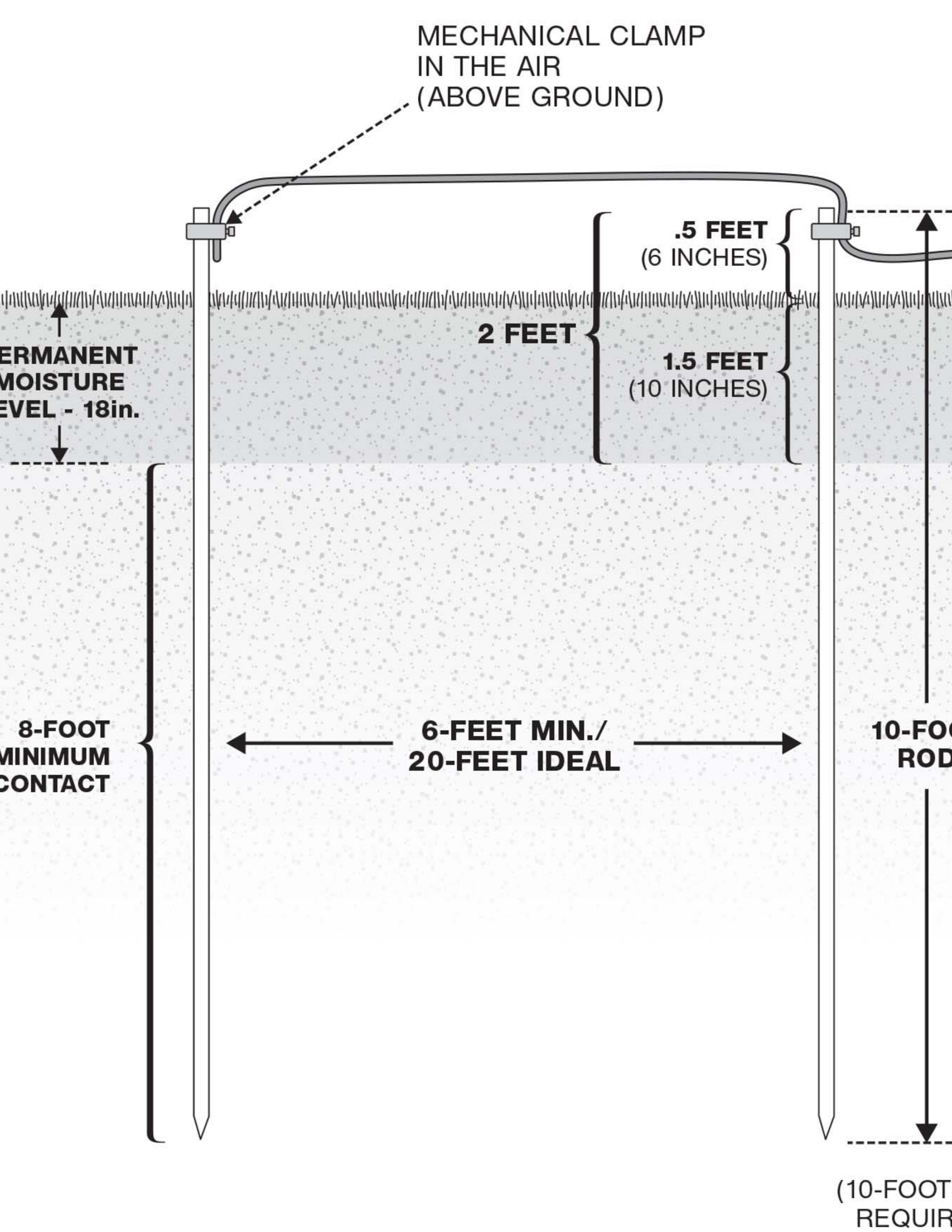
How deep is permanent moisture level? A good rule of thumb is 18 inches.

Submitter Information Verification

Submitter Full Name: David Stockin
Organization: E S Groundiing Solutions
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 15:44:05 EDT 2017



CLAMPS SUITABLE FOR DIRECT BURIAL OR EXOTHERMIC WELD
PERMANENT MOISTURE LEVEL - 18in.
6-FEET MIN./ 20-FEET IDEAL
8- OR 10-FOOT ROD
(10-FOOT ROD PREFERRED)



MECHANICAL CLAMP
IN THE AIR
(ABOVE GROUND)
.5 FEET
(6 INCHES)
2 FEET
1.5 FEET
(10 INCHES)
ERMANENT
MOISTURE
EVEL - 18in.
8-FOOT
MINIMUM
CONTACT
6-FEET MIN./
20-FEET IDEAL
10-FOO
ROD
(10-FOOT
REQUIR

Public Input No. 4353-NFPA 70-2017 [Section No. 250.53(A)(1)]

(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. The permanent moisture level shall be assumed to be 18 inches, unless other information on moisture level is known.

Statement of Problem and Substantiation for Public Input

In practice, engineers and inspectors use 18 inches as a default, as the permanent moisture level is rarely available.

Submitter Information Verification

Submitter Full Name: Jeffrey Drummond

Organization: E&S Grounding Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 23:47:58 EDT 2017

Public Input No. 4355-NFPA 70-2017 [Section No. 250.53(A)(3)]

(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.~~ 6 m (10 ft) apart.

Exception: If it is not possible to space electrodes 6 m (10 ft) apart, then a spacing as close of 1.8 m (6 ft) shall be allowed.

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

Statement of Problem and Substantiation for Public Input

For a standard 10 foot grounding rod, the sphere of influence is 10 feet radius around the ground rod. For maximum effectiveness, 20-foot spacing will keep the 2 rods from interfering with each other and minimize resistance to ground for the 2-rod system.

If there is truly no space for 20 feet between rods, then 6 feet can be allowed as an exemption. However, 20-foot spacing should be the default.

Submitter Information Verification

Submitter Full Name: Jeffrey Drummond
Organization: E&S Grounding Solutions
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 23:51:16 EDT 2017

Public Input No. 4225-NFPA 70-2017 [Section No. 250.53(B)]

(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 2 times the lenght of the electrode. For 8-ft long electrodes a 16-ft spacing is required. For 10-ft long electrodes a 20-ft spacing is required. If approved by the local regulatory authority, an exemption for 1.83 m (6 ft) from any other electrode of another grounding system can be made . Two or more grounding electrodes that are bonded together shall be considered a single grounding electrode system.

Statement of Problem and Substantiation for Public Input

The 6-ft rule violates the sphere-of-influence and should not be the standard, but used only as an exception.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 16:46:31 EDT 2017

Public Input No. 2825-NFPA 70-2017 [Section No. 250.53(C)]

(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.<u>A bonding conductor connected to a ground ring shall not be larger than the ground ring grounding electrode conductor. A bonding conductor connected to a concrete-encased grounding electrode shall not be larger than 4 AWG copper. A bonding conductor connected to a rod, pipe or plate grounding electrode shall not be larger than 6 AWG copper.</u>

Statement of Problem and Substantiation for Public Input

Since the size of the grounding electrode conductor to rod, pipe and plate grounding electrodes is permitted to be 6 AWG, the bonding conductor used to create the grounding electrode systems and connected to rod, pipe or plate grounding electrodes should not be permitted to be larger than the minimum size grounding electrode conductor or 6 AWG.

Since the size of the grounding electrode conductor to concrete-encased grounding electrodes is permitted to be 4 AWG, the bonding conductor used to create the grounding electrode systems and connected to concrete-encased grounding electrodes should not be permitted to be larger than the minimum size grounding electrode conductor or 4 AWG.

Since the size of the grounding electrode conductor to a ground-ring grounding electrode is permitted to be sized from Table 250-66 and may be as small as 8 AWG, the bonding conductor used to create the grounding electrode system and connected a ground-ring grounding electrode should not be permitted to be larger than the size of the grounding electrode conductor to the ground-ring.

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Sun Aug 27 19:13:20 EDT 2017

Public Input No. 1518-NFPA 70-2017 [Section No. 250.53(D)]

~~**(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.*~~

Statement of Problem and Substantiation for Public Input

Since the underground metal water pipe system is not suitable as an electrode (because it has to be supplemented) and I have submitted a PI to remove 250.53(A); if that succeeds then this rule should be deleted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1517-NFPA 70-2017 [Section No. 250.52(A)(1)]	

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 01 13:32:54 EDT 2017

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Public Input No. 3392-NFPA 70-2017 [Section No. 250.53(D)]

~~**(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.*~~

Statement of Problem and Substantiation for Public Input

Metal underground water pipe by it's self is not a suitable electrode, so delete this rule and see new 250.52(C) rule I propose to 'bond' water pipe to grounding electrode system.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3253-NFPA 70-2017 [New Section after 250.52(B)]	

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Sep 05 18:35:16 EDT 2017

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Public Input No. 4166-NFPA 70-2017 [Section No. 250.53(D)]

(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.~~ <u>Metal undergound water pipe may not be used as an electrode in accordance with AWWA regulations.</u>

Statement of Problem and Substantiation for Public Input

It has been illegal under national water code since 1966 to use water pipes as an electrode. The code must be made in compliance with other national regulatory agencies. Please see AWWA regulations from May 22, 1966, reaffirmed Jan. 24, 1971, revised June 14, 2003 and January 25, 2009. Revised Jan. 19, 2014.

"The American Water Works Association (AWWA) opposes the grounding of electric systems to pipe systems conveying drinking water to a customer’s premises.

AWWA opposes the systematic interchange of stray electric current between electrical distribution systems and water distribution systems, as well as the use of the water pipe system as an essential part of any electrical system.

AWWA does not object, however, to the connection of all interior piping of a building to the electrical service neutral and to a separate grounding electrode, provided that such interior pipe systems and grounding connections are electrically isolated from the water supply pipe system."

Submitter Information Verification

Submitter Full Name: David Stockin
Organization: E S Groundiing Solutions
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 15:46:02 EDT 2017

Copyright Assignment

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

(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 <u>No. 1</u> : 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.

<u>Exception No. 2: A supplemental grounding electrode is not required if the metal undergrounding water pipe grounding electrode is connected to one or more of the grounding electrodes described in 250.52(A)(2) through (A)(4).</u>

Statement of Problem and Substantiation for Public Input

When the underground metal water pipe grounding electrode is connected to one or more of the grounding electrodes described in 250.52(A)(2) through (A)(4), it becomes a part of the grounding electrode system that is required in 250.50. As a result, there is no need for an additional supplemental grounding electrode.
The rules for supplementing the underground metal water pipe should only be required if one of what previously were referred to as made electrodes are used.

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Tue Jul 25 23:58:53 EDT 2017

Public Input No. 4172-NFPA 70-2017 [Section No. 250.53(F)]

(F) Ground Ring.

The ground ring is the single best grounding mechanism available. It is the prefered grounding mechanism for all strucutres and should be highly considered for all new installations, especially those structures in lightning prone areas. Ground rings are mandatory for all installations with voltages exceeding 1000V, telecommunication and computer server systems.

(1) The ground ring shall be installed not less than 750 mm (30 in.) below the surface of the earth and located 3 feet outside of the perimeter of the strucutre .

(2) The ground ring is to be bonded to the structural steel and/or steel rebar in the concrete foundation (with or without vapor barrier or epoxy coated steels) at each corner of the structure.

(3) A direct copper connection from the main service panel to the ground ring is required.

(4) Down conductors from Lightning Protection Systems shall be directly connected to the ground ring in accordance with 250.106, 250.4(A)(1), 250.4(B)(1), NFPA 780 4.14, and UL 96a Section 10.4.

(5) The ground ring shall have ground rods installed at corners and at 100-ft intervals.

(6) CATV systems may bond directly to the ground ring in accordance with 250.94, 820, 820.100, 820.100(A)(4), 820.100(B)(1), and 800.100(B)(2). No additional grounding electrodes are required.

(7) Telco systems may bond directly to the ground ring in accordance with 250.94 and 800. No additional grounding electrodes are required.

(8) Fence grounding systems, when required, may be bonded directly to the ground ring in accordance with 250.190 and 250.194.

Statement of Problem and Substantiation for Public Input

When a structure has a vapor barrier and the water pipe has an electrical isolation device (mandatory since 1966), all that is left for grounding are ground rods. The ground ring should be promoted to mandatory levels. It is the best safety mechanism we know of, and should be mandatory in lightning prone areas, as they will need it to bond down conductors. It is also great for reducing electromagnetic disturbances.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 15:50:30 EDT 2017

Public Input No. 4232-NFPA 70-2017 [Section No. 250.53(G)]

(G) 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~~ . 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.~~ rod electrode is not allowed and a 20-ft long bare copper wire must be installed in accordance with 250.52(A)(4) with a ground plate termination in accordance with 250.52(A)(7). 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.

Statement of Problem and Substantiation for Public Input

How can a single horizontal 8-ft rod be acceptable in one location of the code, where 20-ft of horizontal electrode is required in another? The sphere of influence demands that horizontal electrodes be at least twice as long as vertical ones.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 16:51:15 EDT 2017

Public Input No. 4221-NFPA 70-2017 [Section No. 250.53(H)]

(H) Plate Electrode.

Plate electrodes may only be used in conjunction with 20-ft of bare copper conductor in accordance with 250.53(A)(4). Typically, ground plates are installed at the end of the conductor as a termination device for the conductor. Plate electrodes shall be installed not less than 750 mm (30 in.) below the surface of the earth.

Statement of Problem and Substantiation for Public Input

Plate electrodes by themselves are not sufficient. They should only be used at the end of a bare copper wire to provide a termination point.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 16:42:06 EDT 2017

Public Input No. 4240-NFPA 70-2017 [Section No. 250.58]

250.58 Common Grounding Electrode.

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

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

A separatly installed grounding bar may be used to facilitate mandatory connections. The circular mils required under 250.66 must be maintained from the main service panel, to the grounding bar, and down to the electrodes. This ground bar may be used to facilitate the bonding and grounding requirements as found under:

(1) 250.52(A)

(2) 250.53(D)

(3) 250.68(C)

(4) 250.104(A)

(5) 250.104

(6) 250.104(D)(1)

(7) 250.106

(8) 250.94

(9) 830

(10) 840

(11) 250.104(B)

(12) 250.190(A)

(13) 250.194

(14) 250.53(A)(3)

(15) 250.52(A)(5)

Additional Proposed Changes

File Name	Description	Approved
Key_Articles_of_the_Code.pdf	An illustration of the the required grounding and bonding under the code.	✓

Statement of Problem and Substantiation for Public Input

There are dozens of required bonding and grounding connections required under the code. Water pipe and the grounding terminal inside an electrical enclosure are often not enough.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

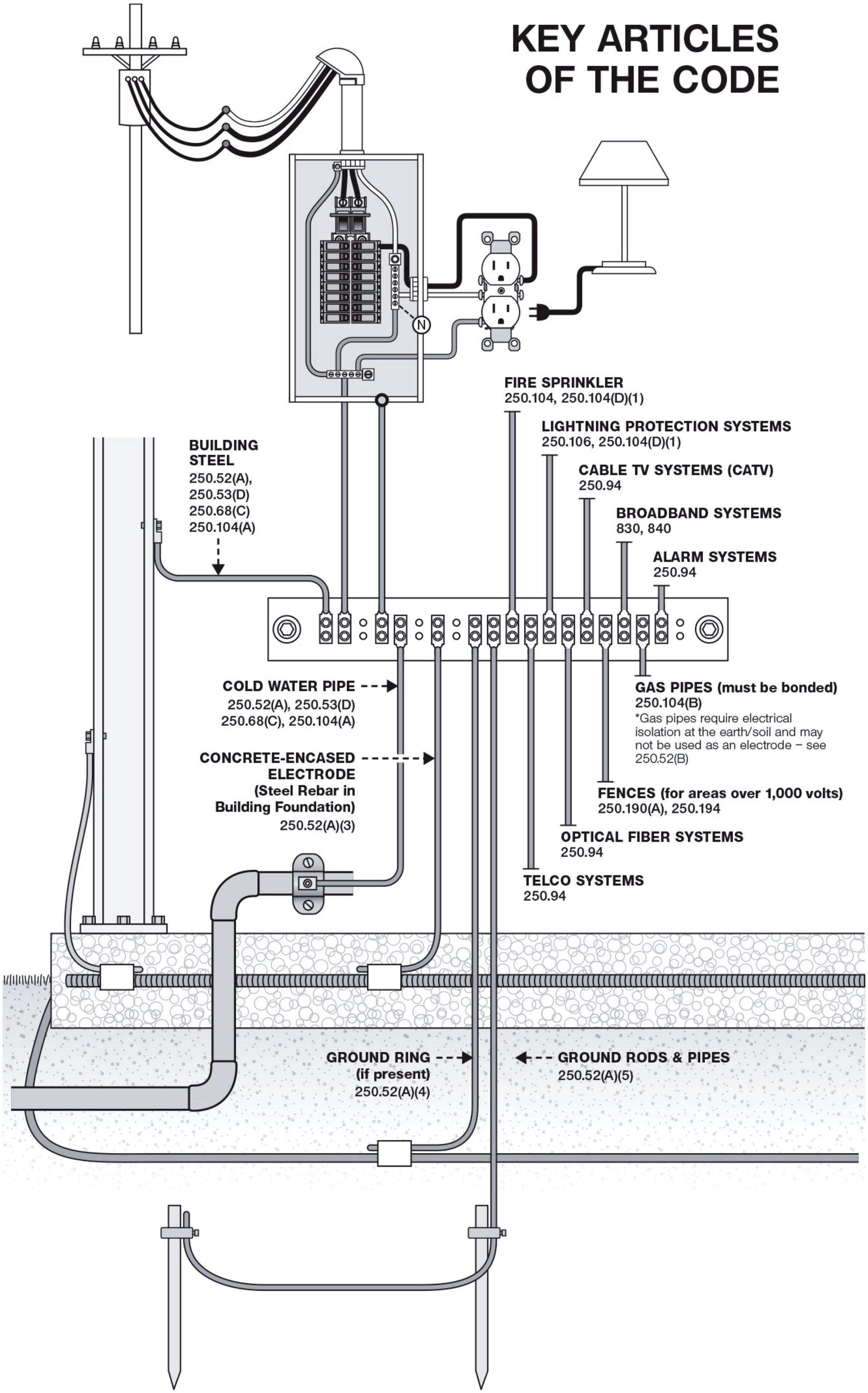
Submittal Date: Thu Sep 07 16:57:58 EDT 2017

Copyright Assignment

I, David Stockin, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am David Stockin, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

KEY ARTICLES OF THE CODE



Public Input No. 2434-NFPA 70-2017 [Section No. 250.64 [Excluding any Sub-Sections]]

Grounding electrode conductors at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system shall be installed as specified in 250.64(A) through (F). <u>This grounding electrode shall be located at least (20 ft) from the equipotential bonding grid of a permanently installed pool, as required by 680.26(A) thru (C), or in agricultural building as required in 547.10</u>

Additional Proposed Changes

File Name	Description	Approved
8-8-17_003.JPG	pool house service	✓
8-8-17_002.JPG	pool house	✓

Statement of Problem and Substantiation for Public Input

Installing a grounding electrode for a service or remote building closer than 20 from the pool equipotential bonding grid(680.26) I would consider very dangerous. leaving 20 feet from the grid would give a larger safety allowance for the fault current to travel. Also this requirement would apply to section 547.10 for agriculture building.

Submitter Information Verification

Submitter Full Name: John Plourde
Organization: JP ELECTRICAL ENTERPRISES
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 18 09:02:18 EDT 2017


SIEMENS

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

(A) Aluminum or Copper-Clad Aluminum Conductors.

Bare aluminum or copper-clad aluminum grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to ~~corrosive conditions~~ conditions corrosive to aluminum or copper-clad aluminum . Where used outside of a building , structure or enclosure, aluminum or copper-clad aluminum grounding electrode conductors shall not be terminated within 450 mm (18 in.) of ~~the~~ exposed earth.

Statement of Problem and Substantiation for Public Input

This language clarifies the termination restrictions for aluminum or copper-clad aluminum conductors under the conditions included in the text. Connections made within enclosures and equipment suitable for installation in outdoor locations do not require additional termination restrictions, and the existing language is sometimes interpreted in a way that restricts acceptable terminations in listed equipment such as switchgear.

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submittal Date: Sat Aug 26 13:55:23 EDT 2017

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

(A) – **Aluminum or Copper-Clad Aluminum Conductors.**

~~Bare~~

Grounding electrode conductors of bare, covered, or insulated aluminum or copper-clad aluminum

~~grounding electrode~~

shall comply with the following:

(1) Bare conductors shall not be

~~used where~~

installed where subject to corrosive conditions or be installed in direct contact with masonry or the earth

~~or where subject to corrosive conditions. Where used outside, aluminum~~

.

(2) Terminations made within listed enclosures identified for outdoor use shall be permitted within 450 mm (18 in.) of the earth.

(3) Aluminum or copper-clad aluminum

~~grounding electrode~~

conductors external to buildings or enclosures shall not be terminated within

~~450 mm~~

450 mm (

~~18 in~~

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.

Statement of Problem and Substantiation for Public Input

This public input is a continuation of SR 1212 from the 2017 NEC cycle that the panel agreed to but had to ballot negative due to a term error discovered at the time of balloting. The proposed text in this public input removed the term "or covered" in list item 1 that is incorrect for this condition. The section is restructured into a list format for clarity to show the three options and requirements. The interior of outdoor rated equipment is considered a dry location in accordance with the applicable UL and IEEE standards, therefore aluminum terminations within these rated enclosures are not subject to exposure to the earth and related corrosive conditions. AHJs are rejecting installations in this type of equipment, even when there is a concrete pad, where there is not a problem. In addition, the allowance is provided for aluminum connections to be made outdoors or or outside rated enclosures as long as it is done with a listed sealed wiring connector. There are standards for this listing and while none exist at this time, this allowance will permit manufacturers to develop and list connectors as the market demands. This is a permissive allowance and not a requirement so the lack of having a product on the market at this time is not substantiation to not permit this allowance.

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: Cdcmello Consulting Llc
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 27 19:19:05 EDT 2017

Copyright Assignment

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

(A) Aluminum or Copper-Clad Aluminum Conductors.

~~Bare~~
Grounding electrode conductors of bare, covered, or insulated aluminum or copper-clad aluminum

~~grounding electrode~~
shall comply with the following:

(1) Bare conductors shall not be

~~used where~~
installed where subject to corrosive conditions or be installed in direct contact with masonry or the earth

~~or where subject to corrosive conditions. Where used outside, aluminum~~

.

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

(3) Aluminum or copper-clad aluminum

~~grounding electrode~~
conductors external to buildings or enclosures shall not be terminated within

~~450 mm~~
450 mm (

~~18 in~~
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.

Statement of Problem and Substantiation for Public Input

This public input is a continuation of SR 1212 from the 2017 NEC cycle that the panel agreed to but had to ballot negative due to a term error discovered at the time of balloting. The proposed text in this public input removed the term "or covered" in list item 1 that is incorrect for this condition. The section is restructured into a list format for clarity to show the three options and requirements. AHJs in some parts of the country have rejected installations of aluminum conductors where terminated on aluminum equipment grounding busbars because the termination was less than 18 inches above the concrete slab or pad at the bottom of the equipment. The additional text in list item (2) is to clarify that a concrete bottom on open bottom equipment is not to be considered as earth for application of these requirements. The interior of outdoor rated equipment is considered a dry location in accordance with the applicable UL and IEEE standards, therefore aluminum terminations within these rated enclosures are not subject to exposure to the earth and related corrosive conditions. In addition, the allowance is provided for aluminum connections to be made outdoors or or outside rated enclosures as long as it is done with a listed sealed wiring connector. There are standards for this listing and while none exist at this time, this allowance will permit manufacturers to develop and list connectors as the market demands. This is a permissive allowance and not a requirement so the lack of having a product on the market at this time is not substantiation to not permit this allowance.

Submitter Information Verification

Submitter Full Name:	Charles Mello
Organization:	Cdcmello Consulting Llc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 28 13:10:27 EDT 2017

Copyright Assignment

I, Charles Mello, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Charles Mello, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

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

(A) Aluminum or Copper-Clad Aluminum Conductors.

Bare aluminum or copper-clad aluminum grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside of a building or a listed type 3R , 4, or 4x enclosure, aluminum or copper-clad aluminum grounding electrode conductors shall not be terminated within 450 mm (18 in.) of the earth unless the termination is listed as a sealed wire connector system .

Statement of Problem and Substantiation for Public Input

This revision makes it clear that aluminum conductors are permitted to be terminated inside listed gear on a ground bar that is less than 18" above the concrete pad as long as the gear is listed and suitable for outdoor locations and the connection is inside the gear. It also is allowing the sealed wire connectors to be used where aluminum is terminated in outdoor locations at a height of less than 18" above the earth. The added text was originally provided for the 2017 edition but due to transcription errors in 1st draft ballot the code making panel could not accept what was in the ballot. In the second draft, the corrected wording was provided, but new text was added without providing opportunity for public comment, so it also failed ballot. This revisions brings back what the code making panel had intended.

Submitter Information Verification

Submitter Full Name: Christine Porter

Organization: Intertek Testing Services

Street Address:

City:

State:

Zip:

Submittal Date: Tue Mar 28 11:08:43 EDT 2017

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

(A) Aluminum or Copper-Clad Aluminum Conductors.

Bare ~~aluminum~~ aluminum or copper-clad aluminum grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum grounding electrode conductors shall not be terminated within 450 mm (18 in.) of the earth.

Additional Proposed Changes

File Name	Description	Approved
2020_Proposals.docx		✓

Statement of Problem and Substantiation for Public Input

Add the attached language to the existing parent paragraph to section 250.64(A) the rest is the list format which did not pass the second revision ballot for 2017 as a result of inadequate public review. The list format has merit but needed a complete cycle of review to comply with the adoption standards. This language in addition to providing a clear orderly arrangement of the rules, addresses two other important issues first it recognizes that outdoor switchgear etc (SUSE listed) may have its grounded circuit bus located within 18" , of grade but it is listed equipment and the points of termination are located within the enclosures (see list item 2 permitting termination of Al conductors). Second list item 3 provides a pathway for aluminum termination out side the mentioned gear where the splice or termination is a listed as a sealed wire-connector system and listed as grounding and bonding equipment.

Submitter Information Verification

Submitter Full Name: Charles Palmieri

Organization: Town of Norwell

Street Address:

City:

State:

Zip:

Submittal Date: Wed Jun 07 09:48:04 EDT 2017

690.47(B) last sentence references 250.52 (A)(2) regarding grounding electrode use of the building metallic frame reference should be to 250.68(C)(2).

(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 or covered conductors shall not be installed where subject to corrosive conditions or be installed in direct contact with masonry or the earth.

(2) Terminations made within listed enclosures identified for outdoor use shall be permitted within 450 mm (18 in.) of the 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 and listed as grounding and bonding equipment.

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

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), rigid polyvinyl chloride conduit (Schedule 80 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.

Statement of Problem and Substantiation for Public Input

I would like to suggest that section 250.64(B)(2) and (3) are revised to specify schedule 80 PVC as an acceptable wiring method for protecting the grounding electrode conductor, where subject to physical damage. This would be in alignment with the UL White Book Guide Information for Electrical Equipment. On page 147 of the 2015/2016 version of the UL White Book, it states that schedule 40 PVC is not listed for areas subject to physical damage. Schedule 80 PVC is listed for being subject to physical damage. A similar example elsewhere in the NEC can be found in section 334.15(B), where type NM cable must be protected from physical damage using schedule 80 PVC, if PVC is the chosen method to protect the NM cable.

Submitter Information Verification

Submitter Full Name: Ryan Andrew

Organization: AJEATT

Street Address:

City:

State:

Zip:

Submittal Date: Mon Mar 20 15:25:48 EDT 2017

Public Input No. 2091-NFPA 70-2017 [Section No. 250.64(C)]

(C) Continuous.

Except as provided in 250.30(A)(5) and (A)(6), 250.30(B)(1), and 250.68(C), grounding electrode conductor(s) shall be installed in one continuous length without a splice or joint. If necessary, splices or connections shall be made as permitted in (1) through (4):

(1) Splicing of the wire-type grounding electrode conductor shall be permitted only by irreversible compression-type connectors listed as grounding and bonding equipment ~~or by the exothermic welding process~~

(2) Exothermic welding or a connector listed as grounding and bonding equipment .

(3) Sections of busbars shall be permitted to be connected together to form a grounding electrode conductor.

(4) Bolted, riveted, or welded connections of structural metal frames of buildings or structures.

(5) Threaded, welded, brazed, soldered or bolted-flange connections of metal water piping.

Statement of Problem and Substantiation for Public Input

Revisions to place exothermic welding on a separate line and add text so that it coordinate with 250.64(D)(1)(2) and 250.64(D)(3). Consistency of the Code is alwasy best for the Code user to ensure proper application.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 10 10:40:49 EDT 2017

Public Input No. 2125-NFPA 70-2017 [Section No. 250.64(D)(1)]

(1) Common Grounding Electrode Conductor and Taps.

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

A grounding electrode conductor tap shall extend to the inside of each disconnecting means enclosure. The grounding electrode conductor taps shall be sized in accordance with 250.66 for the largest service-entrance or feeder conductor serving the individual enclosure.

Exception to (D)(1): A common grounding electrode conductor that is connected to any grounding electrode type specified in 250.66(A), (B), or (C) shall not be required to be larger than the maximum size grounding electrode conductors specified in 250.66(A), (B) or (C) where it meets the specific requirements in each of those sections. The grounding electrode conductor taps COVERED IN (D)(1) shall not be required to be larger than the common grounding electrode conductor sized according to this exception.

The tap conductors shall be connected to the common grounding electrode conductor by one of the following methods in such a manner that the common grounding electrode conductor remains without a splice or joint:

(1) Exothermic welding.

(2) Connectors listed as grounding and bonding equipment.

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

Statement of Problem and Substantiation for Public Input

There are no current allowances to recognize the grounding electrode conductor sizing relief offered in 250.66(A),(B), or (C) for a common grounding electrode conductor and grounding electrode conductor tap, where the grounding electrodes are only the types specified in 250.66(A),(B), or (C) . Even though the Code does not restrict the use of these subdivisions, it is currently silent on the issue. The additional text will help clarify.

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz
Organization: NECA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 11 09:46:13 EDT 2017

Copyright Assignment

Public Input No. 2891-NFPA 70-2017 [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.

Statement of Problem and Substantiation for Public Input

Cable armor is neither a raceway or enclosure as defined in NEC. Section 250.64(E)(1) to set the requirements for the following parts references only raceways and enclosures. Yet, 250.64(E)(3) provides a requirement for sizing a bonding jumper for a grounding electrode conductor encased in cable armor. The revised text adds clarity to the section that cable armor is to be considered along with raceways and enclosures.

Submitter Information Verification

Submitter Full Name:	Charles Mello
Organization:	Cdcmello Consulting Llc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 28 16:38:57 EDT 2017

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

(3) Size.

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

Additional Proposed Changes

File Name	Description	Approved
250.64_E_3_.JPG	raceway with multiple GEC	

Statement of Problem and Substantiation for Public Input

There present wording does not specifically address installations where more than one GEC is installed in a raceway. How do we size the bonding jumper in this case? Do we add the CM area of all of the installed GEC's to determine the size of the bonding jumper? Do we size the bonding jumper on the average size of the GEC? Do we need to install the same amount of bonding jumpers as GEC that are installed in the raceway? Do we size the bonding jumper on the largest installed GEC?. This revision will make it clear that the bonding jumper size will be determined by the one largest GEC installed in the raceway.

Submitter Information Verification

Submitter Full Name: Russ Leblanc

Organization: Leblanc Consulting Services

Street Address:

City:

State:

Zip:

Submittal Date: Sat Apr 22 09:02:54 EDT 2017

Public Input No. 742-NFPA 70-2017 [Section No. 250.64(F)]

(F) Installation to Electrode(s).

Grounding electrode conductor(s) and bonding jumpers interconnecting grounding electrodes shall be installed in accordance with (1), (2), or (3). The grounding electrode conductor shall be sized for the largest grounding electrode conductor required among all the electrodes connected to it.

(1) The grounding electrode conductor shall be permitted to be run to any convenient grounding electrode available in the grounding electrode system where the other electrode(s), if any, is connected by bonding jumpers that are installed in accordance with 250.53(C).

(2) One or more Grounding electrode conductor(s) shall be permitted to be run to one or more grounding electrode(s) ~~individually~~ to create an interconnected grounding electrode system .

(3) Bonding jumper(s) from grounding electrode(s) shall be permitted to be connected to an aluminum or copper busbar not less than 6 mm thick × 50 mm wide (¼ in. thick × 2 in wide.) and of sufficient length to accommodate the number of terminations necessary for the installation. The busbar shall be securely fastened and shall be installed in an accessible location. Connections shall be made by a listed connector or by the exothermic welding process. The grounding electrode conductor shall be permitted to be run to the busbar. Where aluminum busbars are used, the installation shall comply with 250.64(A).

Statement of Problem and Substantiation for Public Input

I believe with the word "individually" at the end of the existing text, it is unclear what the intention is. What's individual? The electrodes or the run? Are we saying we will permit a single GEC to be run to multiple individual electrodes, or are we saying we will permit multiple GEC's to be run individually to multiple electrodes. I think we're saying both. So I propose removing the word individual and describing that we permit one or more GEC's to run to one or more electrodes.

What's confusing to me is whether 250-64F is saying we must name one conductor as the GEC and then describe all the others as bonds. If that's the case, then my suggested language probably adds to the confusion by describing all the interconnections as GEC's.
And if that is the case, then rather than deleting my recommended verbiage, I'd recommend we get rid of the word "bond" from Part III, and just consistently call all the interconnecting conductors as GEC's as well since they are sized the same. (and changing Supplemental Bond to Supplemental Ground... and while we're at it just delete 250.104D since I just take the exceptions all the time anyway.)
But for now, I'd be happing knowing what the real intent of 250-64F2 is and whether my verbiage matches the committee's intent or not.

Thanks,
Rich

Submitter Information Verification

Submitter Full Name:	Rich Gutowski
Organization:	Dennis Group
Affilliation:	self
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue May 16 19:59:49 EDT 2017

Copyright Assignment

I, Rich Gutowski, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Rich Gutowski, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 1858-NFPA 70-2017 [Section No. 250.66]

250.66 Size of Alternating-Current Grounding Electrode Conductor.

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

Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

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

Notes:

1. If multiple sets of service-entrance conductors connect directly to a service drop, set of overhead service conductors, set of underground service conductors, or service lateral, the equivalent size of the largest service-entrance conductor shall be determined by the largest sum of the areas of the corresponding conductors of each set.

2. Where there are no service-entrance conductors, the grounding electrode conductor size shall be determined by the equivalent size of the largest service-entrance conductor required for the load to be served.

[a]This table also applies to the derived conductors of separately derived ac systems.

[b]See installation restrictions in 250.64(A).

(A) Connections to a Rod, Pipe, or Plate Electrode(s).

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

(B) Connections to Concrete-Encased Electrodes.

If the grounding electrode conductor or bonding jumper connected to a single or multiple concrete-encased electrode(s), as described in 250.52(A)(3), does not extend on to other types of electrodes that require a larger size of conductor, the grounding electrode conductor shall not be required to be larger than 4 AWG copper wire.

(C) Connections to Ground Rings.

If the grounding electrode conductor or bonding jumper connected to a ground ring, as described in 250.52(A)(4), does not extend on to other types of electrodes that require a larger size of conductor, the grounding electrode conductor shall not be required to be larger than the conductor used for the ground ring.

(D) Other Electrodes. For all other electrodes, the grounding electrode conductor and bonding jumpers shall be sized in accordance with Table 250.66.

Statement of Problem and Substantiation for Public Input

Table 250.66 only applies if the conditions contained (A), (B), or (C) is not applicable. Have the Table contained in (D) All Other Electodes, this will make the sizing requirements clearer.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 15:11:00 EDT 2017

Public Input No. 1057-NFPA 70-2017 [Section No. 250.66(A)]

(A) Connections to a Rod, Pipe, or Plate Electrode(s).

If the grounding electrode conductor or bonding jumper connected to a single or multiple rod, pipe, or plate electrode(s), or any combination thereof, as described in 250.52(A)(5) or (A)(7), does not extend on to other types of electrodes that require a larger size conductor, the grounding electrode conductor shall not be required to be larger than 6 AWG copper wire or 4 AWG aluminum wire when installed as required by 250 .64(B)

Statement of Problem and Substantiation for Public Input

Contractors frequently lay the grounding electrode conductor in the footer drains and they are often damaged by construction. Emphasis needs to be placed upon securing as a form of protection.

Submitter Information Verification

Submitter Full Name: Jack Jamison

Organization: Miller Engineering Inc

Affilliation: IAEI

Street Address:

City:

State:

Zip:

Submittal Date: Wed Jun 21 10:12:53 EDT 2017

Public Input No. 1860-NFPA 70-2017 [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 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 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.~~

Statement of Problem and Substantiation for Public Input

Relocate this text to 250.52(A)(3), so it's placed where the other similar requirements apply.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3385-NFPA 70-2017 [Section No. 250.52(A)(3)]	

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 15:16:31 EDT 2017

Copyright Assignment

I, Mike Holt, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Mike Holt, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 3730-NFPA 70-2017 [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 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 in accordance with all the following:

? (a) The additional rebar section shall be continuous with the grounding electrode rebar or shall be connected to the grounding electrode rebar with approved overlap 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 electrodes of the grounding electrode system.

Statement of Problem and Substantiation for Public Input

The added text now has three provisions that need to be identified in list format for usability and to aid in enforcement by the AHJ. Within the main requirement adding “foundation or footing” clarifies that the rebar extension cannot just be connected to any rebar, but must be connected to the rebar that is the grounding electrode.

The new list item (a) provides that the rebar that is extended for connection outside the concrete foundation or footing to the wire type grounding electrode conductor is either continuous (bent from the horizontal base to vertically exposes above the foundation or footing) or if a separate piece is installed, as is most commonly done, have the proper overlap as set by the building code and be attached with the usual steel tie wires, exothermic welding, welding or other means approved by the AHJ. This is to prevent an installation where the additional rebar section is only connected at a crossing perpendicular to the rebar grounding electrode with contact just being the diameter of the rebar.

The new list item (c) is to clarify that the rebar system in a footing or foundation is not suitable as the conductor to interconnect other grounding electrodes. Many questions have come up in larger installations where rebar sections were stubbed up and the rebar was being used as the conductor to interconnect electrode such as metallic water to structural steel or to be the connection means of multiple services to meet 250.58. This interconnection could require 3/0 copper or 250 kcmill aluminum and No. 4 or ½ inch rebar has not been demonstrated to have equivalency to these size conductors. There has never been any evidence submitted to support the rebar being used as a conductor for this purpose. The confusion arises because of where this section was placed in the Code along with metallic water that can be used to interconnect electrodes where used within the first five feet or beyond under the exception as well as structural metal that is permitted to be used to interconnect various grounding electrodes. This location implies that rebar that might encircle a building or structure is also suitable to be used as a conductor to interconnect various electrodes. A better location might be in 250.53 and be made as part of the concrete encased electrode installation requirements.

Submitter Information Verification

Submitter Full Name: Charles Mello

Organization: Cdcmello Consulting Llc

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 18:48:20 EDT 2017

Public Input No. 4168-NFPA 70-2017 [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). Where interior metal water piping is used for interconnection of electrodes, at least one electrode, other than the underground metal water piping, shall be bonded directly to the grounding electrode conductor, grounded service entrance conductor, nonflexible grounded service raceway, or any grounded service enclosure. 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 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 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.

Statement of Problem and Substantiation for Public Input

This proposed new language emphasizes that connection to at least one grounding electrode must be maintained where possibility that modification of interior metal piping, within 5 feet from the point of entrance to the building, could isolate the grounding electrode system from the service.
As an example, plumbing products presently in use today include those that provide metallic piping connections, but not always with reliable electrical continuity of the piping system(i.e. 'push-in' type connectors, utilizing no solder, no threads, and with non-compression fit-up).
The intent of this proposal is to help ensure at least one grounding electrode connection will always be maintained for the service.
The proposed new text is supportive of section 250.53(D)(2), as presently written.

Submitter Information Verification

Submitter Full Name: Peter Noval Jr
Organization: Self
Affilliation: None
Street Address:
City:

State:

Zip:

Submittal Date: Thu Sep 07 15:46:48 EDT 2017

Copyright Assignment

Public Input No. 470-NFPA 70-2017 [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 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 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.

Informational note: Section 250.53(D)(2) specifies locations for connection of the supplemental electrode required for metal underground water pipes usd as electrodes

Statement of Problem and Substantiation for Public Input

This informational note is needed to help clarify the fact that supplemental electrodes required by 250.53(D)(2) are only permitted to be connected to the locations specified in 250.53(D)(2). It states...

"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)"

Any other electrodes could be connected to the locations specified in 250.68(C), but the present literal wording in 250.53(D)(2) is mandatory. It does not say "shall be PERMITTED to be bonded to one of the following", it states, "SHALL be bonded to one of the following". This means that any type of electrode that is used to supplement the water pipe electrode, CANNOT be connected to the water pipe!

I believe there is confusion about application of the different requirements of these 2 code sections. The rules in 250.68(C) are permissive, meaning they are allowed, but not required. The language in 250.53(D)(2) is not permissive. It is a mandatory rule, meaning it is specifically required and there is no other way to do it! Yet, I often see diagrams in textbooks, magazines, on websites and other industry information sources where the author will show all of the electrodes in a building connected to the first 5 feet of the interior water pipe! This arrangement is clearly NOT permitted by section 250.53(D)(2). At least one of those electrodes connected to the water pipe in that scenario would need to be designated as the supplemental electrode required by section 250.53(D)(2) and it could only be connected to the locations specified in 250.53(D)(2) since that rule is MANDATORY! All of the other electrodes in the building could stay connected to the water pipe as PERMITTED by section 250.68(C), but not the one designated as the supplemental electrode installed to comply with 250.53(D)(2).

The rules in both sections are fine they way they are written, but I think the subtle differences between the two, sometimes get lost in translation. This informational note will serve as reminder of the mandatory rules and will tie these two rules together.

Submitter Information Verification

Submitter Full Name: Russ Leblanc

Organization: Leblanc Consulting Services

Street Address:

City:

State:

Zip:

Submittal Date: Sat Apr 01 09:21:40 EDT 2017

Public Input No. 189-NFPA 70-2017 [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 threaded couplings or threaded <u>listed</u> 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

Statement of Problem and Substantiation for Public Input

only one and two piece hubs are listed for a service installation should be used.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master electrician

Street Address:

City:

State:

Zip:

Submittal Date: Sun Feb 05 15:55:50 EST 2017

Public Input No. 173-NFPA 70-2017 [Section No. 250.94]

250.94 Bonding for

~~Communication~~

Communications

Systems.

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

(A)

The Intersystem Bonding Termination Device.

An intersystem bonding termination (IBT) for connecting intersystem bonding

conductors

shall be provided external to enclosures at the service equipment or metering equipment enclosure and at the disconnecting means for any additional buildings or structures.

If an IBT is used,

it shall comply with the following:

(1) Be accessible for connection and inspection.

(2) Consist of a set of terminals with the capacity for connection of not less than three intersystem bonding conductors.

(3) Not interfere with opening the enclosure for a service, building or structure disconnecting means, or metering equipment.

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

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

(6) The terminals shall be listed as grounding and bonding equipment.

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

(1) Exposed nonflexible metallic raceways

(2) An exposed grounding electrode conductor

(3) Approved means for the external connection of a copper or other corrosion-resistant bonding or grounding electrode conductor to the grounded raceway or equipment

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

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

(B) Other Means.

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

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

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

Statement of Problem and Substantiation for Public Input

This PI is editorial. “Communication” should be plural, “communications”.

Submitter Information Verification

Submitter Full Name:	Stanley Kaufman
Organization:	Cablesafe Incofs
Affilliation:	CableSafe, Inc.
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Feb 05 05:18:04 EST 2017

Public Input No. 1937-NFPA 70-2017 [Section No. 250.94(A)]

(A) The Intersystem Bonding Termination Device.

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

(1) Be accessible for connection and inspection.

(2) Consist of a set of terminals with the capacity for connection of not less than three intersystem bonding conductors.

(3) Not interfere with opening the enclosure for a service, building or structure disconnecting means, or metering equipment.

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

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

(6) The terminals shall be listed as grounding and bonding equipment.

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

(1) Exposed nonflexible metallic raceways

(2) An exposed grounding electrode conductor

(3) Approved means for the external connection of a copper or other corrosion-resistant bonding or grounding electrode conductor to the grounded raceway or equipment

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

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

Statement of Problem and Substantiation for Public Input

There are new service disconnects and feeder disconnects at existing buildings and structures that the present wording would not require them to install the intersystem bonding termination required in 250.94.

Submitter Information Verification

Submitter Full Name: David Clements

Organization: Intl Assoc Elec Insp

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 09 08:56:12 EDT 2017

Copyright Assignment

Public Input No. 1938-NFPA 70-2017 [Section No. 250.94(A)]

(A) The Intersystem Bonding Termination Device.

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

(1) Be accessible for connection and inspection.

(2) Consist of a set of terminals with the capacity for connection of not less than three intersystem bonding conductors. A multiple occupancy building shall have an intersystem bonding termination for each occupancy.

(3) Not interfere with opening the enclosure for a service, building or structure disconnecting means, or metering equipment.

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

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

(6) The terminals shall be listed as grounding and bonding equipment.

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

(1) Exposed nonflexible metallic raceways

(2) An exposed grounding electrode conductor

(3) Approved means for the external connection of a copper or other corrosion-resistant bonding or grounding electrode conductor to the grounded raceway or equipment

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

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

Statement of Problem and Substantiation for Public Input

This section is hard to comply with when you have multiple occupancies in a building or structure. A single family or commercial occupancy the present wording works great. If you have a duplex with two service disconnects each occupancy should be able to terminate at least three communication systems. Now we try to apply the present wording to a six unit townhome with the service equipment, at one end of the building, consisting an enclosure with six service disconnects feeding six units. Each unit may have a phone, cable TV, or satellite. We need a intersystem bonding termination for each occupancy.

Submitter Information Verification

Submitter Full Name: David Clements
Organization: Intl Assoc Elec Insp
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 09 08:58:13 EDT 2017

Copyright Assignment

Public Input No. 3422-NFPA 70-2017 [Section No. 250.94(A)]

(A) The Intersystem Bonding Termination Device.

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

(1) Be accessible for connection and inspection.

(2) Consist of a set of terminals with the capacity for connection of not less than three intersystem bonding conductors.

(3) Not interfere with opening the enclosure for a service, building or structure disconnecting means, or metering equipment.

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

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

(6) The terminals shall be listed as grounding and bonding equipment.

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

(1) Exposed nonflexible metallic raceways

(2) An exposed grounding electrode conductor

(3) Approved means for the external connection of a copper or other corrosion-resistant bonding or grounding electrode conductor to the grounded raceway or equipment

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

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

Statement of Problem and Substantiation for Public Input

There are new service disconnects and feeder disconnects at existing buildings and structures that the present wording would not
require them to install the intersystem bonding termination required in 250.94.

Submitter Information Verification

Submitter Full Name: David Williams

Organization: Delta Charter Township

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 04:13:38 EDT 2017

Copyright Assignment

I, David Williams, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am David Williams, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 3423-NFPA 70-2017 [Section No. 250.94(A)]

(A) The Intersystem Bonding Termination Device.

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

(1) Be accessible for connection and inspection.

(2) Consist of a set of terminals with the capacity for connection of not less than three intersystem bonding conductors. A multiple occupancy building shall have an intersystem bonding termination for each occupancy.

(3) Not interfere with opening the enclosure for a service, building or structure disconnecting means, or metering equipment.

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

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

(6) The terminals shall be listed as grounding and bonding equipment.

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

(1) Exposed nonflexible metallic raceways

(2) An exposed grounding electrode conductor

(3) Approved means for the external connection of a copper or other corrosion-resistant bonding or grounding electrode conductor to the grounded raceway or equipment

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

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

Statement of Problem and Substantiation for Public Input

This section is hard to comply with when you have multiple occupancies in a building or structure. A single family or commercial occupancy the present wording works great. If you have a duplex with two service disconnects each occupancy should be able to terminate at least three communication systems. Now we try to apply the present wording to a six unit townhome with the service equipment, at one end of the building, consisting an enclosure with six service disconnects feeding six units. Each unit may have a phone, cable TV, or satellite. We need a intersystem bonding termination for each occupancy.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 06 04:19:18 EDT 2017

Copyright Assignment

Public Input No. 1509-NFPA 70-2017 [Section No. 250.94(B)]

(B) Other Means.

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

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

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

Statement of Problem and Substantiation for Public Input

Delete this Informational Note, For sure the IBT does NOT reduce noise on communications systems (actually it increases it, but that's another story...). In addition, can anybody define what 'noise' we are reducing?

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 01 13:05:08 EDT 2017

Public Input No. 1510-NFPA 70-2017 [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.~~

Statement of Problem and Substantiation for Public Input

This is no longer an issue, and should not be permitted by the NEC. Again, 'noise' is not defined by the NEC, and this rule makes no sense. If Code making panel 5 wants to allow this practice, then do so without any text about 'noise.' I will be at the Code panel meeting to better explain.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 01 13:08:25 EDT 2017

Public Input No. 3761-NFPA 70-2017 [Section No. 250.96(B)]

(B) Isolated Grounding Circuits.

~~Where installed for the reduction of electrical noise (electromagnetic interference) on the grounding circuit, an~~ 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.

Statement of Problem and Substantiation for Public Input

Does it matter why the isolated ground system was installed? The requirement should apply to ALL isolated ground systems, regardless of why they were installed. A clever installer, to get around this requirement could simply say "Oh no, this was not installed because of noise considerations..."

Submitter Information Verification

Submitter Full Name: Eric Stromberg

Organization: Los Alamos National Laboratory

Affilliation: Self

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 20:44:34 EDT 2017

Public Input No. 781-NFPA 70-2017 [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.

Statement of Problem and Substantiation for Public Input

Due to the requirements of Section 300.7(B) which now allows the use of an expansion-deflection or deflection fittings, the bonding requirements of a straight expansion or telescoping fittings of Section 250.98, should also apply to these types of fittings to maintain the bonding of electrical equipment and conductive materials required by Section 250.4. These fittings should be made to be electrically continuous to maintain safety.

Submitter Information Verification

Submitter Full Name: Darryl Hill
Organization: Wichita Electrical JATC
Street Address:
City:
State:
Zip:

Submittal Date: Mon May 22 14:19:30 EDT 2017

Public Input No. 2972-NFPA 70-2017 [Section No. 250.100]

~~**250.100** Bonding in Hazardous (Classified) Locations.~~

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

~~Informational Note: See 501.30 , 502.30 , 503.30 , 505.25 , or 506.25 for specific bonding requirements.~~

Statement of Problem and Substantiation for Public Input

Delete this section completely because the equipment grounding conductor requirements for hazardous (classified) locations are contained in Chapter 5 Articles.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 29 16:40:33 EDT 2017

Public Input No. 3311-NFPA 70-2017 [Section No. 250.100]

250.100 Bonding in Hazardous (Classified) Locations.

Regardless of the voltage of the electrical system, the electrical continuity of non–current-carrying metal parts of equipment, raceways, cable trays and other enclosures in any hazardous (classified) location, as defined in 500.5, 505.5, and 506.5, shall be ensured by any of the bonding methods specified in 250.92(B)(2) through (B)(4). ~~One or more of these bonding methods shall be used whether or not equipment grounding conductors~~ In addition, an equipment grounding conductor of the wire type ~~are installed~~ shall be installed in all raceways and multiconductor cables .

Informational Note: See 501.30, 502.30, 503.30, 505.25, or 506.25 for specific bonding requirements.

Statement of Problem and Substantiation for Public Input

Rigid metal conduit and other metallic raceways are subject to corrosion and the continuity can fail over a period of several years. In classified locations, raceways should not be considered to be the only path for ground faults.

Submitter Information Verification

Submitter Full Name: Paul Guidry

Organization: Fluor Enterprises, Inc.

Affilliation: Associated Builders and Contractors

Street Address:

City:

State:

Zip:

Submittal Date: Tue Sep 05 12:18:27 EDT 2017

Public Input No. 2437-NFPA 70-2017 [Section No. 250.102(C)(2)]

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

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

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

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

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

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

Notes:

1. If the ungrounded supply conductors are larger than 1100 kcmil copper or 1750 kcmil aluminum, the grounded conductor or bonding jumper shall have an area not less than 12½ percent of the area of the largest ungrounded supply conductor or equivalent area for parallel supply conductors. The grounded conductor or bonding jumper shall not be required to be larger than the largest ungrounded conductor or set of ungrounded conductors.

2. If the ungrounded supply conductors are larger than 1100 kcmil copper or 1750 kcmil aluminum and if the ungrounded supply conductors and the bonding jumper are of different materials (copper, aluminum, or copper-clad aluminum), the minimum size of the grounded conductor or bonding jumper shall be based on the assumed use of ungrounded supply conductors of the same material as the grounded conductor or bonding jumper and will have an ampacity equivalent to that of the installed ungrounded supply conductors.

3. If multiple sets of service-entrance conductors are used as permitted in 230.40, Exception No. 2, or if multiple sets of ungrounded supply conductors are installed for a separately derived system, the equivalent size of the largest ungrounded supply conductor(s) shall be determined by the largest sum of the areas of the corresponding conductors of each set.

4. If there are no service-entrance conductors, the supply conductor size shall be determined by the equivalent size of the largest service-entrance conductor required for the load to be served.

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

Statement of Problem and Substantiation for Public Input

The current text would exclude system in which the overcurrent protection was installed by a utility. The proposed text makes it clear that the overcurrent protection being described is for the premises wiring system

Submitter Information Verification

Submitter Full Name: Dennis Querry

Organization: Trinity River Authority

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 18 10:30:46 EDT 2017

Public Input No. 308-NFPA 70-2017 [Section No. 250.102(C)(2)]

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

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

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

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

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

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

Notes:

1. If the ungrounded supply conductors are larger than 1100 kcmil copper or 1750 kcmil aluminum, the grounded conductor or bonding jumper shall have an area not less than 12 ½ percent of the area of the largest ungrounded supply conductor or equivalent area for parallel supply conductors. The grounded conductor or bonding jumper shall not be required to be larger than the largest ungrounded conductor or set of ungrounded conductors.

2. If the ungrounded supply conductors are larger than 1100 kcmil copper or 1750 kcmil aluminum and if the ungrounded supply conductors and the bonding jumper are of different materials (copper, aluminum, or copper-clad aluminum), the minimum size of the grounded conductor or bonding jumper shall be based on the assumed use of ungrounded supply conductors of the same material as the grounded conductor or bonding jumper and will have an ampacity ~~equivalent~~ equal to or greater than that of the installed ungrounded supply conductors.

3. If multiple sets of service-entrance conductors are used as permitted in 230.40, Exception No. 2, or if multiple sets of ungrounded supply conductors are installed for a separately derived system, the equivalent size of the largest ungrounded supply conductor(s) shall be determined by the largest sum of the areas of the corresponding conductors of each set.

4. If there are no service-entrance conductors, the supply conductor size shall be determined by the equivalent size of the largest service-entrance conductor required for the load to be served.

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

Statement of Problem and Substantiation for Public Input

The term "equivalent" would indicate equal to, and in this case "equal to or greater than" would more accurately describe the requirement. This would allow for conductors with an ampacity greater than the installed conductors to be used if the ampacities are not equal.

Submitter Information Verification

Submitter Full Name: John Kjome
Organization: Minneapolis JATC
Affilliation: IBEW/IAEI
Street Address:
City:
State:
Zip:
Submittal Date: Mon Feb 27 13:21:56 EST 2017

Copyright Assignment

I, John Kjome, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am John Kjome, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 1081-NFPA 70-2017 [Section No. 250.104]

250.104 Bonding of Piping Systems and Exposed Structural Metal.

(A) Metal Water Piping.

The metal water piping system shall be bonded as required in (A)(1), (A)(2), or (A)(3) of this section.

(1) General.

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

(1) Service equipment enclosure

(2) Grounded conductor at the service

(3) Grounding electrode conductor if of sufficient size

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

The bonding jumper(s) shall be installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible. The bonding jumper(s) shall be sized in accordance with Table 250.102(C)(1)except as permitted in 250.104(A)(2) and 250.104(A)(3).

(2) Buildings of Multiple Occupancy.

In buildings of multiple occupancy where the metal water piping system(s) installed in or attached to a building or structure for the individual occupancies is metallically isolated from all other occupancies by use of nonmetallic water piping, the metal water piping system(s) for each occupancy shall be permitted to be bonded to the equipment grounding terminal of the switchgear, switchboard, or panelboard enclosure (other than service equipment) supplying that occupancy. The bonding jumper shall be sized in accordance with 250.102(D).

(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), 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.

(B) Other Metal Piping.

If installed in or attached to a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded to any of the following:

(1) Equipment grounding conductor for the circuit that is likely to energize the piping system

(2) Service equipment enclosure

(3) Grounded conductor at the service

(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 250.122, and equipment grounding conductors shall be sized in accordance with Table 250.122using the rating of the circuit that is likely to energize the piping system(s). The points of attachment of the bonding jumper(s) shall be accessible.

Informational Note No. 1: Bonding all piping and metal air ducts within the premises will provide additional safety.

Informational Note No. 2: Additional information for gas piping systems can be found in Section 7.~~13~~ 12 of NFPA 54-~~2015~~ 2018 , *National Fuel Gas Code* ~~.~~

~~(C)~~

and Section 301 of ICC International Fuel Gas Code-2018

(C) CSST Piping Systems.

CSST gas piping systems, and any gas piping systems containing one or more segments of CSST, shall be electrically continous and bonded to the electrical service grounding electrode system or, where provided, lightning protection grounding electrode system. The bonding jumeper shall be a 6 AWG copper wire or equivalent and the lenght of the bonding jumper shall not exceed 75 feet (22m) for bonding CSST gas piping systems. The bonding conductor connection shall be made between the point of fuel gas delivery and the first CSST fitting. Any additional grounding electrodes installed to meet this requirement shall be bonded to the electrical service grounding electrode system or, where provided, lightning protection grounding electrode system. Devices used for the bonding connection shall be listed for the application in accordance with ANSI/UL 467, Grounding and Bonding Equipment.

Exception: This section shall not apply to listed Arc-Resistant Jacketed CSST when it is connected to appliances or equipment that are connected to the equipment grounding conductor for the circuit that is likely to energize the CSST piping system.

(D) Structural Metal.

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

(1) Service equipment enclosure

(2) Grounded conductor at the service

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

(4) Grounding electrode conductor, if of sufficient size

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

The bonding conductor(s) or jumper(s) shall be sized in accordance with Table 250.102(C)(1)and installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible unless installed in compliance with 250.68(A) Exception No. 2.

(~~D~~ E) Separately Derived Systems.

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

(1) Metal Water Piping System(s).

The grounded conductor of each separately derived system shall be bonded to the nearest available point of the metal water piping system(s) in the area served by each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1)based on the largest ungrounded conductor of the separately derived system.

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

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

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.

(3) Common Grounding Electrode Conductor.

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

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

Statement of Problem and Substantiation for Public Input

The NFPA Membership at the 2018 Technical meeting changed the requirements for electrically bonding CSST piping systems and these changes belong as positive code language in the NEC. CSST is required to be bonded to the electrical service grounding electrode service, a lightning protection system, or bonding to additional electrode that are then required to be bonded to the electrical service grounding electrode system. The length of the bonding jumper cannot exceed 75 feet in length and now has to be connected between the point of fuel delivery and the first CSST fitting.

Unfortunately CSST piping systems are not being properly bonded due to the requirements being in the National Fuel Gas Code. Electrical inspectors can only enforce the NEC requirements and Informational Note 2 to 250.104(B) is not enforceable per 90.4(C). CSST gas piping system installers are not licensed electricians and are not qualified persons to bond a CSST piping system to an electrical service and leave the bonding of the piping system to the electrical contractor. The electrical contractor is only aware of the requirements in 250.104(B).

By adding the requirements to the NEC, CSST piping systems will now be properly bonded by electricians and the AHJ responsible for enforcing the NEC will have purview over the proper bonding of the CSST piping systems to the electrical service grounding electrode system. The added exception recognizes that 2018 National Fuel Gas Code permits listed Arc-Resistant Jacketed CSST to be bonded by the equipment grounding conductor of the circuit that could energize the listed Arc-Resistant Jacketed CSST piping system.

Submitter Information Verification

Submitter Full Name: Brian Baughman
Organization: Generac Power Systems Inc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 28 11:31:24 EDT 2017

Copyright Assignment

Public Input No. 4100-NFPA 70-2017 [Section No. 250.104]

250.104 Bonding of Piping Systems and Exposed Structural Metal. Bonding of piping systems and exposed structural metal shall meet the performance requirements in 250.4(A)(4) and 250.4(B)(3) as applicable, and shall meet the specific requirements in (A) through (D) below as applicable.

Informational Note: See NFPA 780-2014, Standard for the Installation of Lightning Protection Systems, for information on installation of grounding and bonding for lightning protection systems.

(A) Metal Water Piping.

The metal water piping system shall be bonded as required in (A)(1), (A)(2), or (A)(3) of this section.

(1) General.

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

(1) Service equipment enclosure

(2) Grounded conductor at the service

(3) Grounding electrode conductor if of sufficient size

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

The bonding jumper(s) shall be installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible. The bonding jumper(s) shall be sized in accordance with Table 250.102(C)(1)except as permitted in 250.104(A)(2) and 250.104(A)(3).

(2) Buildings of Multiple Occupancy.

In buildings of multiple occupancy where the metal water piping system(s) installed in or attached to a building or structure for the individual occupancies is metallically isolated from all other occupancies by use of nonmetallic water piping, the metal water piping system(s) for each occupancy shall be permitted to be bonded to the equipment grounding terminal of the switchgear, switchboard, or panelboard enclosure (other than service equipment) supplying that occupancy. The bonding jumper shall be sized in accordance with 250.102(D).

(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), 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.

(B) Other Metal Piping.

If installed in or attached to a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded to any of the following:

(1) Equipment grounding conductor for the circuit that is likely to energize the piping system

(2) Service equipment enclosure

(3) Grounded conductor at the service

(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 250.122, and equipment grounding conductors shall be sized in accordance with Table 250.122using the rating of the circuit that is likely to energize the piping system(s). The points of attachment of the bonding jumper(s) shall be accessible.

Informational Note No. 1: Bonding all piping and metal air ducts within the premises will provide additional safety.

Informational Note No. 2: Additional information for gas piping systems can be found in Section 7.13 of NFPA 54-2015, *National Fuel Gas Code*.

(C) Structural Metal.

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

(1) Service equipment enclosure

(2) Grounded conductor at the service

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

(4) Grounding electrode conductor, if of sufficient size

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

The bonding conductor(s) or jumper(s) shall be sized in accordance with Table 250.102(C)(1)and installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible unless installed in compliance with 250.68(A) Exception No. 2.

(D) Separately Derived Systems.

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

(1) Metal Water Piping System(s).

The grounded conductor of each separately derived system shall be bonded to the nearest available point of the metal water piping system(s) in the area served by each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1)based on the largest ungrounded conductor of the separately derived system.

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

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

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.

(3) Common Grounding Electrode Conductor.

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

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

Statement of Problem and Substantiation for Public Input

The proposed driving text for this section is long overdue and will go a long way to help all users understand the purpose of the bonding requirements in 250.104. The bonding requirements in this section relate to bonding conductive parts likely to become energized in a fashion that will ensure that a ground-fault current path is provided to facilitate the operation of an overcurrent device in the event that should occur. These requirements have nothing to do with providing lightning protection for conductive or nonconductive piping systems in or on the building. Lightning protection system installation and requirements are beyond the scope of the NEC. Even though there are informational notes following 250.4(A)(5) and 250.4(B)(4) it is important to provide this reminder here for users. The scope is clear in 90.1 and is for the protection of persons and property from hazards arising from the use of electricity. This clearly excludes lightning because we don't use lightning. NFPA 780 is where lightning protection requirements belong.

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz

Organization: NECA

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 14:10:45 EDT 2017

Public Input No. 2829-NFPA 70-2017 [Section No. 250.104(A)(1)]

(1) – ~~General~~ Buildings or Structures Directly Supplied by a Service .

Metal water piping system(s) installed in or attached to a building or structure that is directly supplied by a service shall be bonded to any of the following:

(1) Service equipment enclosure

(2) Grounded conductor at the service

(3) Grounding electrode conductor if of sufficient size

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

The bonding jumper(s) shall be installed in accordance with 250.64(A), 250.64(B), and 250.64(E). The points of attachment of the bonding jumper(s) shall be accessible. The bonding jumper(s) shall be sized in accordance with Table 250.102(C)(1)~~except as permitted in 250~~ . ~~104(A)(2) and 250.104(A)(3)~~ ~~.~~

Statement of Problem and Substantiation for Public Input

The changes proposed are intended to add clarity that the general rule applies to a building or structure that is supplied directly by a service. This then require that the metal water piping system be bonded with a conductor that is sized according to Table 250.102(C)(1).
Special requirements are provided for buildings of multiple occupancy that have specific conditions. These occupancies are typically supplied by a feeder and the metal water piping bonding conductor is sized the same way as the equipment grounding conductor in the feeder.
Specific requirements are provided in 250.104(A)(3) for buildings or structures that are supplied by a feeder. See the companion public input that is intended to provide clarity.
As a result, there is no need for the exception statement in 250.104(A)(1) second paragraph.

Related Public Inputs for This Document

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

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Sun Aug 27 20:16:04 EDT 2017

Public Input No. 3203-NFPA 70-2017 [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)~~ 66 except as permitted in 250.104(A)(2) and 250.104(A)(3).

Statement of Problem and Substantiation for Public Input

My understanding is that this change was made by the technical correlating committee and that it was not a panel 5 initiated change. This PI is so that panel 5 can discuss it and determine what the intention was. It appears, to the author of this PI, that the correct reference is T250.66, as this retains alignment with the rest of the Article.

Submitter Information Verification

Submitter Full Name: Eric Stromberg

Organization: Los Alamos National Laboratory

Affilliation: Self

Street Address:

City:

State:

Zip:

Submittal Date: Sun Sep 03 18:43:05 EDT 2017

Public Input No. 4129-NFPA 70-2017 [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), based on the size of the ungrounded service conductors that supply the building or structure, except as permitted in 250.104(A)(2) and 250.104(A)(3).

Statement of Problem and Substantiation for Public Input

The text as presently written states the bonding jumpers shall be sized in accordance with Table 250.102(C)(1).
The footnote to Table 250.102(C)(1) states that "for the purposes of applying this table and its notes, the term ' bonding jumper' refers to main bonding jumpers, system bonding jumpers, and supply-side bonding jumpers."
Sizing of bonding jumpers for metal water piping does not appear to be addressed by the Table, based on the footnote.
The added text eliminates potential confusion by providing clear direction on how to use Table 250.102(C)(1) to size bonding jumpers for metal water piping.

Submitter Information Verification

Submitter Full Name: Peter Noval Jr

Organization: Self

Affilliation: None

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 14:58:27 EDT 2017

Public Input No. 2090-NFPA 70-2017 [Section No. 250.104(A)(2)]

(2) Buildings of Multiple Occupancy.

In buildings of multiple occupancy where the metal water piping system(s) installed in or attached to a building or structure for the individual occupancies is metallically isolated from all other occupancies by use of nonmetallic water piping, the metal water piping system(s) for each occupancy shall be permitted to be bonded to the equipment grounding terminal of the switchgear, switchboard, or panelboard enclosure (other than service equipment) supplying that occupancy. The bonding jumper shall be sized in accordance ~~with~~ ~~250.102(D)~~ with Table 250.122, based on the rating of the overcurrent protective device for the circuit supplying the occupancy.

Statement of Problem and Substantiation for Public Input

Fix this rule, it's crazy to reference 250.104(D) Separately Derived Systems... have it read like it did in the 2014 NEC "Table 250.122, based on the rating of the overcurrent protective device for the circuit supplying the occupancy."

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 10 10:35:48 EDT 2017

Public Input No. 2830-NFPA 70-2017 [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~~ 250 .102(~~C)(1)~~ ~~, based on the size of the feeder or branch-circuit conductors that supply the building or structure~~ D) . The bonding jumper shall not be required to be larger than the largest ungrounded feeder or branch-circuit conductor supplying the building or structure.

Statement of Problem and Substantiation for Public Input

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

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2829-NFPA 70-2017 [Section No. 250.104(A)(1)]	

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Sun Aug 27 20:30:11 EDT 2017

Public Input No. 3204-NFPA 70-2017 [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)~~ 66 , 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.

Statement of Problem and Substantiation for Public Input

My understanding is that this change was made by the technical correlating committee and that it was not a panel 5 initiated change. This PI is so that panel 5 can discuss it and determine what the intention was. It appears, to the author of this PI, that the correct reference is T250.66, as this retains alignment with the rest of the Article.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3203-NFPA 70-2017 [Section No. 250.104(A)(1)]	Possible mistake in changing table reference

Submitter Information Verification

Submitter Full Name: Eric Stromberg

Organization: Los Alamos National Laboratory

Affilliation: Self

Street Address:

City:

State:

Zip:

Submittal Date: Sun Sep 03 18:49:44 EDT 2017

Public Input No. 944-NFPA 70-2017 [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)~~ 66 , 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.

Statement of Problem and Substantiation for Public Input

This PI proposes returning the text to the sizing requirements that were used since its inception in the 1978 NEC. There was no technical reason to make this change in the 2017 cycle. Proposal 108-1 (NEC 1978 edition) to modify 250-80, Bonding of Piping Systems was the original proposal that clarified the sizing requirements for this application. The applicable portion of the 1978 NEC substantiation reads “The use of Table 250-94 in part (a) is justified on basis that it would have been used to size the grounding electrode conductor to the water pipe had the pipe served as the grounding electrode and was continuous throughout the premises. It is not reasonable that it be sized in a different manner if it were not the electrode.” There has been no evidence of any problems in the field by using the sizing requirements established in the 1978 NEC.

Submitter Information Verification

Submitter Full Name: David Hittinger

Organization: Independent Electrical Contractors

Affilliation: Independent Electrical Contractors Codes and Standard

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jun 08 08:46:29 EDT 2017

Public Input No. 3229-NFPA 70-2017 [New Section after 250.104(A)(3)]

TITLE OF NEW CONTENT

(B) Metal Gas Piping . Metal gas piping installed in or attached to a building or structure shall be bonded in accordance with the following:

Pipe and Tubing Other Than CSST . Each above ground portion of a gas piping system other than CSST that is likely to become energized shall be electrically continuous and bonded to an effective ground fault current path. Gas piping other than CSST shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance.

CSST . CSST gas piping systems and gas piping systems containing one or more segments of CSST, shall be electrically continuous and bonded to the electrical service grounding electrode system, or where provided, lightning protection grounding electrode system.

The bonding jumper shall connect to a metallic pipe, pipe fitting or CSST fitting.

The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent.

The length of the jumper between the connection to the gas piping system and the grounding electrode system shall not exceed 75-ft (22-m). Any additional grounding electrodes installed to meet this requirement shall be bonded to the electrical service grounding electrode system, or where provided, lightning protecton grounding electrode system.

Arc Resistant Jacketed CSST . CSST listed with an arc resistant jacket or coating system in accordance with ANSI LC-1/CSA 6.26, *Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)* , shall be electrically continuous and bonded to an effective ground fault current path. Where any CSST component of a piping system does not have an arc resistant jacket or coating system, the bonding requirements for CSST shall apply. Arc resistant jacketed CSST shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance.

Informational Note: Material extracted from the National Fuel Gas Code/NFPA 54-2018 covering the complete bonding requirements for metal gas piping systems can be found in Informative Annex K.

Additional Proposed Changes

File Name	Description	Approved
Informative_Annex_K.1504547097743.docx		✓

Statement of Problem and Substantiation for Public Input

The NFPA Standards Council has assigned the bonding requirements for gas piping systems to the National Fuel Gas Code Committee which has required the extra bonding of CSST since the 2009 edition of the NFPA 54 Code. This proposal makes all bonding requirements included in the Section 7.12 of the National Fuel Gas Code-2018 (NFPA-54-2018) also a requirement of the NEC, including bonding of CSST gas piping systems. The proposal also adds the bonding requirements as extracted code text in an Informative Annex because electrical contractors do not generally carry or own a copy of the National Fuel Gas Code. Requirements in NFPA 54, National Fuel Gas Code state that corrugated stainless steel tubing shall be either bonded directly to the grounding electrode system in addition to the bonding requirements contained within NEC 250.104(B)-2017 or be certified as a listed arc-resistant design (per ANSI LC-1).

The current absence of coverage in the National Electrical Code for the full range of bonding requirements for all gas piping materials has led to confusion and conflicts in the field. Some states have placed the responsibility of bonding CSST to plumbers (NH) and homeowners (NC). Some states (MA) do not enforce the bonding of CSST within the electrical code. As fire and electrical safety are important, then clarity is needed so that these important installation requirements will be uniformly assigned to the most knowledgeable contractors in all jurisdictions.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3236-NFPA 70-2017 [Section No. 250.104(B)]	both concern bonding of metal gas piping

Submitter Information Verification

Submitter Full Name: Robert Torbin
Organization: Omega Flex Inc
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 04 13:17:47 EDT 2017

Informative Annex K: Bonding Requirements for Metal Gas Piping Systems

7.12 Electrical Bonding and Grounding.

7.12.1 Pipe and Tubing other than CSST. Each aboveground portion of a gas piping system other than CSST that is likely to become energized shall be electrically continuous and bonded to an effective ground-fault current path. Gas piping other than CSST shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance.

7.12.2 * CSST. CSST gas piping systems and gas piping systems containing one or more segments of CSST, shall be electrically continuous and bonded to the electrical service grounding electrode system or where provided, lightning protection grounding electrode system.

7.12.2.1 The bonding jumper shall connect to a metallic pipe, pipe fitting, or CSST fitting.

7.12.2.2 The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent.

7.12.2.3 The length of the jumper between the connection to the gas piping system and the grounding electrode system shall not exceed 75-ft (22-m). Any additional grounding electrodes installed to meet this requirement shall be bonded to the electrical service grounding electrode system or where provided, lightning protection grounding electrode system.

7.12.2.4 Bonding connections shall be in accordance with NFPA 70, National Electrical Code®.

7.12.2.5 Devices used for the bonding connection shall be listed for the application in accordance with UL 467, Grounding and Bonding Equipment.

7.12.3 Arc Resistant Jacketed CSST. CSST listed with an arc resistant jacket or coating system in accordance with ANSI LC 1/CSA 6.26, *Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST),* shall be electrically continuous and bonded to an effective ground fault current path. Where any CSST component of a piping system does not have an arc resistant jacket or coating system, the bonding requirements of 7.12.2 shall apply. Arc resistant jacketed CSST shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance.

7.12.4* Prohibited Use. Gas piping shall not be used as a grounding conductor or electrode.

7.12.5* Lighting Protection System. Where a lightning protection system is installed, the bonding of the gas piping shall be in accordance with NFPA 780, Standard for the Installation of Lightning Protection Systems, 2008.

Public Input No. 588-NFPA 70-2017 [New Section after 250.120(B)]

(C) Metallic Raceways Installed on Roofs.

Where branch circuit or feeder conductors are installed on a roof, an equipment grounding conductor of the wire type shall be installed in metallic raceway systems that use non-threaded fittings.

Statement of Problem and Substantiation for Public Input

Section 440.9 was added to the 2017 NEC to require a wire type equipment grounding conductor be installed in metallic raceway systems that use non-threaded fittings serving HVAC equipment on a roof. The same hazard exists for all metallic raceway systems that use non-threaded fittings installed on a roof regardless of the equipment supplied. Non-threaded fittings are easily broken when raceways are stepped on or lifted up for roof repair/replacement. A metallic raceway system relying on intact fittings as an important element of the ground fault return path becomes a serious safety issue when those fittings are broken.

Please note that this should be new section 250.120(D). Terraview designated this as 250.120(C) and that section currently exists and it is not the intention of this PI to replace 250.120(C).

Submitter Information Verification

Submitter Full Name:	David Hittinger
Organization:	Independent Electrical Contractors
Affilliation:	Independent Electrical Contractors Codes and Standard
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Apr 24 15:56:19 EDT 2017

Public Input No. 3236-NFPA 70-2017 [Section No. 250.104(B)]

(~~B~~ C) – Other Metal Piping.

If installed in or attached to a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded to any of the following:

(1) Equipment grounding conductor for the circuit that is likely to energize the piping system

(2) Service equipment enclosure

(3) Grounded conductor at the service

(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 250.122, and equipment grounding conductors shall be sized in accordance with Table 250.122using the rating of the circuit that is likely to energize the piping system(s). The points of attachment of the bonding jumper(s) shall be accessible.

Informational Note No. 1: Bonding all piping and metal air ducts within the premises will provide additional safety.

~~Informational Note No. 2: Additional information for gas piping systems can be found in Section 7.13 of NFPA 54-2015, *National Fuel Gas Code* .~~ .

Renumber existing 250.104(C) as (D) and 250.104 (D) as (E)..

Statement of Problem and Substantiation for Public Input

The NFPA Standards Council has assigned the bonding requirements for gas piping systems to the National Fuel Gas Code Committee which has required the extra bonding of CSST since the 2009 edition of the NFPA 54 Code. This proposal makes all bonding requirements included in the Section 7.12 of the National Fuel Gas Code-2018 (NFPA-54-2018) also a requirement of the NEC, including bonding of CSST gas piping systems. The proposal also adds the bonding requirements as extracted code text in an Informative Annex because electrical contractors do not generally carry or own a copy of the National Fuel Gas Code. Requirements in NFPA 54, National Fuel Gas Code state that corrugated stainless steel tubing shall be either bonded directly to the grounding electrode system in addition to the bonding requirements contained within NEC 250.104(B)-2017 or be certified as a listed arc-resistant design (per ANSI LC-1).

The current absence of coverage in the National Electrical Code for the full range of bonding requirements for all gas piping materials has led to confusion and conflicts in the field. Some states have placed the responsibility of bonding CSST to plumbers (NH) and homeowners (NC). Some states (MA) do not enforce the bonding of CSST within the electrical code. As fire and electrical safety are important, then clarity is needed so that these important installation requirements will be uniformly assigned to the most knowledgeable contractors in all jurisdictions.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3229-NFPA 70-2017 [New Section after 250.104(A)(3)]	both affect bonding of metal gas piping

Submitter Information Verification

Submitter Full Name: Robert Torbin

Organization: Omega Flex Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Sep 04 13:52:11 EDT 2017

Public Input No. 309-NFPA 70-2017 [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) 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.

Statement of Problem and Substantiation for Public Input

In the 2017 NEC, structural steel as an electrode what modified to more accurately depict that it is only an electrode where in direct contact with the ground. If the structural metal interconnected to form a building frame is not used as an electrode, but is intentionally grounded by connection to the concrete encased electrode, it would not require bonding per 250.104 leaving a high impedance fault current path between the steel and the source. In the case that the concrete encased electrode is bonded to the grounding electrode system, the conductor would not need to be larger than a #4, still limiting the fault current capacity of the building steel. By deleting the phrase "is not intentionally grounded or bonded" one would be required to bond the steel with the appropriately sized bonding jumper creating an effective ground fault current path. An exception can be added for those installations where the building steel does qualify as an electrode and is already bonded with the appropriately sized conductor.

Submitter Information Verification

Submitter Full Name: John Kjome

Organization: Minneapolis JATC

Affilliation: IBEW/IAEI

Street Address:

City:

State:

Zip:

Submittal Date: Mon Feb 27 13:43:29 EST 2017

Public Input No. 945-NFPA 70-2017 [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)~~ 66 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.

Statement of Problem and Substantiation for Public Input

This PI proposes returning the text to the sizing requirements that were used since its inception in the 1978 NEC. There was no technical reason to make this change in the 2017 cycle. Proposal 108-1 (NEC 1978 edition) to modify 250-80, Bonding of Piping Systems was the original proposal that clarified the sizing requirements for this application. The applicable portion of the 1978 NEC substantiation reads “The use of Table 250-94 in part (a) is justified on basis that it would have been used to size the grounding electrode conductor to the water pipe had the pipe served as the grounding electrode and was continuous throughout the premises. It is not reasonable that it be sized in a different manner if it were not the electrode.” There has been no evidence of any problems in the field by using the sizing requirements established in the 1978 NEC.

Submitter Information Verification

Submitter Full Name: David Hittinger

Organization: Independent Electrical Contractors

Affilliation: Independent Electrical Contractors Codes and Standard

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jun 08 08:57:43 EDT 2017

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

(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. The bondng jumper is not required to be sized larger than the grounding electrode conductor.

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.

Statement of Problem and Substantiation for Public Input

Wording under 250.104(C) Structural Metal states: if the structural metal building steel is not intentionally grounded or bonded and is likely to become energized shall be bonded to any of the following....
In my opinion, the extension of the grounding electrode conductor to the structural steel would meet the bonding requirements required by 250.104(C). The size of the GEC (250.66 Table) would always be sized smaller than bonding table located in 250.102(C)(1) for larger service conductors when the 12 1/2% would be used. The conductor sizing seems extremely large for what we are trying to accomplish.
Example: We install a large 3000 amp service, with 10 parallel sets of 500 KCMIL AL runs. The bonding jumper that would be required to the 1" water piping system would be a 650 KCMIL based on 250.102(C)(1) table. A 3/0 could be extended to the building steel, but the water piping system would require a 650 KCMIL.

Submitter Information Verification

Submitter Full Name: Dean Hunter
Organization: Minnesota Department of Labor
Street Address:
City:
State:
Zip:

Submittal Date: Wed Aug 16 15:14:39 EDT 2017

Public Input No. 2803-NFPA 70-2017 [Section No. 250.104(D)(1)]

__(1)__ Metal Water Piping System(s).

The grounded conductor of each separately derived system shall be bonded to the nearest available point of the metal water piping system(s) in the area served by each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1)based on the largest ungrounded conductor of the separately derived system.

Exception No. 1: A separate bonding jumper to the metal water piping system shall not be required if the metal water piping system is <u>either</u> used as the grounding electrode for the separately derived system ~~and~~ <u>or complies with section 250.68(C)(1), and</u> 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 <u>either</u> used as the grounding electrode for a separately derived system <u>or complies ith secion 250.68(C)(2),</u> and is bonded to the metal water piping in the area served by the separately derived system.

Statement of Problem and Substantiation for Public Input

This revision is needed because the recent revisions to sections 250.52(A)(2) make it clear that the metal frame of a building is not a grounding electrode if the metal is not in contact with the earth. Section 250.68(C)(2) permits the metal building frame to be used as a grounding electrode conductor or to interconnect electrodes. Interior metal water piping is not always considered a grounding electrode but Section 250.68(C)(1) permits interior metal water piping to extend the connection to an electrode. This additional proposed wording follows the similar wording presently used in sections 250.30(A)(5) and 250.30(A)(6)(2) and (3).

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Sat Aug 26 19:47:54 EDT 2017

Public Input No. 508-NFPA 70-2017 [Section No. 250.104(D)(1)]

(1) Metal Water Piping System(s).

The grounded conductor of each separately derived system shall be bonded to the nearest available point of the metal water piping system(s) in the area served by each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1) based on the largest ungrounded conductor of the separately derived system.

Exception No. 1: A separate bonding jumper to the metal water piping system shall not be required if the metal water piping system is used as ~~the~~ a grounding electrode for the separately derived system and the water piping system is in the area served. The grounding electrode conductor for the separately derived system shall not be smaller than the bonding jumper required in 250.104(D)(1).

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 connection to the grounding electrode system for a separately derived system and is bonded to the metal water piping in the area served by the separately derived system. The grounding electrode conductor for the separately derived system shall not be smaller than the bonding jumper required in 250.104(D)(1).

Statement of Problem and Substantiation for Public Input

The sizing requirement for a bonding jumper in 250.104(D) has changed and as a result, where the bonding jumper is required to be larger than a 3/0, and the grounding electrode conductor is part of the fault current path for the separately derived system, it too should be sized larger than a 3/0.

Submitter Information Verification

Submitter Full Name: John Kjome

Organization: Minneapolis JATC

Affilliation: IBEW 292

Street Address:

City:

State:

Zip:

Submittal Date: Tue Apr 11 14:34:58 EDT 2017

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

(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)~~ 66 based on the largest ungrounded conductor of the separately derived system.

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

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

Statement of Problem and Substantiation for Public Input

This PI proposes returning the text to the sizing requirements that were used since its inception in the 1978 NEC. There was no technical reason to make this change in the 2017 cycle. Proposal 108-1 (NEC 1978 edition) to modify 250-80, Bonding of Piping Systems was the original proposal that clarified the sizing requirements for this application. The applicable portion of the 1978 NEC substantiation reads “The use of Table 250-94 in part (a) is justified on basis that it would have been used to size the grounding electrode conductor to the water pipe had the pipe served as the grounding electrode and was continuous throughout the premises. It is not reasonable that it be sized in a different manner if it were not the electrode.” There has been no evidence of any problems in the field by using the sizing requirements established in the 1978 NEC.

Submitter Information Verification

Submitter Full Name:	David Hittinger
Organization:	Independent Electrical Contractors
Affilliation:	Independent Electrical Contractors Codes and Standard
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Jun 08 09:03:25 EDT 2017

Public Input No. 2811-NFPA 70-2017 [Section No. 250.104(D)(2)]

(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.

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 either used as the grounding electrode for the separately derived system or complies with section 250 .68(C)(2).

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 either used as the grounding electrode for a separately derived system or complies with section 250.68(C)(1), and is bonded to the building structural metal in the area served by the separately derived system.

Statement of Problem and Substantiation for Public Input

These revisions are needed because the recent revisions to sections 250.52(A)(2) make it clear that the metal frame of a building is not a grounding electrode if the metal is not in contact with the earth. Section 250.68(C)(2) permits the metal building frame to be used as a grounding electrode conductor or to interconnect electrodes. Interior metal water piping is not always considered a grounding electrode but Section 250.68(C)(1) permits interior metal water piping to extend the connection to an electrode. This additional proposed wording follows the similar wording presently used in sections 250.30(A)(5) and 250.30(A)(6)(2) and (3).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2803-NFPA 70-2017 [Section No. 250.104(D)(1)]	bonding of metal water piping and structural metal near separately derived systems

Submitter Information Verification

Submitter Full Name: Russ Leblanc

Organization: Leblanc Consulting Services

Street Address:

City:

State:

Zip:

Submittal Date: Sat Aug 26 20:14:40 EDT 2017

Public Input No. 512-NFPA 70-2017 [Section No. 250.104(D)(2)]

(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.

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 connection to the grounding electrode system for the separately derived system. The grounding electrode conductor for the separately derived system shall not be smaller than the bonding jumper required in 250.104(D)(2).

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~~ a grounding electrode ~~for~~ in the area served by a separately derived system and is bonded to the building structural metal in the area served by the separately derived system. The grounding electrode conductor for the separately derived system shall not be smaller than the bonding jumper required in 250.104(D)(2).

Statement of Problem and Substantiation for Public Input

The sizing requirement for a bonding jumper in 250.104(D) has changed and as a result, where the bonding jumper is required to be larger than a 3/0, and the grounding electrode conductor is part of the fault current path for the separately derived system, it too should be sized larger than a 3/0.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 508-NFPA 70-2017 [Section No. 250.104(D)(1)]	Same theory

Submitter Information Verification

Submitter Full Name: John Kjome
Organization: Minneapolis JATC
Affilliation: IBEW 292
Street Address:
City:
State:
Zip:
Submittal Date: Tue Apr 11 15:05:14 EDT 2017

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

(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)~~ 66 based on the largest ungrounded conductor of the separately derived system.

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.

Statement of Problem and Substantiation for Public Input

This PI proposes returning the text to the sizing requirements that were used since its inception in the 1978 NEC. There was no technical reason to make this change in the 2017 cycle. Proposal 108-1 (NEC 1978 edition) to modify 250-80, Bonding of Piping Systems was the original proposal that clarified the sizing requirements for this application. The applicable portion of the 1978 NEC substantiation reads "The use of Table 250-94 in part (a) is justified on basis that it would have been used to size the grounding electrode conductor to the water pipe had the pipe served as the grounding electrode and was continuous throughout the premises. It is not reasonable that it be sized in a different manner if it were not the electrode." There has been no evidence of any problems in the field by using the sizing requirements established in the 1978 NEC.

Submitter Information Verification

Submitter Full Name: David Hittinger

Organization: Independent Electrical Contractors

Affiliation: Independent Electrical Contractors Codes and Standard

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jun 08 09:04:46 EDT 2017

Public Input No. 3997-NFPA 70-2017 [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, *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, *Standard for the Installation of Lightning Protection Systems*.

<u>Informational Note No. 3 Grounding and bondng terminatons for Lightning Protection Systems shall be Listed for the purpose. See NFPA 780-2014.</u>

Statement of Problem and Substantiation for Public Input

Grounding and bonding terminations for lightning protection systems (LPS) are not standard, everyday grounding and bonding connections.
LPS connections have larger surface area, and are specifically Listed the NRTL for the specific purpose of LPS.
Misapplication in the field is a common occurrence, and if the work is not reviewed by UL, or a LPS trained AHJ, the result can be hazardous. The worst risk is to personnel, the second is to property.
This informational note will alert and guide personnel toward NFPA 780 requirements, and improve electrical safety.

Submitter Information Verification

Submitter Full Name: Michael Weitzel
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 11:53:24 EDT 2017

Public Input No. 4335-NFPA 70-2017 [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. A ground ring circumnavigating the building or structures perimeter installed in compliance with 250.52(A)(4) should be considered for all new construction in lightning prone areas.

Informational Note No. 1: See 250.60 for use of strike termination devices. For further information, see NFPA 780-2014, *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, *Standard for the Installation of Lightning Protection Systems*.

Statement of Problem and Substantiation for Public Input

Ground rings are the best protection for preventing fires from lightning strikes.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 21:57:53 EDT 2017

Public Input No. 223-NFPA 70-2017 [Section No. 250.110]

250.110 Equipment Fastened in Place (Fixed) or Connected by Permanent Wiring Methods.

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

(1) Where within 2.5 m (8 ft) vertically or 1.5 m (5 ft) horizontally of ground or grounded metal objects and subject to contact by persons

(2) Where located in a wet or damp location and not isolated

(3) Where in electrical contact with metal

(4) Where in a hazardous (classified) location as covered by Articles 500 through 517

(5) Where supplied by a wiring method that provides an equipment grounding conductor, except as permitted by 250.86, Exception No. 2, for short sections of metal enclosures

(6) Where equipment operates with any terminal at over 150 volts to ground

Exception No. 1: If exempted by special permission, the metal frame of electrically heated appliances that have the frame permanently and effectively insulated from ground shall not be required to be grounded.

Exception No. 2: Distribution apparatus, such as transformer and capacitor cases, mounted on wooden poles at a height exceeding 2.5 m (8 ft) above ground or grade level shall not be required to be grounded.

Exception No. 3: Listed equipment protected by a system of double insulation, or its equivalent, shall not be required to be connected to the equipment grounding conductor. Where such a system is employed, the equipment shall be distinctively marked.

Statement of Problem and Substantiation for Public Input

you can have equipment on the supply side that also needs bonding/grounding and the will cover both

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Master
Street Address:
City:
State:
Zip:
Submittal Date: Thu Feb 09 13:15:04 EST 2017

Public Input No. 2037-NFPA 70-2017 [Section No. 250.112(I)]

(I) Remote-Control, Signaling, and Fire Alarm Circuits.

Equipment supplied by Class 1 ~~circuits shall be grounded unless operating at less than 50 volts. Equipment supplied by Class 1 power-limited circuits, by~~ , Class 2 and Class 3 remote-control and signaling ~~circuits~~ , and ~~by~~ fire alarm ~~circuits~~ circuits shall be ~~grounded where system grounding is required by Part II or Part VIII of this article.~~ connected to the circuit equipment grounding conductor where required to be grounded in accordance with 250.20 for alternating-current systems and 250.162 for direct-current systems.

Statement of Problem and Substantiation for Public Input

Rewrite of this section so that we now know what it's about. Better to reference specific rules rather than 'parts' of Article 250 in this case.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 09 15:32:24 EDT 2017

Public Input No. 2822-NFPA 70-2017 [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.

Statement of Problem and Substantiation for Public Input

The requirement as presently written is unclear. Section 250.118 identifies 14 different options for types of equipment grounding conductors and only one of them, the wire type in 250.118(1) is sized to 250.122. There is nothing in 250.122 that relates to the sizing of raceways, wireways, AC cable, and similar "raceway" type equipment grounding conductors. The revised text makes it clear that whatever equipment grounding conductor from 250.118 that is used must be connected and then further states that wire type equipment grounding conductors when used are to be sized in accordance with 250.122.

Submitter Information Verification

Submitter Full Name: Charles Mello

Organization: Cdcmello Consulting Llc

Street Address:

City:

State:

Zip:

Submittal Date: Sun Aug 27 17:57:42 EDT 2017

Public Input No. 1200-NFPA 70-2017 [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, normally non–current-carrying metal parts of cord-and-plug-connected equipment shall be connected to the equipment grounding conductor.

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: Motors, where guarded, shall not be required to be connected to an equipment grounding conductor.

Exception No. 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:

- (4) Refrigerators, freezers, and air conditioners
- (5) Clothes-washing, clothes-drying, dish-washing machines; ranges; kitchen waste disposers; information technology equipment; sump pumps and electrical aquarium equipment
- (6) Hand-held motor-operated tools, stationary and fixed motor-operated tools, and light industrial motor-operated tools
- (7) Motor-operated appliances of the following types: hedge clippers, lawn mowers, snow blowers, and wet scrubbers
- (8) Portable handlamps , and portable luminaires.

(9) In other than residential occupancies:

- (10) Refrigerators, freezers, and air conditioners
- (11) Clothes-washing, clothes-drying, dish-washing machines; information technology equipment; sump pumps and electrical aquarium equipment
- (12) Hand-held motor-operated tools, stationary and fixed motor-operated tools, and light industrial motor-operated tools
- (13) Motor-operated appliances of the following types: hedge clippers, lawn mowers, snow blowers, and wet scrubbers
- (14) Portable handlamps , and portable luminaires.
- (15) Cord-and-plug-connected appliances used in damp or wet locations or by persons standing on the ground or on metal floors or working inside of metal tanks or boilers
- (16) Tools likely to be used in wet or conductive locations

  Exception: Tools and portable handlamps 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.

Statement of Problem and Substantiation for Public Input

Portable handlamps were originally covered by UL 298, titled "Portable Electric Hand Lamps". UL 298 was withdrawn in 2004, and has been superceded by UL 153, titled "Portable Electric Luminaires". Devices that were once called "Portable Handlamp" on their label are now being labeled as "Portable Luminaire", but are the same product. Therefore, 3(e) and 4(e) should include "portable luminaires" to continue to cover the grounding need for these products.

Submitter Information Verification

Submitter Full Name: Michael Kovacic

Organization: ES Squared Inc

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jul 20 17:25:50 EDT 2017

Public Input No. 1382-NFPA 70-2017 [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:

  (6) The conduit is terminated in listed fittings.

  (7) The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

  (8) The size of the conduit does not exceed metric designator 35 (trade size 1 1⁄4).

  (9) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

  (10) 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 equipment grounding conductor shall be installed.

(11) Listed liquidtight flexible metal conduit meeting all the following conditions:

  (12) The conduit is terminated in listed fittings.

  (13) For metric designators 12 through 16 (trade sizes 3⁄8 through 1⁄2), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

  (14) For metric designators 21 through 35 (trade sizes 3⁄4 through 1 1⁄4), 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 3⁄8 through 1⁄2) in the ground-fault current path.

  (15) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

  (16) 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 equipment grounding conductor shall be installed.

(17) Flexible metallic tubing where the tubing is terminated in listed fittings and meeting the following conditions:

  (18) The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.

  (19) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(20) Armor of Type AC cable as provided in 320.108.

(21) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.

(22) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

  (23) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118 (1).

  (24) 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

(25) 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

(26) Cable trays as permitted in 392.10 and 392.60.

(27) Cablebus framework as permitted in 370.60(1).

(28) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(29) Surface metal raceways listed for grounding.

(30) Metallic cabinets, cutout, outlet, device, pull and junction boxes and conduit bodies.

Informational Note: For a definition of *Effective Ground-Fault Current Path*, see Article 100.

Statement of Problem and Substantiation for Public Input

There are a number of places where code rules require that various items that are physically attached to cabinets, cutout, outlet, device pull and junction boxes, and conduit bodies comply with the grounding requirements of 250.110. The requirement in 250.110 is that these items be connected to an Equipment Grounding Conductor. Where boxes and conduit bodies are used the associated covers are required to comply with 250.110. If the boxes and conduit bodies are not listed in 250.118 as Equipment Grounding Conductors, we would be required to use a wire bonding jumper to connect the covers to an EGC. This is not being done in the field, but is what the code currently requires. The same applies where we are using a metallic raceway as the Equipment Grounding conductor and we connect those raceways to a metallic enclosure....we use the metallic enclosure to extend the EGC to the raceway that leaves the enclosure, yet there is nothing in the code that actually permits that. The metallic enclosures need to appear in 250.118, so that they can be used as EGCs.

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jul 27 14:55:55 EDT 2017

Public Input No. 2515-NFPA 70-2017 [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:

  (6) The conduit is terminated in listed fittings.

  (7) The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

  (8) The size of the conduit does not exceed metric designator 35 (trade size 1 1⁄4).

  (9) 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).

  (10) 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 equipment grounding conductor shall be installed.

(11) Listed liquidtight flexible metal conduit meeting all the following conditions:

  (12) The conduit is terminated in listed fittings.

  (13) For metric designators 12 through 16 (trade sizes 3⁄8 through 1⁄2), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

  (14) For metric designators 21 through 35 (trade sizes 3⁄4 through 1 1⁄4), 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 3⁄8 through 1⁄2) in the effective ground-fault current path.

  (15) 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).

  (16) 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 equipment grounding conductor shall be installed.

(17) Flexible metallic tubing where the tubing is terminated in listed fittings and meeting the following conditions:

  (18) The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.

  (19) 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).

(20) Armor of Type AC cable as provided in 320.108.

(21) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.

(22) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

  (23) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118 (1).

  (24) 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

(25) 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

(26) Cable trays as permitted in 392.10 and 392.60.

(27) Cablebus framework as permitted in 370.60(1).

(28) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(29) Surface metal raceways listed for grounding.

Informational Note: For a definition of *Effective Ground-Fault Current Path*, see Article 100.

Statement of Problem and Substantiation for Public Input

The modified text, at the time of this writing, did not reflect my suggested changes. The changes are simply this: change 'ground-fault current path' to 'effective ground-fault current path' in all occurrences in this section. This is in (5)d, (6)c, (6)d, and (7)b. Further down in this section, in the MC section, the phrase 'effective ground-fault current path' is already used. And, the informational note refers to the 'effective ground-fault current path.'

This is a companion PI to one that recommends deleting the definition of "ground-fault current path" in article 100. An "effective ground-fault current path" is one that is intentionally constructed. All of the wiring methods above are intentionally constructed.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2159-NFPA 70-2017 [Definition: Ground-Fault Current Path.]	With the addition of 'effective' to these sections, the definition in article 100 is no longer needed.

Submitter Information Verification

Submitter Full Name: Eric Stromberg

Organization: Los Alamos National Laboratory

Affilliation: Self

Street Address:

City:

State:

Zip:

Submittal Date: Sat Aug 19 19:21:09 EDT 2017

Public Input No. 2584-NFPA 70-2017 [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:

- (6) The conduit is terminated in listed fittings.
- (7) The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
- (8) The size of the conduit does not exceed metric designator 35 (trade size 1 1⁄4).
- (9) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).
- (10) 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 equipment grounding conductor shall be installed.

(11) Listed liquidtight flexible metal conduit meeting all the following conditions:

- (12) The conduit is terminated in listed fittings.
- (13) For metric designators 12 through 16 (trade sizes 3⁄8 through 1⁄2), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
- (14) For metric designators 21 through 35 (trade sizes 3⁄4 through 1 1⁄4), 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 3⁄8 through 1⁄2) in the ground-fault current path.
- (15) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).
- (16) 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 equipment grounding conductor shall be installed.

(17) Flexible metallic tubing where the tubing is terminated in listed fittings and meeting the following conditions:

- (18) The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.
- (19) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(20) Armor of Type AC cable as provided in 320.108.

(21) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.

(22) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

- (23) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118 (1).
- (24) 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

(25) 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

(26) Cable trays as permitted in 392.10 and 392.60.

(27) Cablebus framework as permitted in 370.60(1).

(28) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(29) Surface metal raceways listed for grounding.

(30) Metal enclosures connected to an equipment grounding conductor.

Informational Note: For a definition of *Effective Ground-Fault Current Path*, see Article 100.

Statement of Problem and Substantiation for Public Input

Add item (15) Metal enclosures connected to an equipment grounding conductor.
This is to make it clear that the EGC includes metal enclosures, such as outlet boxes, disconnects, transformers, etc.

Submitter Information Verification

Submitter Full Name:	Mike Holt
Organization:	Mike Holt Enterprises Inc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 21 11:43:58 EDT 2017

Public Input No. 2823-NFPA 70-2017 [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:

(6) The conduit is terminated in listed fittings.

(7) The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

(8) The size of the conduit does not exceed metric designator 35 (trade size 1 1/4).

(9) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(10) 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 equipment~~

a. a wire type equipment grounding conductor shall be installed.

(11) Listed liquidtight flexible metal conduit meeting all the following conditions:

(12) The conduit is terminated in listed fittings.

(13) For metric designators 12 through 16 (trade sizes 3/8 through 1/2), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

(14) For metric designators 21 through 35 (trade sizes 3/4 through 1 1/4), 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 3/8 through 1/2) in the ground-fault current path.

(15) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(16) 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 equipment~~

a. a wire type equipment grounding conductor shall be installed.

(17) Flexible metallic tubing where the tubing is terminated in listed fittings and meeting the following conditions:

(18) The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.

(19) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(20) Armor of Type AC cable as provided in 320.108.

(21) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.

(22) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

(23) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118 (1).

(24) 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

(25) 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

(26) Cable trays as permitted in 392.10 and 392.60.

(27) Cablebus framework as permitted in 370.60(1).

(28) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(29) Surface metal raceways listed for grounding.

Informational Note: For a definition of *Effective Ground-Fault Current Path*, see Article 100.

Statement of Problem and Substantiation for Public Input

The present wording is unclear. To say that flexible metal conduit or liquidtight flexible metal conduit , which can be an equipment grounding conductor itself, needs another equipment grounding conductor generically if used for flexibility makes no sense. How would one install EMT in this flexible metal conduit since EMT is one of the permitted equipment grounding conductors that is now generically referenced. The intent of the requirement is to have a wire type equipment grounding conductor installed in the flexible raceway where the required flexibility condition exists. The revised text makes adds the necessary clarity to the requirement for what is intended.

Note to NFPA staff. There are only slight text changes made to 250.118(5)(e) and 250.118(6)(e) where the TerraView is showing the whole section to be underlined as new text. Also the list format is incorrect adding a new (a) under the (e).

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: Cdcmello Consulting Llc
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 27 18:03:53 EDT 2017

Public Input No. 2979-NFPA 70-2017 [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:

- (6) The conduit is terminated in listed fittings.
- (7) The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
- (8) The size of the conduit does not exceed metric designator 35 (trade size 1 $^{1}/_{4}$).
- (9) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).
- (10) 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 equipment grounding conductor shall be installed.

(11) Listed liquidtight flexible metal conduit meeting all the following conditions:

- (12) The conduit is terminated in listed fittings.
- (13) For metric designators 12 through 16 (trade sizes $^{3}/_{8}$ through $^{1}/_{2}$), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
- (14) For metric designators 21 through 35 (trade sizes $^{3}/_{4}$ through 1 $^{1}/_{4}$), 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 $^{3}/_{8}$ through $^{1}/_{2}$) in the ground-fault current path.
- (15) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).
- (16) 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 equipment grounding conductor shall be installed.

(17) Flexible metallic tubing where the tubing is terminated in listed fittings and meeting the following conditions:

- (18) The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.
- (19) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(20) Armor of Type AC cable as provided in 320.108.

(21) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.

(22) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

- (23) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118 (1).
- (24) 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

(25) _ 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

(26) Cable trays as permitted in 392.10 and 392.60.

(27) Cablebus framework as permitted in 370.60(1).

(28) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(29) Surface metal raceways listed for grounding.

(30) Listed metal boxes, conduit bodies, cabinets, cutout boxes, meter socket enclosures, and other listed metal encosures.

Informational Note: For a definition of *Effective Ground-Fault Current Path*, see Article 100.

Additional Proposed Changes

File Name	Description	Approved
DSCF6397.JPG	Metal cabinets and boxes	✓
081.JPG	metal junction box	✓
086.JPG	metal pull box	✓
058.JPG	metal junction box	✓

Statement of Problem and Substantiation for Public Input

This new item #15 is needed to clarify that metal boxes, cabinets and other metal enclosures are permitted to be used for grounding and bonding of metal raceways, metal cables, and other metal equipment that is connected to the metal box, cabinet or enclosure. For example, when installing 2 AC cables into a metal box, the grounding connection between the 2 cables is ultimately established by connecting the cables to the metal box, but there is no section in the code that specifically permits using the metal box as the equipment grounding conductor, even though that is actually what is being done. We could say the same thing when using EMT, RMC or other metal raceways that are permitted to be used as an equipment grounding conductor. If no green or bare equipment grounding wire is installed in the raceway, then grounding/bonding connections are ultimately being established to the EMT or RMC via the metal cabinets or the metal boxes to which the raceways are connected. The code should specifically recognize this practice, otherwise it could be considered a violation if bonding bushings and bonding jumpers were not used for bonding raceway to raceway, raceway to equipment grounding terminal bar, cable to cable, or cable to equipment grounding terminal bar, etc. etc. when connecting these wiring methods to metal cabinets, boxes etc.

Submitter Information Verification

Submitter Full Name: Russ Leblanc

Organization: Leblanc Consulting Services

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 30 06:52:49 EDT 2017

Copyright Assignment

I, Russ Leblanc, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Russ Leblanc, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature


SQUARE D


TO BUILDING "H"
TO BUILDING "H"
TO BUILDING "H"
TO BUILDING "H"
TO BUILDING "F&G"

Public Input No. 316-NFPA 70-2017 [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~~ , or equivalent copper clad steel 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:

- (6) The conduit is terminated in listed fittings.
- (7) The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
- (8) The size of the conduit does not exceed metric designator 35 (trade size 1 $^{1}/_{4}$).
- (9) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).
- (10) 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 equipment grounding conductor shall be installed.

(11) Listed liquidtight flexible metal conduit meeting all the following conditions:

- (12) The conduit is terminated in listed fittings.
- (13) For metric designators 12 through 16 (trade sizes $^{3}/_{8}$ through $^{1}/_{2}$), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
- (14) For metric designators 21 through 35 (trade sizes $^{3}/_{4}$ through 1 $^{1}/_{4}$), 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 $^{3}/_{8}$ through $^{1}/_{2}$) in the ground-fault current path.
- (15) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).
- (16) 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 equipment grounding conductor shall be installed.

(17) Flexible metallic tubing where the tubing is terminated in listed fittings and meeting the following conditions:

- (18) The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.
- (19) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(20) Armor of Type AC cable as provided in 320.108.

(21) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.

(22) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

- (23) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118 (1).
- (24) 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

(25) 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

(26) Cable trays as permitted in 392.10 and 392.60.

(27) Cablebus framework as permitted in 370.60 (1).

(28) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(29) Surface metal raceways listed for grounding.

Informational Note: For a definition of *Effective Ground-Fault Current Path*, see Article 100.

Statement of Problem and Substantiation for Public Input

For campus type electrical distribution system, solar farms, and wind farms it is very common to utilize an equivalently sized copper clad steel ground conductor versus copper due to cost and also for theft deterrence. All types of available ground conductors should be added to the list or the paragraph should be revised to just remove the list and refer to ground conductors having equivalent current carrying capacity properties as those listed in table 250.122.

Submitter Information Verification

Submitter Full Name: Douglas Mutcher

Organization: Westwood Professional Services

Street Address:

City:

State:

Zip:

Submittal Date: Fri Mar 03 11:35:00 EST 2017

Public Input No. 3205-NFPA 70-2017 [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:

(6) The conduit is terminated in listed fittings.

(7) The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

(8) The size of the conduit does not exceed metric designator 35 (trade size 1 1⁄4).

(9) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(10) 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 equipment grounding conductor shall be installed.

(11) Listed liquidtight flexible metal conduit meeting all the following conditions:

(12) The conduit is terminated in listed fittings.

(13) For metric designators 12 through 16 (trade sizes 3⁄8 through 1⁄2), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

(14) For metric designators 21 through 35 (trade sizes 3⁄4 through 1 1⁄4), 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 3⁄8 through 1⁄2) in the ground-fault current path.

(15) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(16) 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 equipment grounding conductor shall be installed.

(17) Flexible metallic tubing where the tubing is terminated in listed fittings and meeting the following conditions:

(18) The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.

(19) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(20) Armor of Type AC cable as provided in 320.108.

(21) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.

(22) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

(23) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118 (1).

(24) 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

(25) 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

(26) Cable trays as permitted in 392.10 and 392.60.

(27) Cablebus framework as permitted in 370.60(1).

(28) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(29) Surface metal raceways listed for grounding.

(30) Enclosures, boxes, and fittings that are listed for use as an effective ground-fault current path.

Informational Note: For a definition of *Effective Ground-Fault Current Path*, see Article 100.

Statement of Problem and Substantiation for Public Input

Currently, boxes are not considered an equipment grounding conductor. Light switch yokes, however, must be connected to an equipment grounding conductor. If the raceway is the EGC, and a 10-32 pigtail is used to connect the light switch yoke to the box, Code requirements have not technically been met.

Submitter Information Verification

Submitter Full Name:	Eric Stromberg
Organization:	Los Alamos National Laboratory
Affilliation:	Self
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Sep 03 18:54:35 EDT 2017

Public Input No. 3742-NFPA 70-2017 [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. (see Article 344)

(3) Intermediate metal conduit. (see Article 342)

(4) Electrical metallic tubing.(see Article 358)

(5) Listed flexible metal conduit meeting all the following conditions:

> (6) The conduit is terminated in listed fittings.
>
> (7) The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
>
> (8) The size of the conduit does not exceed metric designator 35 (trade size $1\frac{1}{4}$).
>
> (9) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).
>
> (10) 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 equipment grounding conductor shall be installed.

(11) Listed liquidtight flexible metal conduit meeting all the following conditions:

> (12) The conduit is terminated in listed fittings.
>
> (13) For metric designators 12 through 16 (trade sizes $\frac{3}{8}$ through $\frac{1}{2}$), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
>
> (14) For metric designators 21 through 35 (trade sizes $\frac{3}{4}$ through $1\frac{1}{4}$), 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 $\frac{3}{8}$ through $\frac{1}{2}$) in the ground-fault current path.
>
> (15) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).
>
> (16) 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 equipment grounding conductor shall be installed. (see Article 356)

(17) Flexible metallic tubing where the tubing is terminated in listed fittings and meeting the following conditions:

> (18) The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.
>
> (19) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft). (See Article 360)

(20) Armor of Type AC cable as ~~provided in~~ permitted in 320.108.

(21) The copper sheath of mineral-insulated, metal-sheathed cable Type MI. (see Article 332)

(22) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

> (23) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118 (1).
>
> (24) 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

(25) 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

(26) Cable trays as permitted in 392.10 and 392.60.

(27) Cablebus framework as permitted in 370.60(1).

(28) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(29) Surface metal raceways listed for grounding.

Informational Note: For a definition of *Effective Ground-Fault Current Path*, see Article 100.

Statement of Problem and Substantiation for Public Input

(see Article xxx) in the selected sections provide ease of access/reference, ease of proper installation, and ease of enforcement. Can be built upon and applied to other complex articles, if applicable.

Submitter Information Verification

Submitter Full Name: Brian Sukhoo

Organization: IBEW

Affilliation: Electricians Local #25

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 19:31:35 EDT 2017

Public Input No. 4178-NFPA 70-2017 [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. Exception: An insulated equipment grounding conductor routed with the circuit ungrounded conductors shall be installed in all non-threaded metal raceways on rooftops. The equipment grounding conductor shall be sized in accordance with Section 250.122.

(5) Listed flexible metal conduit meeting all the following conditions:

- (6) The conduit is terminated in listed fittings.
- (7) The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
- (8) The size of the conduit does not exceed metric designator 35 (trade size 1 1⁄4).
- (9) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).
- (10) 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 equipment grounding conductor shall be installed.

(11) Listed liquidtight flexible metal conduit meeting all the following conditions:

- (12) The conduit is terminated in listed fittings.
- (13) For metric designators 12 through 16 (trade sizes 3⁄8 through 1⁄2), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.
- (14) For metric designators 21 through 35 (trade sizes 3⁄4 through 1 1⁄4), 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 3⁄8 through 1⁄2) in the ground-fault current path.
- (15) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).
- (16) 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 equipment grounding conductor shall be installed.

(17) Flexible metallic tubing where the tubing is terminated in listed fittings and meeting the following conditions:

- (18) The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.
- (19) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(20) Armor of Type AC cable as provided in 320.108.

(21) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.

(22) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

- (23) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118 (1).

(24) 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

(25) 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

(26) Cable trays as permitted in 392.10 and 392.60.

(27) Cablebus framework as permitted in 370.60(1).

(28) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(29) Surface metal raceways listed for grounding.

Informational Note: For a definition of *Effective Ground-Fault Current Path*, see Article 100.

Statement of Problem and Substantiation for Public Input

When non threaded joints come loose, for whatever reason, safety to personnel is often compromised.
I know of at least 3 electricians that have been shocked by touching metallic raceways or equipment on a rooftop where there was an undetected ground fault. The requirement for an EGC installed outdoors in wet locations for non-threaded metal raceways was adopted years ago by the State of Washington, and still resides in state electrical law.
CMP 11 added a requirement to the 2017 NEC in Section 440.9 that an insulated equipment grounding conductor be installed in all non-threaded metal raceways serving HVAC equipment. The requirement should include all rooftop loads.
This is a personnel safety issue, nothing else.

Submitter Information Verification

Submitter Full Name: Michael Weitzel
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 15:56:36 EDT 2017

Public Input No. 505-NFPA 70-2017 [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. Where electrical metallic tubing is installed on roof tops, an equipment grounding conductor, of the wire type, shall be provided within the raceway.

(5) Listed flexible metal conduit meeting all the following conditions:

 (6) The conduit is terminated in listed fittings.

 (7) The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

 (8) The size of the conduit does not exceed metric designator 35 (trade size 1 1/4).

 (9) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

 (10) 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 equipment grounding conductor shall be installed.

(11) Listed liquidtight flexible metal conduit meeting all the following conditions:

 (12) The conduit is terminated in listed fittings.

 (13) For metric designators 12 through 16 (trade sizes 3/8 through 1/2), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

 (14) For metric designators 21 through 35 (trade sizes 3/4 through 1 1/4), 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 3/8 through 1/2) in the ground-fault current path.

 (15) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

 (16) 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 equipment grounding conductor shall be installed.

(17) Flexible metallic tubing where the tubing is terminated in listed fittings and meeting the following conditions:

 (18) The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.

 (19) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(20) Armor of Type AC cable as provided in 320.108.

(21) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.

(22) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

 (23) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118 (1).

 (24) 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

(25) 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

(26) Cable trays as permitted in 392.10 and 392.60.

(27) Cablebus framework as permitted in 370.60(1).

(28) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(29) Surface metal raceways listed for grounding.

Informational Note: For a definition of *Effective Ground-Fault Current Path*, see Article 100.

Additional Proposed Changes

File Name	Description	Approved
Cole_Conduit_photo_1.jpg	Conduit photo 1	✓
Cole_Conduit_photo_2.jpg	Conduit photo 2	✓

Statement of Problem and Substantiation for Public Input

Conduits installed per code over a period of time are stepped on, moved for re-roofing jobs, abused because of snow removal, etc. This supplemental ground would ensure that continuity will be maintained if and when the conduit separates. There are many instances where the conduit has separated and the hot wire insulation has been compromised thus energizing the conduit. Reaching down and attempting to put the conduit back together can cause a current path through the heart. From our own experience we have seen this happen and only because of proper safety practices has disaster been avoided. Through polling of our association members, over 50% say they have encountered this situation. This is subjecting installers to unnecessary hazards. Numerous state codes now require a supplemental ground in any conduit running across a roof and some require the ground in any EMT system that is subjected to a wet environment. The argument that this type of raceway system should not have been installed because it is exposed to damage does not take into account that these systems have been installed on roofs for many years and is an accepted industry practice. Code Panel 11 passed a similar proposal for the 2017 NEC code cycle by adding 440.9 for HVAC and similar equipment located on a roof. This is a safety issue that needs to be addressed.

There are two photos of EMT separated to illustrate why a wire type equipment ground should be required.

Please note that the only change being submitted is to 250.118(4). Please disregard underlining in other sections as that is a Terraview issue.

Submitter Information Verification

Submitter Full Name:	David Hittinger
Organization:	Independent Electrical Contractors
Affilliation:	Independent Electrical Contractors Codes and Standard
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Apr 10 18:52:58 EDT 2017

Copyright Assignment

I, David Hittinger, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am David Hittinger, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 761-NFPA 70-2017 [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:

 (6) The conduit is terminated in listed fittings.

 (7) The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

 (8) The size of the conduit does not exceed metric designator 35 (trade size 1 1⁄4).

 (9) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

 (10) 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 equipment grounding conductor shall be installed.

(11) Listed liquidtight flexible metal conduit meeting all the following conditions:

 (12) The conduit is terminated in listed fittings.

 (13) For metric designators 12 through 16 (trade sizes 3⁄8 through 1⁄2), the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.

 (14) For metric designators 21 through 35 (trade sizes 3⁄4 through 1 1⁄4), 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 3⁄8 through 1⁄2) in the ground-fault current path.

 (15) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

 (16) 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 equipment grounding conductor shall be installed.

(17) Flexible metallic tubing where the tubing is terminated in listed fittings and meeting the following conditions:

 (18) The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.

 (19) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current path does not exceed 1.8 m (6 ft).

(20) Armor of Type AC cable as provided in 320.108.

(21) The copper sheath of mineral-insulated, metal-sheathed cable Type MI.

(22) Type MC cable that provides an effective ground-fault current path in accordance with one or more of the following:

 (23) It contains an insulated or uninsulated equipment grounding conductor in compliance with 250.118 (1).

 (24) 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

(25) _ 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

(26) Cable trays as permitted in 392.10 and 392.60.

(27) Cablebus framework as permitted in 370.60(1).

(28) Other listed electrically continuous metal raceways and listed auxiliary gutters.

(29) Surface metal raceways listed for grounding.

(30) Metallic equipment enclosures.

Informational Note: For a definition of *Effective Ground-Fault Current Path*, see Article 100.

Statement of Problem and Substantiation for Public Input

Note: the proposed change in this public input is simply to add an additional item to the list in 250.118, namely "(15) Metallic equipment enclosures". For me, the TerraView software is showing additional changes in the "markup view" of the edited text, namely an incorrect renumbering of the entire list. When I turn off "markup view", the proper numbering is retained.

There is currently a conflict between 250.118, the definition of Equipment Grounding Conductor, and common practice.

When using an equipment grounding conductor not of the wire type, such as rigid metal conduit, common practice is to rely on metallic equipment enclosures, such as a panelboard cabinet, to provide continuity for the "ground-fault current path" between sections of conduit. As such, per the Article 100 definition, metallic equipment enclosures are Equipment Grounding Conductors. And they certainly "enclose circuit conductors", so they fall under the scope of 250.118. However, the list in 250.118 does not presently include metallic equipment enclosures.

The simplest way to resolve this logical conflict would be to add an additional item to the list, "(15) Metallic equipment enclosures." If the Technical Committee prefers, the scope of 250.118 could instead be limited to equipment grounding conductors run with or enclosing circuit conductors "between equipment enclosures."

Submitter Information Verification

Submitter Full Name: Wayne Whitney
Organization: None
Affilliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 18 13:34:52 EDT 2017

Public Input No. 1743-NFPA 70-2017 [Section No. 250.119 [Excluding any Sub-Sections]]

Unless required elsewhere in this *Code,* equipment grounding conductors shall be permitted to be bare, covered, or insulated. Individually covered or insulated equipment grounding conductors shall have a continuous outer finish that is either green or green with one or more yellow stripes except as permitted in this section. Conductors with insulation or individual covering that is green, green with one or more yellow stripes, or otherwise identified as permitted by this section shall not be used for ungrounded or grounded circuit conductors.

Exception No. 1: Power-limited Class 2 or Class 3 cables <u>installed in compliance with Part III of Article 725</u> , power-limited fire alarm cables ~~, or communications cables containing only circuits operating at less than 50 volts where connected to equipment not required to be grounded in accordance with 250.112(I) shall~~ <u>installed in compliance with part III of Article 760, and communications cables installed in compliance with 725.154(A), 760.154(A) or Part V of Article 800 shall</u> be permitted to use a conductor with green insulation or green with one or more yellow stripes for other than equipment grounding purposes.

Exception No. 2: Flexible cords having an integral insulation and jacket without an equipment grounding conductor shall be permitted to have a continuous outer finish that is green.

Informational Note: An example of a flexible cord with integral-type insulation is Type SPT-2, 2 conductor.

Exception No. 3: Conductors with green insulation shall be permitted to be used as ungrounded signal conductors where installed between the output terminations of traffic signal control and traffic signal indicating heads. Signaling circuits installed in accordance with this exception shall include an equipment grounding conductor in accordance with 250.118. Wire-type equipment grounding conductors shall be bare or have insulation or covering that is green with one or more yellow stripes.

Statement of Problem and Substantiation for Public Input

Class 2, Class 3, power-limited fire alarm and communications cables all have a color code that includes green wires. These green wires are not intended for grounding; they are signal wires.
It is inappropriate to limit the voltage to 50 volts as contained in the original text. Class 2 and Class 3 circuits may operate at voltages exceeding 50 volts. Introduction of Power over Ethernet (PoE) requirements into the NEC 2017 Edition permits a voltage of 60 volts on communications conductors.
References to specific sections of Articles 725, 760 and 800 are added to clarify the application of Exception No. 1.

Submitter Information Verification

Submitter Full Name: James Brunssen
Organization: Telcordia Technologies Ericss
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 03 17:22:53 EDT 2017

Public Input No. 2784-NFPA 70-2017 [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.

Statement of Problem and Substantiation for Public Input

There is no logical reason why the requirement "Where the conditions of maintenance and supervision ensure that only qualified persons service the installation" exists for re-identifying conductors of a multi-conductor cable. No such requirement exists for reidentifying conductors sized 6 AWG or smaller in 200.6(A) or for conductors sized 4 AWG or larger in 200.6(B). No such requirement exists in 200.6(D) for reidentifying conductors of different systems that are installed in a raceway, cable, box, auxiliary gutter, or other type of enclosure.
Section 210.7(C)(1), which covers the use of conductors in (multiconductor) cables with insulation that identifies them as grounded conductors, permits conductor insulations to be reidentified to indicate its use. Specific instructions are given for such reidentification. In addition, specific requirements are provided for use of reidentified conductors for switch loops. This reidentification of conductor insulation is permitted without a requirement for qualified persons in qualified occupancies.
No such requirement exists in 210.5(C) for branch circuits for "Where the conditions of maintenance and supervision ensure that only qualified persons service the installation" only qualified persons perform these identification tasks.
The identification of the grounded conductor in feeders simply refers back to 200.6 without additional requirement.
Extensive requirements exist in 215.12 for identification of equipment grounding conductors and for ungrounded conductors. No requirement exists for such tasks to be performed by only qualified persons in qualifying facilities.
General requirements for identification of conductors is found in 310.110. There is no requirement for identification "Where the conditions of maintenance and supervision ensure that only qualified persons service the installation" in Article 310.
General requirements for identifying equipment grounding conductors are found in 250.119. As found in 250.119(A), re-identification of conductors 4 AWG or larger can be performed by anyone without restriction.
Many other sections of the NEC permit or require identification. So far as this submitter can determine, 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.
A companion public input intends to correct 200.6(E).

Related Public Inputs for This Document

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

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 25 19:53:06 EDT 2017

Copyright Assignment

Public Input No. 550-NFPA 70-2017 [Section No. 250.120(A)]

<u>(A)</u> Raceway, Cable Trays, Cable Armor, Cablebus, or Cable Sheaths.

Where it consists of a raceway, cable tray, cable armor, cablebus framework, or cable sheath or where it is a wire within a raceway or cable, it shall be installed in accordance with the applicable provisions in this *Code* using fittings for joints and terminations approved for use with the type raceway or cable used. All connections, joints, and fittings shall be made tight using suitable tools.

<u>*Exception: Where metallic raceways are installed outdoors on a roof, an equipment grounding conductor of the wire type shall be installed in outdoor portions of the raceway systems that use non-threaded fittings.*</u>

Informational Note: See the UL guide information on FHIT systems for equipment grounding conductors installed in a raceway that are part of an electrical circuit protective system or a fire-rated cable listed to maintain circuit integrity.

Statement of Problem and Substantiation for Public Input

This change aligns other code sections (see 440.9) and improves safety of the electrical equipment ground fault return path. Due to the nature of building construction, roof top raceways are constantly relocated, bumped, moved, damaged and separated at fittings during the lifetime of the system installation. This will insure the continued effective path back to the electrical source to facilitate the overcurrent device.

Submitter Information Verification

Submitter Full Name: Kyle Rood

Organization: POP

Street Address:

City:

State:

Zip:

Submittal Date: Mon Apr 17 14:10:43 EDT 2017

Public Input No. 2797-NFPA 70-2017 [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. Bare conductors shall not ~~come~~ be installed in direct contact with masonry or the earth or where subject to conditions corrosive ~~conditions~~ to the conductor metal . Aluminum or copper-clad aluminum conductors shall not be terminated within 450 mm (18 in.) of ~~the earth~~ bare earth where installed outside of a building, structure or enclosure .

Statement of Problem and Substantiation for Public Input

This clarifies the termination limitations for aluminum and copper-clad aluminum conductors under the conditions specified in the text. Covered conductors are explicitly permitted for aluminum and copper-clad aluminum equipment grounding conductors in 250.118 and should be included in 250.120 to avoid correlation issues. Terminations made inside equipment and enclosures that are suitable for outdoor installation do not require additional termination restrictions.

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submittal Date: Sat Aug 26 13:58:03 EDT 2017

Public Input No. 2857-NFPA 70-2017 [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.~~
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.

(3) Aluminum or copper-clad aluminum conductors external to buildings or enclosures shall not be terminated within

~~450 mm~~
450 mm (

~~18 in~~
18 in .) of the earth , unless insulated . The termination shall be listed as a sealed wire-connector system.

Statement of Problem and Substantiation for Public Input

This public input is a continuation of SR1222 from the 2017 NEC cycle that the panel agreed to but had to ballot negative due to a term error discovered at the time of balloting. The proposed text in this public input removed the term "or covered" in list item 1 that is incorrect for this condition. The section is restructured into a list format for clarity to show the three options and requirements. The interior of outdoor rated equipment is considered a dry location in accordance with the applicable UL and IEEE standards, therefore aluminum terminations within these rated enclosures are not subject to exposure to the earth and related corrosive conditions. AHJs are rejecting installations in this type of equipment, even when there is a concrete pad, where there is not a problem. In addition, the allowance is provided for aluminum connections to be made outdoors or or outside rated enclosures as long as it is done with a listed sealed wiring connector. There are standards for this listing and while none exist at this time, this allowance will permit manufacturers to develop and list connectors as the market demands. This is a permissive allowance and not a requirement so the lack of having a product on the market at this time is not substantiation to not permit this allowance.

Submitter Information Verification

Submitter Full Name: Charles Mello

Organization: Cdcmello Consulting Llc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 28 13:04:27 EDT 2017

Copyright Assignment

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Public Input No. 2861-NFPA 70-2017 [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.~~
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. Where 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~~
450 mm (

~~18 in~~
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.

Statement of Problem and Substantiation for Public Input

This public input is a continuation of SR 1222 from the 2017 NEC cycle that the panel agreed to but had to ballot negative due to a term error discovered at the time of balloting. The proposed text in this public input removed the term "or covered" in list item 1 that is incorrect for this condition. The section is restructured into a list format for clarity to show the three options and requirements. AHJs in some parts of the country have rejected installations of aluminum conductors where terminated on aluminum equipment grounding busbars because the termination was less than 18 inches above the concrete slab or pad at the bottom of the equipment. The additional text in list item (2) is to clarify that a concrete bottom on open bottom equipment is not to be considered as earth for application of these requirements. The interior of outdoor rated equipment is considered a dry location in accordance with the applicable UL and IEEE standards, therefore aluminum terminations within these rated enclosures are not subject to exposure to the earth and related corrosive conditions. In addition, the allowance is provided for aluminum connections to be made outdoors or or outside rated enclosures as long as it is done with a listed sealed wiring connector. There are standards for this listing and while none exist at this time, this allowance will permit manufacturers to develop and list connectors as the market demands. This is a permissive allowance and not a requirement so the lack of having a product on the market at this time is not substantiation to not permit this allowance

Submitter Information Verification

Submitter Full Name:	Charles Mello
Organization:	Cdcmello Consulting Llc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 28 13:21:52 EDT 2017

Copyright Assignment

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

(B) Aluminum and Copper-Clad Aluminum Conductors.

Equipment grounding conductors of bare or insulated aluminum or copper-clad aluminum shall be permitted. Bare conductors shall not come in direct contact with masonry or the earth or where subject to corrosive conditions. Aluminum or copper-clad aluminum conductors shall not be terminated within 450 mm (18 in.) of the earth.

<u>Exception; Sealed wire connector systems listed and identified for direct burial shall be permitted to terminate AL and CU-clad AL conductors within 450 mm (18 in.) of the earth.</u>

Statement of Problem and Substantiation for Public Input

if a product is approve for this purpose is should be allowed. there is no prohibition to splice an equipment grounding conductor in a submerged application using a listed sealed wire connector. lets have the same allowance for the 18 inch or less application.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi

Organization: Master electrician

Street Address:

City:

State:

Zip:

Submittal Date: Sun Sep 03 09:59:26 EDT 2017

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

(B) Aluminum and Copper-Clad Aluminum Conductors.

Equipment grounding conductors of bare or insulated aluminum or copper-clad aluminum shall be permitted. Bare conductors shall not come in direct contact with masonry or the earth or where subject to corrosive conditions. Aluminum or copper-clad aluminum conductors shall not be terminated within 450 mm (18 in.) of the earth. Terminations made within listed enclosures suitable for outdoor use shall be permitted within 450 mm (18 in.) of the earth.

Statement of Problem and Substantiation for Public Input

Terminations of aluminum and copper-clad aluminum within listed outdoor enclosures at distances less than the 18 in. of earth specified have proven reliable and this section should clearly state the allowance of such connections. The permission was included in the first draft of the 2017 NEC but was lost in the other proposed revisions and comments to this section.

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 06 21:14:02 EDT 2017

Public Input No. 2585-NFPA 70-2017 [New Section after 250.144]

250.145 SWITCHES AND COVER PLATES

Snap switches, including dimmer and similar control switches, shall be connected to the circuit equipment grounding conductor in one of the following methods:

(1) The switch is mounted with metal screws to a metal box or metal cover that is connected to an equipment grounding conductor or to a nonmetallic box with integral means for connecting to an equipment grounding conductor.

(2) An equipment grounding conductor or equipment bonding jumper is connected to an equipment grounding termination of the snap switch.

Exception No. 1: Where no means exists within the snap-switch enclosure for connecting to the equipment grounding conductor, or where the wiring method does not include or provide an equipment grounding conductor, a snap switch without a connection to an equipment grounding conductor shall be permitted for replacement purposes only. A snap switch wired under the provisions of this exception and located within 2.5 m (8 ft) vertically, or 1.5 m (5 ft) horizontally, of ground or exposed grounded metal objects shall be provided with a faceplate of nonconducting noncombustible material with nonmetallic attachment screws, unless the switch mounting strap or yoke is nonmetallic or the circuit is protected by a ground-fault circuit interrupter.

Exception No. 2: Listed kits or listed assemblies shall not be required to be connected to an equipment grounding conductor if all of the following conditions are met:

(1) The device is provided with a nonmetallic faceplate that cannot be installed on any other type of device,

(2) The device does not have mounting means to accept other configurations of faceplates,

(3) The device is equipped with a nonmetallic yoke, and

(4) All parts of the device that are accessible after installation of the faceplate are manufactured of nonmetallic materials.

Exception No. 3 to (B): A snap switch with integral nonmetallic enclosure complying with 300.15(E) shall be permitted without a connection to an equipment grounding conductor.

(2) Metal faceplates shall be connected to the equipment grounding conductor by means of a metal mounting screw(s) securing the faceplate to a metal outlet box or metal switch yoke.

Statement of Problem and Substantiation for Public Input

PLEASE add the requirements on connecting switches and cover plates to Article 250! Currently these requirements are contained in 404.9, and 404.9(B) is totally screwed up. This panel really doesn't understand what Grounding or Bonding is... See:
(B) Grounding. Snap switches, including dimmer and similar control switches, shall be connected to an equipment grounding conductor and shall provide a means to connect metal faceplates to the equipment grounding conductor, whether or not a metal faceplate is installed. Metal faceplates shall be grounded. Snap switches shall be considered to be part of an effective ground-fault current path if either of the following conditions is met:...

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:

State:

Zip:

Submittal Date: Mon Aug 21 11:52:09 EDT 2017

Copyright Assignment

I, Mike Holt, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Mike Holt, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 854-NFPA 70-2017 [Section No. 250.121]

250.121 Use of Equipment Grounding Conductors.

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

Exception: A wire-type equipment grounding conductor installed in compliance with 250.6(A) and the applicable requirements for both the equipment grounding conductor and the grounding electrode conductor in Parts II, III, and VI of this article shall be permitted to serve as both an equipment grounding conductor and a grounding electrode conductor *when supplying a feeder panelboard,switchboard or switchgear and a warning sign shall be installed at the feeder panel location with:*

Warning

This enclosure has a combination Grounding electrode and Equipment grounding conductor

shock hazard exists if grounding electrode conductor/ equipment grounding conductor is removed while the Main supply is enegized .

Statement of Problem and Substantiation for Public Input

the way it is written it could apply to branch circuits or any equipment with a feeder. This makes it clear only a feeder paneboards, swithchboards,switchgear is allowed to have this combo EGC/GEC. the additional signage to indicate it is the Buildings Main grounding electrode conductor is needed for future maintenance and safety

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Master electrician
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 29 14:03:14 EDT 2017

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

(A) General.

Copper, aluminum, or copper-clad aluminum equipment grounding conductors of the wire type shall not be smaller than shown in Table 250.122, but in no case shall they be required to be larger than the circuit conductors supplying the equipment. The term circuit conductors referred to in this section refers to the largest ungrounded conductor(s) of a single run and the combined accumulative circular mil area of the largest ungrounded conductor(s) of a parallel arrangement. Where a cable tray, a raceway, or a cable armor or sheath is used as the equipment grounding conductor, as provided in 250.118 and 250.134(A), it shall comply with 250.4(A)(5) or (B)(4).

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

Statement of Problem and Substantiation for Public Input

There are those that still misapply the provisions of this section as it relates to the use of the term “circuit conductors.” The term “circuit conductors” means just that, and includes all conductors (including all those installed in parallel) to create one conductor of the circuit. As an example, if there are (6) 500 kcmil conductors per phase in a parallel arrangement installed in (6) separate raceways, the size of the largest ungrounded “circuit conductor” of the run is (6) times 500,000 cm or 3,000,000 cm per each ungrounded circuit conductor of the parallel run, not 500 kcmil. As revised, this section should be much clearer and applied more consistently.

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz

Organization: NECA

Street Address:

City:

State:

Zip:

Submittal Date: Thu Aug 03 11:42:49 EDT 2017

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

~~**(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.~~

Statement of Problem and Substantiation for Public Input

This requirement is unnecessary. The note to Table 250.122 already requires a larger EGC where necessary to create an effective ground-fault current path. No substantiation was provided to prove that using ungrounded conductors of one size larger than the minimum required ampacity is a safety concern with the prescribed EGC size required by Table 250.122. The existing Table 250.122 already allows the use of the same size EGC for multiple sizes of overcurrent protective devices and the various sizes of conductors that have sufficient ampacity for the OCPD.

If taken literally, the language suggested for deletion could also limit the installer to one conductor material or the other. For example, if a 250 amp circuit breaker were installed to serve a noncontinuous load of 245 amps, a 350 kcmil aluminum conductor with an ampacity of 250 amps in the 75C column of Table 310.15(B)(16) would be "the minimum size that has sufficient ampacity for the intended installation." If the installer or designer wanted to use a copper conductor, they would need to use a 250 kcmil copper with 255 amps - which is greater than the "minimum size that has sufficient ampacity." If using that 250 kcmil copper, the installer could no longer use a 4 AWG copper or 2 AWG aluminum EGC, they would be required to upsize the EGC proportionally, which means they would have to pull a minimum 3 AWG copper or 1 AWG aluminum EGC. If they chose to use the 350 kcmil aluminum, they could use the smaller EGC size indicated in Table 250.122. How is this practical, and how does it increase safety?

This is just one example of the unintended consequences of this language, and the language should be deleted.

Submitter Information Verification

Submitter Full Name: Christel Hunter

Organization: Cerro Wire

Street Address:

City:

State:

Zip:

Submittal Date: Sat Aug 26 13:52:04 EDT 2017

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

(B) Increased in Size.

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

Statement of Problem and Substantiation for Public Input

This section has been the subject of dispute and revision for many code cycles. The existing language is unclear and has not been supported with technical substantiation. The impedance of the ground fault circuit is the concern, not the operating temperature. The other code provisions that require increasing conductor size such as conduit fill and ambient temperature are related to operating temperature and insulation failure. While operating temperature affects circuit impedance, it has not been shown that increasing conductor size over that required by Table 250.122 will mitigate it or that it is significant in fault conditions. The equipment grounding conductor is only intended to carry the fault current for a few hundred milliseconds at most until the overcurrent protective device opens. If the device fails to open, other catastrophic damage will occur and the size of the equipment grounding conductor won't matter. The requirement to increase equipment grounding conductor size due to operating temperature was introduced based on a hypothetical condition with no empirical evidence or theoretical support and should be removed.

Submitter Information Verification

Submitter Full Name: Nathan Philips

Organization: Integrated Electronic Systems

Affilliation: NECA

Street Address:

City:

State:

Zip:

Submittal Date: Fri Sep 01 14:14:24 EDT 2017

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

(B) Increased in Size.

~~Where~~ If ungrounded conductors are increased in size from the minimum size that has sufficient ampacity for the intended installation, wire-type equipment grounding conductors, ~~where~~ if installed, shall be increased in size proportionately ~~,~~ according to the circular mil area of the ungrounded conductors. The minimum size of ungrounded conductors shall be determined before the application of any adjustment or correction factors.

Statement of Problem and Substantiation for Public Input

For proper application of this section, it is necessary to determine when the size of ungrounded conductors have been increased. In other words, what is the size of ungrounded conductors that are appropriate for the circuit, be it service, feeder or branch circuit conductors?

Equipment grounding conductors of the wire type are subject to the same conditions of use, be it elevated temperatures or heat generated by excessive current-carrying conductors, as the ungrounded conductors. Code-panel 5 has never been supplied by any factual information that adverse conditions of use can impede the performance of equipment grounding conductors in carrying out their function of carrying fault current. We have heard unfounded conjecture on this issue.

It should be noted that the title of Table 250.122 contains the word "Minimum". This indicates that the size of the EGC may need to be larger than that found in the table. The Note to the table states that the size of the equipment grounding conductor "shall" be increased in size if necessary to provide the effective equipment grounding conductor that is required by 250.4(A)(5) or (B)(4). No details are provided as to how or when this increase in size is to be triggered.

The proposed changes to this section should be accepted to ensure that the critical effective ground fault current path is provided.

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Tue Sep 05 11:12:18 EDT 2017

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

~~**(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.~~

Additional Proposed Changes

File Name	Description	Approved
.1504787015920		✓
NEC_2020_PI_Table_250.122_Proposed.xlsx		✓

Statement of Problem and Substantiation for Public Input

Delete 250.122 (B) and replace Table 250.122 with the attached proposed table.
Calculating and determining increased in size of EGC is practically infeasible due to multiple variables unknown during the design stage. For examples 110.14 (C) requires default terminal temperature to be based on based on circuit rating ie 60C for circuits rated 100 A or less. If the actual terminations are 75C, it requires increasing the size of equipment grounding conductor. AHJ may have to require calculations to ensure the ungrounded conductor was not increased from the minimum sie requited. proposed table based on UL 1277 which sizes equipment grounding conductor based on the ungrounded conductors. This will alleviate the concern on proper sizing of equipment grounding conductor because it is based on ungrounded conductor size. AHJ and users can readily determine the proper size of EGC.

Submitter Information Verification

Submitter Full Name: Daleep Mohla

Organization: DCM Electrical Consulting Serv

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 08:22:40 EDT 2017

TABLE 250.122

Copper				
90 °C Conductors		75 °C conductors		90 °C Co
Size of largest ungrounded circuit Conductor	smallest AWG size of unsectioned EGC	Size of largest ungrounded circuit Conductor	smallest AWG size of unsectioned EGC	Size of largest ungrounded circuit Conductor
14	14	14	14	X
12	12	12	12	12
10	10	10	10	10
8	10	8	10	8
6	8	6	8	6
4	8	4	8	4
3	6	3	8	3
2	6	2	6	2
1	6	1	6	1
1/0	6	1/0	6	1/0
2/0	6	2/0	6	2/0
3/0	4	3/0	**6**	3/0
4/0	4	4/0	4	4/0
250	4	250	4	250
300	3	300	**4**	300
350	3	350	3	350
400	3	400	3	400
500	2	500	**3**	500
600	2	600	2	600
700	1	700	**2**	700
750	1	750	**2**	750
800	1	800	**2**	800
900	1	900	1	900
1000	1/0	1000	**1**	1000

Based on UL 1277 Tables 8.1 and 8.2

Note: Where multiple equipment grounding conductors are used in parallel runs.
parallel equipment groundng cnductor shall be installed according to 250.122(F)(1)

Aluminum or copper clad aluminum		
nductors	75 ^{O} C Conductors	
smallest AWG size of unsectioned EGC	**Size of largest ungrounded circuit Conductor**	**smallest AWG size of unsectioned EGC**
X	X	X
12	12	12
10	10	10
8	8	8
8	6	8
6	4	6
6	3	6
6	2	6
4	1	6
4	1/0	4
4	2/0	4
4	3/0	4
2	4/0	4
2	250	2
2	300	2
2	350	2
1	400	2
1	500	1
1	600	1
1/0	700	1
1/0	750	1
1/0	800	1
1/0	900	1/0
1/0	1000	1/0

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

(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.

Exception: increasng the size of the equipment grounding conductor shall not be required for those portions of the circuit where the equpment grounding conductor of the wire type is installed with the circuit condctors in a metal raceway serving as an equipment grounding conductor for the circuit as permitted in section 250.118.

Statement of Problem and Substantiation for Public Input

Some relief is needed for this requirement since it can be very difficult or even impossible for installers and inspectors to apply this rule.
This is one of those rules where the theory "sounds good on paper", but can be a nightmare for installers and inspectors to apply......a couple examples...

Installation #1 consists of a 400-amp breaker, 600kcmil copper circuit wires and a #3 copper ground wire installed in EMT 300 feet long. Perfectly legal for a 400 amp load!

Installation #2 also consists of a 400-amp breaker, 600kcmil copper circuit wires and a #3 copper ground wire installed in EMT 300 feet long, but this time it's a VIOLATION because the circuit wires were actually increased from the minimum 500kcmil copper to the larger 600kcmil in order to reduce voltage drop for a 380amp load.
This makes no sense to me. How in the world can an inspector enforce this when the installations use the same components and look the same????

According to the literal wording in 250.122(B), scenario 2 would be a violation because "the minimum size that has sufficient ampacity for the intended installation" would be the 500 Kcmil. Increasing those circuit conductors to 600kcmil results in an increase of 20% from the minimum permitted size. For that installation, the area of the #3 AWG equipment ground wire would also need to be increased 20% (52,620cm + 20% = 63,144cm min. which results in a #2 equipment ground) in order to comply with the literal wording in 250.122(B). How can an inspector spot this if a #3 AWG ground wire would "normally" be fine for a 400-amp breaker? Very difficult code rule to apply! This rule can be completely “side stepped” anyways if the equipment ground wire were simply removed if the raceway was a metal raceway recognized as an equipment grounding conductor in accordance with section 250.118. Increasing the size of the equipment ground wire simply makes no sense in this case. In instances where the metal raceways serve as the equipment grounding conductor, increasing the size of the equipment ground wire should not be required especially since increasing the size of the circuit conductors often results in the need for a larger raceway, which actually results in an increased size of the equipment grounding conductor anyways.

Another scenario...

Multiple circuits are installed in one portion of a raceway, with only one #8AWG equipment ground wire installed for the group of circuits with its size based on the largest overcurrent device (100 amp for example) of the group as permitted by section 250.122(C).

The conductors for one of the smaller circuits (15 amp with #14 AWG circuit and ground wire) have been increased to #10 AWG due to voltage drop. Does the original #8 AWG equipment ground wire in this case need to be increased???? The literal wording would seem so. Or can we just ignore 250.122(B) for this instance? It's probably safe to ignore it in this instance, since the #8 is larger than required for a 15amp circuit anyway. It can certainly be ignored if the #8 equipment ground were simply removed and the raceway was a metal raceway recognized as an equipment grounding conductor in accordance with section.

This revision, while not the answer to all of the possible scenarios, is at least a step in the right direction of providing a rule that makes sense, is practical, and can be applied and inspected without the difficulties that may exist with the present wording.

In instances where the metal raceways serve as the equipment grounding conductor, increasing the size of the equipment ground wire should not be required.

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Sat Apr 22 09:20:26 EDT 2017

Copyright Assignment

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

(B) Increased in Size.

Where ungrounded conductors are increased in size ~~from the minimum size that has sufficient ampacity for the intended installation,~~ due to voltage drop, design considerations or other site conditions, wire-type equipment grounding conductors, where installed, shall be increased in size proportionately ~~,~~ according to the circular mil area of the ungrounded conductor. The increase in size for the equipment grounding conductors shall not apply if the ungrounded conductors are increased in size for adjustment or correction factors due to ambient temperature or raceway fill .

Statement of Problem and Substantiation for Public Input

The present text is confusing for code users. This revision makes it clear that increasing the ungrounded conductors due to adjustment or correction factors does not require an increase in size of the equipment grounding conductor. It is technically incorrect to require an increase in the minimum size of an equipment grounding conductor which functions only for a short-time when adjustment or correction factors have increased the size of the ungrounded conductors. If one were to assert that equipment grounding conductors should be increased in size due to any increase in an ungrounded conductor, one would also have to assert that Table 250.122 is irrelevant and Table 250.102 (C) would need to be used exclusively. That assertion is an enormous technical change.

Submitter Information Verification

Submitter Full Name: David Hittinger

Organization: Independent Electrical Contractors

Affilliation: Independent Electrical Contractors Codes and Standard

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jun 08 08:27:54 EDT 2017

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

(C) Multiple Circuits.

Where a single equipment grounding conductor is run with multiple circuits in the same raceway, cable, or cable tray, it shall be sized for the largest ~~overcurrent device protecting~~ ungrounded 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).

Statement of Problem and Substantiation for Public Input

The PI 3896 proposes to replace the current Table 250.122 based on overcurrent device rating to be based on ungrounded conductor sizes. This proposed change is submitted to align 250.122 (C) with the proposed new table

Related Public Inputs for This Document

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

Submitter Information Verification

Submitter Full Name: Daleep Mohla

Organization: DCM Electrical Consulting Serv

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 08:57:31 EDT 2017

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

(F) Conductors in Parallel.

For circuits of parallel conductors as permitted in 310.10(H), the equipment grounding conductor shall be installed in accordance with (1) or (2).

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

(a) *Single Raceway or Cable Tray*. If conductors are installed in parallel in the same raceway or cable tray, a single wire-type conductor shall be permitted as the equipment grounding conductor. The wire-type equipment grounding conductor shall be sized in accordance with 250.122, based on ~~the overcurrent protective device~~ <u>the ungrounded conductor</u> for the feeder or branch circuit. <u>The size of equipment grounding conductor shall be based on the combined sum of ungrounded conductors contained in the raceway of individual feeder or branch circuit if a single equipmeent grounding conductor is utilized . Where multiple conductor cable with an equipment grounding conductor in each cable are utilzed for each feeder or branch circuit, the equipment groudning conductor in each cable shallbe based on table 250.122.</u> Wire-type equipment grounding conductors 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.

(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~~ <u>ungrounded conductor size</u> for the feeder or branch circuit. Metal raceways or auxiliary gutters in accordance with 250.118 or cable trays complying with 392.60(B) shall be permitted as the equipment grounding conductor.

(2) Multiconductor Cables.

(a) If multiconductor cables are installed 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 equipment grounding conductor that is sized in accordance with 250.122 shall be permitted in combination with the equipment grounding conductors provided within the multiconductor cables and shall all be connected together.

(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.

(d) 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.

Additional Proposed Changes

File Name	Description	Approved
NEC_2020_PI_Table_250.122_Proposed.xlsx		✓

Statement of Problem and Substantiation for Public Input

This proposed PI will align this PI with the change submitted in PI 3896.
The proposed PI 3896 converts the Table 250.122 from sizing EGC based on overcurrent devices to ungrounded conductors

Submitter Information Verification

Submitter Full Name: Daleep Mohla
Organization: DCM Electrical Consulting Serv
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 07 09:02:28 EDT 2017

Copyright Assignment

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☑ By checking this box I affirm that I am Daleep Mohla, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

TABLE 250.122				
Copper				
90 °C Conductors		75 °C conductors		90 °C Co
Size of largest ungrounded circuit Conductor	smallest AWG size of unsectioned EGC	Size of largest ungrounded circuit Conductor	smallest AWG size of unsectioned EGC	Size of largest ungrounded circuit Conductor
14	14	14	14	X
12	12	12	12	12
10	10	10	10	10
8	10	8	10	8
6	8	6	8	6
4	8	4	8	4
3	6	3	8	3
2	6	2	6	2
1	6	1	6	1
1/0	6	1/0	6	1/0
2/0	6	2/0	6	2/0
3/0	4	3/0	**6**	3/0
4/0	4	4/0	4	4/0
250	4	250	4	250
300	3	300	**4**	300
350	3	350	3	350
400	3	400	3	400
500	2	500	**3**	500
600	2	600	2	600
700	1	700	**2**	700
750	1	750	**2**	750
800	1	800	**2**	800
900	1	900	1	900
1000	1/0	1000	**1**	1000

Based on UL 1277 Tables 8.1 and 8.2

Note: Where multiple equipment grounding conductors are used in parallel runs.
parallel equipment groundng cnductor shall be installed according to 250.122(F)(1)

Aluminum or copper clad aluminum		
nductors	75 ^{O} C Conductors	
smallest AWG size of unsectioned EGC	Size of largest ungrounded circuit Conductor	smallest AWG size of unsectioned EGC
X	X	X
12	12	12
10	10	10
8	8	8
8	6	8
6	4	6
6	3	6
6	2	6
4	1	6
4	1/0	4
4	2/0	4
4	3/0	4
2	4/0	4
2	250	2
2	300	2
2	350	2
1	400	2
1	500	1
1	600	1
1/0	700	1
1/0	750	1
1/0	800	1
1/0	900	1/0
1/0	1000	1/0

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

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

(a) *Single Raceway or Cable Tray*. If conductors are installed in parallel in the same raceway or cable tray, a single wire-type conductor shall be permitted as the equipment grounding conductor. The wire-type equipment grounding conductor shall be sized in accordance with 250.122, based on the overcurrent protective device for the feeder or branch circuit. Wire-type equipment grounding conductors 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.

(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~~ A single equipment grounding conductor of the wire type installed in each raceway shall be sized in compliance with 250.122 based on the overcurrent protective device for the feeder or branch circuit.Multiple wire-type conductors shall be permitted to be installed in parallel to create the required equipment grounding conductor in each raceway of the parallel run provided the paralleled equipment grounding conductor(s) meets the requirements in 310.10(H) and Table 250.122. 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.

Statement of Problem and Substantiation for Public Input

The current rule does not specifically prohibit installing two wire-type EGCs from being installed in parallel to create one minimum size EGC in each raceway of a parallel arrangement. As long as the requirements in 310.10(H) and size requirements are met, the installation should be permitted.

Example: A 4000 ampere feeder requires a 500 kcmil copper wire-type EGC in each raceway of a parallel arrangement. Two parallel 250 kcmil copper EGCs of the wire type should be permitted to create the required 500 kcmil copper equipment grounding conductor in each raceway.

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz
Organization: NECA
Street Address:
City:
State:
Zip:

Submittal Date: Thu Aug 03 11:59:45 EDT 2017

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

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

(a) *Single Raceway or Cable Tray*. If conductors are installed in parallel in the same raceway or cable tray, a single wire-type conductor shall be permitted as the equipment grounding conductor. The wire-type equipment grounding conductor shall be sized in accordance with 250.122, based on the overcurrent protective device for the feeder or branch circuit. Wire-type equipment grounding conductors 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.

(b) *Multiple Raceways*. If conductors are installed in parallel in multiple raceways, <u>a</u> wire-type equipment grounding ~~conductors~~ <u>conductor</u> , ~~where used~~ <u>if used</u> , shall be installed in ~~parallel in~~ each raceway <u>and shall be connected in parallel</u> . 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 circuit. 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.

Statement of Problem and Substantiation for Public Input

This is intended primarily to be an editorial improvement to clarify the installation of wire-type equipment grounding conductors.

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 27 21:20:25 EDT 2017

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

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

(a) *Single Raceway or Cable Tray*. If conductors are installed in parallel in the same raceway or cable tray, a single wire-type conductor shall be permitted as the equipment grounding conductor. The wire-type equipment grounding conductor shall be sized in accordance with 250.122, based on the overcurrent protective device for the feeder or branch circuit. Wire-type equipment grounding conductors 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.

(b) *Multiple Raceways*. If conductors are installed in ~~paral~~ parallel ? ~~lel~~ 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 circuit. 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.

Statement of Problem and Substantiation for Public Input

spelling

need to remove question mark but system would not allow the change

Submitter Information Verification

Submitter Full Name: Kyle Rood

Organization: POP

Street Address:

City:

State:

Zip:

Submittal Date: Mon Apr 17 10:28:10 EDT 2017

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

(2) Multiconductor Cables.

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

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

(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.

(d) 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.

Statement of Problem and Substantiation for Public Input

Editorially "If" is replaced with "Where" for clarity. The use of "if" infers an assumption, an incident, or an event.

The requirements in 250.122(F)(2) apply to all multiconductor cables including those with and without a metallic jacket. 250.122(F)(2)(b) now prescriptively permits metal jacketed cable, such as Type MC, to be installed in parallel, in cable tray with a single full sized EGC installed in the tray. The single full sized EGC may handle fault current when installed in cable tray with non-metallic jacketed multiconductor cables. The single full size EGC where installed in cable tray with parallel metal jacketed cables will serve two functions: (1) it will take up space in the cable tray and (2) it will act as a dust collector. The single full size EGC where installed with parallel metal jacketed cables is incapable of handling fault current and is in direct conflict with the requirements of 300.3(B).

In my opinion, requirements for EGC's in parallel in raceways and cable assemblies need significant revision.

There is no practical reason to permit current carrying conductors to be installed in parallel and require full size EGC's in conduit or cable. I have received multiple answers from committee members when this question arises. I struggle with the answers. Here are a few:
(1) Some state that this is a "long standing requirement." That is not technical substantiation. If it is incorrect then we must fix it. The fact that a requirement has existed for many cycles does not mean it is correct.
(2) What if a cable or conduit is compromised in the middle of the feeder? What is the likelihood of that occurring? That does not occur. What if something hits my service entrance conductors? Should all service conductor installations be installed in RMC? What if there is an earthquake?
(3) When you install EGC's in metal raceways they are supplemental in the event the metal conduit is compromised. Are you kidding me? If that is the committees argument then remove permission for metal raceways as EGC's. That would be another mistake.

The use of MC cable for parallel feeders has become extremely popular in fast track construction. There is no practical reason to require full size EGC's when installing MC cable in parallel. There is no practical reason to require full size EGC's when installing conductors in parallel in raceways. The argument that "this is what we have always done" no longer holds water. It is time to get it right, time to change these requirements. If we can parallel current carrying conductors for an 800 amp feeder, we can parallel the EGC's as well.

This is the public input stage. CMP-5 does not need a public input to completely revise 250.122(F). However, I urge the committee to consider a complete revision for EGC requirements where conductors are run in parallel.

Submitter Information Verification

Submitter Full Name: James Dollard
Organization: IBEW Local Union 98
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 06 08:29:12 EDT 2017

Copyright Assignment

Public Input No. 819-NFPA 70-2017 [Section No. 250.122(F)(2)]

(2) Multiconductor Cables.

(a) If multiconductor cables are installed 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 equipment grounding conductor that is sized in accordance with 250.122 ~~shall~~ , and located no more than 300mm (12 in.) from the multiconductor cables, 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.

(d) 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.

Statement of Problem and Substantiation for Public Input

The basis for limiting the distance the single equipment grounding conductor permitted externally from the multiconductor cables as explain in section 250.122(F)(2)(b) is based on research done by R.H Kaufmann's "Some fundamentals of Equipment Grounding Circuit Design". The concept of keeping all conductors as close as possible is to reduce the effects of inductive reactance within AC impedance. The actual reactance will increase as the external permitted single EGC is increased in distance from the multiconductor cables. By placing a maximum distance on the external EGC we increase the chances of its successful operation and lessen the effects of AC impedance on the reliability of the overcurrent protective device.

Unless any studies have been performed otherwise we know the effects of inductive reactance on wire when all conductors are not run in close proximity so setting a limit of the separation helps to HOPE the properly sized external EGC coupled with the now undersized internal EGC's from the multiconductor cables in parallel will actually allow the overcurrent protective device to function properly as intended.

Submitter Information Verification

Submitter Full Name: Paul Abernathy
Organization: Electrical Code Academy, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 26 15:53:24 EDT 2017

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

(G) ~~Feeder Taps~~ Supply side bonding and Equipment grounding conductors .

Equipment grounding and supply side bonding conductors run with ~~feeder taps~~ supply side system conductors shall not be smaller than ~~shown in Table 250~~ required by

Table 250 .122

~~based~~

. Based on the

~~rating of the~~

overcurrent device

~~ahead~~

that would of

~~the feeder but~~

been installed for the ungrounded conductors. the provisions of 240.4(B) shall not be

~~required to be larger than the tap conductors~~

permitted .

~~Table 250~~ Table 250 .~~122 Minimum~~ 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 (AWG or kcmil)**	
	Copper	**Aluminum or Copper-Clad Aluminum***
15	14	12
20	12	10
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	750
5000	700	1200
6000	800	1200

Note: Where necessary to comply with 250.4(A)(5) or (B)(4), the equipment grounding conductor shall be sized larger than given in this table.

*See installation restrictions in 250.120.

Statement of Problem and Substantiation for Public Input

the new language that identifies this type of conductor as supply side or equipment bonding conductors

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 260-NFPA 70-2017 [Definition: Tap Conductor.]	

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Master electrician
Street Address:
City:
State:
Zip:
Submittal Date: Thu Feb 09 13:33:08 EST 2017

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

(G) Feeder Taps.

Equipment grounding conductors run with feeder taps shall not be smaller than shown in Table 250.122 based on the rating of the overcurrent device ahead of the feeder 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 (AWG or kcmil)**	
	Copper	**Aluminum or Copper-Clad Aluminum***
15	14	12
20	12	10
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	~~350~~ 300
2000	250	400
2500	350~~600~~	500
3000	400	600
4000	500	750
5000	700	1200
6000	800	1200

Note: Where necessary to comply with 250.4(A)(5) or (B)(4), the equipment grounding conductor shall be sized larger than given in this table.

*See installation restrictions in 250.120.

Statement of Problem and Substantiation for Public Input

The ampacity of 4/0 copper is equal to 300 kcmil aluminum in the ampacity tables, and the ampacity of 350 copper is equal to 500 kcmil aluminum. These are more valid equivalencies than the previous values.

(For some reason, the crossed out value of "600" shows up in the wrong column, not sure why.)

Submitter Information Verification

Submitter Full Name:	Christel Hunter
Organization:	Cerro Wire
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Sep 07 19:16:32 EDT 2017

Copyright Assignment

I, Christel Hunter, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Christel Hunter, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

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

Part VII. Methods of Equipment Grounding Conductor Connections

Statement of Problem and Substantiation for Public Input

Revise the Part title so that it matches the contact of the rules.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 11:36:55 EDT 2017

Public Input No. 1839-NFPA 70-2017 [Section No. 250.132]

250.132 Short Sections of Raceway.

Isolated sections of metal raceway or cable armor ~~, where required to be grounded,~~ shall be connected to an equipment grounding conductor in accordance with 250.134.

Statement of Problem and Substantiation for Public Input

Remove the term 'ground' since it does not add any clarity.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 11:38:38 EDT 2017

Public Input No. 1837-NFPA 70-2017 [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 methods specified in 250.134(A) or (B).

(A) Equipment Grounding Conductor Types.

By connecting to any of the equipment grounding conductors permitted by 250.118.

(B) With Circuit Conductors.

By connecting to an equipment grounding conductor contained within the same raceway, 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 cords for fixed equipment.

Statement of Problem and Substantiation for Public Input

Remove the term 'ground' in that it causes confusion.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 11:34:59 EDT 2017

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

Sections 250.134(A), 250.134(B)

(A) Equipment Grounding Conductor Types.

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

(B) With Circuit Conductors.

By connecting to an equipment grounding conductor ~~contained~~ of the wire type contained within the same raceway, 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 cords for fixed equipment.

Statement of Problem and Substantiation for Public Input

As currently written it appears that I have two options: Option B is to install a wire-type EGC inside the wiring method of the circuit feeding the equipment. Option A allows for the non wire-types in 250.118(2) through (14), but also seems to allow the wire type. If I am using option A it could be argued that the requirements of B don't apply, meaning that I could just run a green wire outside of the wiring method to the equipment. Although that flies in the face of 300.3(B), why not just remove the possibility for confusion?

Submitter Information Verification

Submitter Full Name: Ryan Jackson

Organization: Ryan Jackson

Street Address:

City:

State:

Zip:

Submittal Date: Fri Mar 31 12:55:27 EDT 2017

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

250.136 Equipment Considered ~~Grounded~~ Connected to Equipment Grounding Conductor .

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

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

Electrical equipment secured to and in electrical contact with a metal rack or structure provided for its support and 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.

(B) 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.

Statement of Problem and Substantiation for Public Input

Remove the term 'ground' and add equipment grounding conductor for clarity.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 11:42:30 EDT 2017

Public Input No. 1841-NFPA 70-2017 [Section No. 250.138]

250.138 Cord-and-Plug-Connected Equipment.

Non–current-carrying metal parts of cord-and-plug-connected equipment ~~, if grounded,~~ shall be connected to an equipment grounding conductor by one of the methods in 250.138(A) or (B).

(A) By Means of an Equipment Grounding Conductor.

By means of an equipment grounding conductor run with the power supply conductors in a cable assembly or flexible cord properly terminated in a grounding-type attachment plug with one fixed grounding contact.

Exception: The grounding contacting pole of grounding-type plug-in ground-fault circuit interrupters shall be permitted to be of the movable, self-restoring type on circuits operating at not over 150 volts between any two conductors or over 150 volts between any conductor and ground.

(B) By Means of a Separate Flexible Wire or Strap.

By means of a separate flexible wire or strap, insulated or bare, connected to an equipment grounding conductor, and protected as well as practicable against physical damage, where part of equipment.

Statement of Problem and Substantiation for Public Input

Remove the term 'ground' that causes confusion.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 11:44:43 EDT 2017

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

(A) Supply-Side Equipment.

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

(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)

(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)

Statement of Problem and Substantiation for Public Input

Replace the term 'ground' with 'connect' for clarity.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 11:46:14 EDT 2017

Public Input No. 4103-NFPA 70-2017 [Section No. 250.142(A)]

(A) Supply-Side Equipment.

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

(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)

(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) <u>On the supply side or within the enclosure of the main disconnecting means or overcurrent devices of electric power production sources.</u>

Statement of Problem and Substantiation for Public Input

This PI is to complete the set of requirements related to the installation of electric power production sources on the supply side of a service disconnecting means. The basic requirement is set forth in 705.12(A) with details provided in a new PI for 230.86(6) and this PI. Since the NEC does not specifically allow the grounded conductor to be used to bond these enclosures, we need to add this to the list in 250.142. Some AHJs have specifically disallowed this connection because of the wording in 250.142(A) which can be a safety hazard.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3752-NFPA 70-2017 [Section No. 230.82]	Establishes detail for connections on the supply side of the service disconnecting means

Submitter Information Verification

Submitter Full Name: Philip Undercuffler

Organization: PV Industry Forum

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 14:12:48 EDT 2017

Public Input No. 4360-NFPA 70-2017 [Section No. 250.142(A)]

~~**(A)** Supply-Side Equipment.~~

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

(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)~~

(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)~~

Statement of Problem and Substantiation for Public Input

The grounded conductor (neutral) should never be used to ground the supply-side equipment. If there is a neutral-to-ground bond in the service panel (i.e. main bonding jumper) and then you bond the transformer case to the neutral, you have created a parallel path that allows neutral current to flow on the conduit between the transformer and the service panel during *normal* operating conditions. Instead, a supply-side bonding jumper (similar to the EGC) should be run in the conduit to bond the transformer to the service panel.

This problem of using the grounded conductor (neutral) to ground equipment on the supply-side is repeated in other parts of 250.

Submitter Information Verification

Submitter Full Name: Jeffrey Drummond

Organization: E&S Grounding Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Fri Sep 08 00:43:53 EDT 2017

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

(B) Load-Side Equipment.

Except as permitted in 250.30(A)(1) and 250.32(B) Exception, 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, supply side disconnecting means as permitted by 230.82, 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 all of the following conditions apply:

(1) No service ground-fault protection is 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. 4: Electrode-type boilers operating at over 1000 volts shall be grounded as required in 490.72(E)(1) and 490.74.

Statement of Problem and Substantiation for Public Input

Replace 'grounded' with 'connected' and add reference to 230.82 that permits supply side connections of service equipment.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 11:47:59 EDT 2017

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

(B) Load-Side Equipment.

Except as permitted in Part X. Grounding of systems and Circuits of over 1000 Volts, 250.30(A) ? (1) and 250.32(B) Exception, a grounded circuit conductor shall not be used for grounding non–current-carrying metal parts of equipment on the load side of the service disconnecting means 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 meter enclosures by connection to the grounded circuit conductor on the load side of the service disconnect where all of the following conditions apply:

(1) No service ground-fault protection is 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. 4: Electrode-type boilers operating at over 1000 volts shall be grounded as required in 490.72(E) (1) and 490.74.

Statement of Problem and Substantiation for Public Input

the neutral is permitted to be grounded in more then one location in over 1000 volt system

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Master electricain
Street Address:
City:
State:
Zip:
Submittal Date: Sun Feb 05 19:30:09 EST 2017

Public Input No. 2160-NFPA 70-2017 [Section No. 250.142(B)]

(B) Load-Side Equipment.

Except as permitted in 250.30(A)(1) and 250.32(B) Exception, a grounded circuit conductor shall not be used for grounding non–current-carrying metal parts of equipment on the load side of the service disconnecting means 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 meter enclosures by connection to the grounded circuit conductor on the load side of the service disconnect where all of the following conditions apply:~~

(1) ~~No service ground-fault protection is 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:~~ 2: 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. ~~4~~ 3 : Electrode-type boilers operating at over 1000 volts shall be grounded as required in 490.72(E)(1) and 490.74.

Statement of Problem and Substantiation for Public Input

It is a general requirement of the Code to not allow neutral to case connections downstream of the main bonding jumper. There is no technical reason to allow meters to be an exception, and it is inconsistent with the overall philosophy of the Code. The only justification that i have heard for the grounding of downstream meters is "the utility won't turn on the power unless the neutrals are bonded to the enclosure." But these meters are downstream of the service point and are not under the jurisdiction of the utility. The rules for these meters should be the same as for any other equipment in the system.

Submitter Information Verification

Submitter Full Name: Eric Stromberg

Organization: Los Alamos National Laboratory

Affilliation: Self

Street Address:

City:

State:

Zip:

Submittal Date: Sun Aug 13 18:08:34 EDT 2017

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Public Input No. 881-NFPA 70-2017 [Section No. 250.142(B)]

(B) Load-Side Equipment.

Except as permitted in 250.30(A)?(1) and 250.32(B) Exception, a grounded circuit conductor shall not be used for grounding non–current-carrying metal parts of equipment on the load side of the service disconnecting means 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 meter enclosures by connection to the grounded circuit conductor on the load side of the service disconnect where all of the following conditions apply:~~

(1) *~~No service ground-fault protection is 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~~ Exceotion No. 2 : 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. ~~4~~ 3 : Electrode-type boilers operating at over 1000 volts shall be grounded as required in 490.72(E)(1) and 490.74.

Statement of Problem and Substantiation for Public Input

this exception belongs in 250.24, PI 882 has be submitted to relocate this section

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Master electrician
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 01 13:19:47 EDT 2017

Public Input No. 1844-NFPA 70-2017 [Section No. 250.144]

250.144 Multiple Circuit Connections.

Where equipment is ~~grounded and is~~ supplied by ~~separate connection to~~ more than one circuit ~~or grounded premises wiring system~~ , an equipment grounding conductor termination shall be provided for each such connection as specified in 250.134 and 250.138.

Statement of Problem and Substantiation for Public Input

Edit text for clarity on the application of the requirements.

Submitter Information Verification

Submitter Full Name:	Mike Holt
Organization:	Mike Holt Enterprises Inc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 07 11:51:19 EDT 2017

Public Input No. 2799-NFPA 70-2017 [New Section after 250.148]

250.147 Metal Receptacle Faceplates

Metal faceplates shall be permitted to be connected to the equipment grounding conductor by means of metal mounting screw(s) securing the faceplate to a an outlet box that is connected to an equipment grounding conductor or receptacle whose grounding terminals are connected to an equipment grounding or bonding conductor.

Statement of Problem and Substantiation for Public Input

There needs to be a clear rule in Article 250 addressing the connection of metal receptacle faceplates. Other panels have requirements to address this, but this requirement belongs in Article 250, not Article 517.

Submitter Information Verification

Submitter Full Name:	Mike Holt
Organization:	Mike Holt Enterprises Inc
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sat Aug 26 18:20:11 EDT 2017

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

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

An equipment bonding jumper shall be used to connect the grounding terminal of a grounding-type receptacle to a ~~grounded box unless grounded as~~ metal outlet box that is connected to an equipment grounding conductor, except as permitted in 250.146(A) through (D). The equipment bonding jumper shall be sized in accordance with Table 250.122 based on the rating of the overcurrent device protecting the circuit conductors.

(A) Surface-Mounted Box.

Where the box is mounted on the surface, direct metal-to-metal contact between the device yoke and the box or a contact yoke or device that complies with 250.146(B) shall be permitted to ~~ground~~ connect the receptacle grounding terminal to the metal box. 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 to cover-mounted receptacles unless 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~~ equipment bonding means when (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) when 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~~ equipment bonding 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.

Statement of Problem and Substantiation for Public Input

Edits to simply tell the user what the Code actually wants using the proper terms.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Sat Aug 26 18:10:52 EDT 2017

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☑ By checking this box I affirm that I am Mike Holt, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

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

An equipment bonding jumper shall be used to connect the grounding terminal of a grounding-type receptacle to a grounded metal box ~~unless grounded~~ except as provided 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.

Statement of Problem and Substantiation for Public Input

This Public Input is primarily editorial in nature. However it is needed since some of the boxes in 250.146(A) through (D) are or can be nonmetallic.

Submitter Information Verification

Submitter Full Name: Phil Simmons

Organization: Simmons Electrical Services

Street Address:

City:

State:

Zip:

Submittal Date: Tue Sep 05 11:47:42 EDT 2017

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

(A) Surface-Mounted Box.

(1) Receptacle to Box. Where the box is mounted on the surface, direct metal-to-metal contact between the device yoke and the box ~~or a contact yoke or device that complies with 250.146(B)~~ shall be permitted to ~~ground~~ connect the receptacle grounding contacts to the metal box. ~~At least one of the insulating washers shall be removed from~~ For receptacles that do not have a self-grounging contact yoke or device that complies with 250.146(B) ~~to ensure direct metal-to-metal contact. This provision shall not apply to cover-mounted receptacles unless the box and cover combination are listed as providing satisfactory ground~~ , a t least one of the insulating washers from the device yoke shall be removed .

(2) Receptacle to Cover. Receptacles attached to a cover of a listed box and cover combination provides satisfactory continuity between the box and the receptacle ~~. A listed exposed work cover~~ grounding contacts. Receptacle shall be ~~permitted~~ secured to ~~be~~ the ~~grounding and bonding means when (1) the device is attached to the cover with~~ 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)~~ when the cover mounting holes are located on a flat non-raised portion of the cover.

Statement of Problem and Substantiation for Public Input

Break this rule up into two separate subsections for ease of usage, and revised text for clarity.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 07 11:53:33 EDT 2017

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

(A) Surface-Mounted Box.

Where the box is mounted on the surface, direct metal-to-metal contact between the device yoke and the box or a contact yoke or device that complies with 250.146(B) shall be permitted to ground the receptacle to the box. 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 to cover-mounted receptacles unless 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:

(1) ~~the~~ 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) ~~when the~~ The cover mounting holes are located on a flat non-raised portion of the cover.

Statement of Problem and Substantiation for Public Input

In 250.146 (A), there are list items that are not properly formatted as per the style manual. When stating the list items the word before the start needs a colon and then start a new line and do list item one and start another line for list item 2 and so on.

Submitter Information Verification

Submitter Full Name: gage ribarchak

Organization: IBEW Local 5

Affilliation: Second-year Apprentice

Street Address:

City:

State:

Zip:

Submittal Date: Thu Feb 16 10:05:43 EST 2017

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

(A) Surface-Mounted Metal Box.

~~Where~~ If the metal box is mounted on the surface, direct metal-to-metal contact between the device yoke and the box, or a contact yoke or device that complies with 250.146(B), shall be permitted to ~~ground~~ connect the receptacle to the box. 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 to~~ Direct metal-to-metal contact for providing grounding 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~~ if:

(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~~ or

(2) ~~when~~ the cover mounting holes are located on a flat non-raised portion of the cover.

Statement of Problem and Substantiation for Public Input

While this Public Input is primarily editorial in nature, important changes are being made to add clarity to the application of these requirements. It also puts the rule regarding cover-mounted receptacles in positive rather than negative text.

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 05 11:57:11 EDT 2017

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

(C) Floor Boxes.

Floor boxes designed for and listed as providing satisfactory ~~ground~~ continuity between the box and the device shall be permitted.

Statement of Problem and Substantiation for Public Input

Delete the term 'ground' as it does not add any clarity.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 07 12:12:42 EDT 2017

Public Input No. 1511-NFPA 70-2017 [Section No. 250.146(D)]

(D) Isolated Ground Receptacles.

~~Where installed for the reduction of electrical noise (electromagnetic interference) on the grounding circuit, a receptacle in which the grounding terminal~~ The grounding terminal that 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.

Statement of Problem and Substantiation for Public Input

Remove the text about reduction of electrical noise, since this can't be explained. If the practice is permitted, then permit it and remove the intro text.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 01 13:13:56 EDT 2017

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

250.148 Continuity and Attachment of Equipment Grounding Conductors to Boxes.

If circuit conductors are spliced within a box or terminated on equipment within or supported by a box, all equipment grounding conductor(s) associated with any of those circuit conductors shall be connected together within the box ~~or~~ and to the box with devices suitable for the use in accordance with 250.8 and250.148(A) through (E).

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.

Connections and splices shall be made in accordance with 110.14(B) except that insulation shall not be required.

(B) ~~Grounding~~ Electrical Continuity.

The arrangement of ~~grounding~~ connections shall be such that the disconnection or the removal of a receptacle, luminaire, or other device fed from the box does not interfere with or interrupt the equipment grounding conductor continuity.

(C) Metal Boxes.

A connection shall be made between ~~the one or more~~ an equipment grounding ~~conductors~~ conductor 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.

(D) Nonmetallic Boxes.

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

(E) Solder.

Connections depending solely on solder shall not be used.

Statement of Problem and Substantiation for Public Input

Edits to require the equipment grounding conductors to terminate to a metal box, and other edits to use proper NEC terms, like equipment grounding conductor, instead of 'ground.'

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Tue Sep 05 18:57:40 EDT 2017

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

250.148 Continuity and Attachment of Equipment Grounding Conductors ~~to~~ in Boxes.

If circuit conductors are spliced within a box or terminated on equipment within or supported by a box, all equipment grounding conductor(s) associated with any of those circuit conductors shall be connected to each other within the box or to the box with devices suitable for the use in accordance with 250.8 and 250.148(A) through (E).

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.

Connections and splices shall be made in accordance with 110.14(B) except that insulation shall not be required.

(B) Grounding Continuity.

The arrangement of grounding connections shall be such that the disconnection or the removal of a receptacle, luminaire, or other device fed from the box does not interfere with or interrupt the grounding continuity.

(C) Metal Boxes.

A connection 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.

(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 grounding.

(E) Solder.

Connections depending solely on solder shall not be used.

Statement of Problem and Substantiation for Public Input

The title of this section is only discussing metal boxes, so changing "to" to "in" resolves the problem.
By adding the words "to each other" what I believe to be the intent of this rule is clarified. In 2017 language was added to include "any of" and "all" EGCs, yet there is no crystal clear rule that they be connected together. For example, a plastic box with two circuits for two duplex receptacles. Do those EGCs need to be spliced together in the box? I believe the added text in 2017 intends it, yet falls short of actually mandating it.

Submitter Information Verification

Submitter Full Name: Ryan Jackson

Organization: Ryan Jackson

Street Address:

City:

State:

Zip:

Submittal Date: Fri Mar 31 14:22:01 EDT 2017

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

If circuit conductors are spliced within a metal box or terminated on equipment within or supported by a metal box, all equipment grounding conductor(s) associated with any of those circuit conductors shall be connected within the metal box ~~or~~ and to the metal box with devices suitable for the use in accordance with 250.8 and 250.148(A) through (E).

If circuit conductors are spliced within a non-metallic box or terminated on equipment within or supported by a non-metallic box, all equipment grounding conductor(s) associated with any of those circuit conductors shall be connected within the non-metallic box with devices suitable for the use in accordance with 250.8 and 250.148(A) through (E).

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.

Statement of Problem and Substantiation for Public Input

I realize that we made some minor edits to this section in the 2017. However, I don't think we are clear just yet.

It is confusing to have language that is inclusive to grounding for both metal boxes and nonmetallic boxes in the same paragraph, since the requirements are different for both. The problem lies with the wording "...shall be connected within the box or to the box." This has the net effect of giving the installer a choice (due to the word OR) even though that was never our intent.

I've separated our intended requirements and listed them separately - the first paragraph for metal boxes, and the subsequent paragraph for nonmetallic boxes. The reason for this change is for clarification purposes.

Submitter Information Verification

Submitter Full Name: Nick Sasso
Organization: State of Wyoming
Affilliation: www.electrical-code-expert.com
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 28 11:53:39 EDT 2017

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

If circuit conductors are spliced within a box or terminated on equipment within or supported by a box, all equipment grounding conductor(s) associated with ~~any of those~~ all circuit conductors that enter the box shall be connected within the box or to the box with devices suitable for the use in accordance with 250.8 and250.148(A) through (E).

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.

Statement of Problem and Substantiation for Public Input

This section was revised for the 2017 code, but the code text does not reflect the intent of the panel statement in the first revision. The statement said: "The revised text clarifies that all of the EGC's present in the box are required to be connected together regardless of the circuit they are associated with.". The rule has not actually changed from 2014. The current rule requires that equipment grounding conductors associated with any of "those circuit conductors" be connected. The problem is that the words "those circuit conductors" refers to "circuit conductors are spliced within a box or terminated on equipment" The rule needs to refer to all circuit conductors in the box, if the rule is to match the panel's stated intent.

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Mon Sep 04 10:02:10 EDT 2017

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

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

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

Statement of Problem and Substantiation for Public Input

This section is not needed because the requirement exists in 250.8(B).

Submitter Information Verification

Submitter Full Name:	Phil Simmons
Organization:	Simmons Electrical Services
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Sep 05 12:47:37 EDT 2017

Public Input No. 2733-NFPA 70-2017 [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 .

Statement of Problem and Substantiation for Public Input

Anywhere else in the code that a value is given for volts, that value is always followed by "volts." This last sentence in Section 250.174(C) is dealing with insulated rubber mats and shall be provided when the voltage exceeds 150 "volts". The sentence actually ends with just "150." For clarity and consistency the word "volts" should be added.

Submitter Information Verification

Submitter Full Name: Darryl Hill

Organization: Wichita Electrical JATC

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 25 12:58:11 EDT 2017

Public Input No. 1172-NFPA 70-2017 [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.

Statement of Problem and Substantiation for Public Input

Changes to provide consistency with other sections of this Code.

Submitter Information Verification

Submitter Full Name: David Bredhold

Organization: C&I Engineering

Street Address:

City:

State:

Zip:

Submittal Date: Tue Jul 18 07:05:17 EDT 2017

Public Input No. 699-NFPA 70-2017 [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 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 <u>where the equipment grounding conductor is fully insulated</u>

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.

Statement of Problem and Substantiation for Public Input

For feeders, allowing a bare neutral conductor and a bare equipment grounding conductor would more than likely create accidental contact between the two, resulting in unwanted parallel paths. So if the neutral is allowed to be bare, then the equipment grounding conductor should have to be insulated.

Submitter Information Verification

Submitter Full Name: Nick Sasso

Organization: State of Wyoming

Street Address:

City:

State:

Zip:

Submittal Date: Sat May 13 02:12:20 EDT 2017

Public Input No. 503-NFPA 70-2017 [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:

(2) Transformers supplying conductors to a building or other structure

(3) Underground circuits where the neutral conductor is exposed

(4) Overhead circuits installed outdoors

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

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

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

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

Exception No. 1: In a multi-point 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.

Statement of Problem and Substantiation for Public Input

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. For the most part the NESC and NEC are in alignment where they overlap and this would align both standards to avoid questions by authorities familiar with one standard over another.

Submitter Information Verification

Submitter Full Name: Douglas Mutcher
Organization: Westwood Professional Services
Street Address:
City:
State:
Zip:
Submittal Date: Mon Apr 10 12:26:58 EDT 2017

Copyright Assignment

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Public Input No. 4326-NFPA 70-2017 [Section No. 250.186]

250.186 Grounding Service-Supplied Alternating-Current Systems.

(A) Systems with a Grounded Conductor at the Service Point.

Where an ac system is grounded at any point and is provided with a ~~grounded~~ neutral conductor at the service point, a ~~grounded~~ neutral conductor(s) shall be installed and routed with the ungrounded (phase) conductors to each service disconnecting means and shall be connected to each disconnecting means ~~grounded~~ neutral conductor(s) terminal or bus (terminating neutrals to the grounding bus is prohibited except as allowed under 250 .28). A main bonding jumper shall connect the ~~grounded~~ neutral conductor(s) to each service disconnecting means's enclosure. The ~~grounded~~ neutral conductor(s) shall be installed in accordance with 250.186(A)(1) through (A)(4). The size of the solidly grounded circuit (neutral) conductor(s) shall be the larger of that determined by 250.184 or 250.186(A)(1) or (A)(2).

Exception: Where 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~~ neutral conductor(s) to the assembly ~~common grounded~~ neutral conductor(s) terminal or bus. The assembly ~~shall~~ may include a ~~main bonding jumper~~ neutral-to-ground bond for connecting the ~~grounded~~ neutral conductor(s) to the assembly enclosure, in accordance with 250 .28, as long as this does not cause objectionable currents (normal operating neutral currents) to be placed on exposed metallic parts, in violation of 250.6, 250.24(A)(5), 250.30(A)(1), 250.30(A)(5), 250.32(B)(1), and 250.142(B).

(1) Sizing for a Single Raceway or Overhead Conductor.

The grounded conductor shall not be smaller than the required grounding electrode conductor specified in Table 250.102(C)(1)but shall not be required to be larger than the largest ungrounded service-entrance conductor(s).

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

If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or as overhead parallel conductors, the grounded conductors shall also be installed in parallel. The size of the grounded conductor in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

Informational Note: See 310.10(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) Impedance Grounded Neutral Systems.

Impedance grounded neutral systems shall be installed in accordance with 250.187.

(B) Systems Without a Grounded Conductor at the Service Point.

Where an ac system is grounded at any point and is not provided with a grounded conductor at the service point, ~~a supply-side bonding jumper~~ an equipment grounding conductor shall be installed and routed with the ungrounded (phase) conductors to each service disconnecting means and shall be connected to each disconnecting means equipment grounding conductor terminal or bus. The ~~supply-side bonding jumper~~ equipment grounding conductor shall be installed in accordance with 250.186(B)(1) through (B)(3).

Exception: Where two or more service disconnecting means are located in a single assembly listed for use as service equipment, it shall be permitted to connect the ~~supply-side bonding jumper~~ equipment grounding conductor to the assembly common equipment grounding terminal or bus. Terminating to the neutral terminal or bus is strictly prohibited.

(1) Sizing for a Single Raceway or Overhead Conductor.

The ~~supply-side bonding jumper~~ equipment grounding conductor shall not be smaller than the required grounding electrode conductor specified in Table 250.102(C)(1)but shall not be required to be larger than the largest ungrounded service-entrance (phase) conductor(s).

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

If the ungrounded service-entrance (phase) conductors are installed in parallel in two or more raceways or overhead conductors, the ~~supply-side bonding jumper~~ equipment grounding conductor shall also be installed in parallel. The size of the ~~supply-side bonding jumper~~ equipment grounding conductor in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

(3) Impedance Grounded Neutral Systems.

Impedance grounded neutral systems shall be installed in accordance with 250.187.

Additional Proposed Changes

File Name	Description	Approved
17-Stockin_CH17_357-362.pdf	A complete copy of Chapter 17 from McGraw-Hills 2014 Earthing & Grounding Handbook.	✓

Statement of Problem and Substantiation for Public Input

"Main bonding jumper" and "supply-side equipment bonding jumper" is simply an equipment grounding conductor (EGC). These additional terms only add confusion. They should be sized in accordance with 250.122 and routed just like any branch circuit grounding conductor. There is no need for different terminology.

Also, its a neutral wire, everyone knows what this means. The term "grounded conductor" and "common conductor" and "ground fault circuit conductor" should be globally replaced.

There are numerous terms that have been erroneously placed in the code. It should be globally fixed. Please see attached pdf from McGraw-Hills 2014 NED Earthing & Grounding Handbook.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 21:09:12 EDT 2017

Chapter Seventeen

BONDING JUMPERS

Article 250 of the National Electrical Code (NEC) uses the term *jumper* to identify a variety of different electrical engineering functions throughout the Code. Unfortunately, the Code uses the same terms to indicate different engineering functions, and in some places uses several different terms to indicate the same engineering function; in fact, it seems that the Code uses the various terminologies interchangeably and wherever it sees fit. You will find throughout the text of this book an attempt to correct the terminology confusion.

The short summary here will not get into listing specific examples, as they are identified as you go through the chapters of the book. This will simply give you, for your informational purposes, an overview of the bewildering array of terminology that is used in the Code and how the terms are intermixed.

The confusion we talk about regarding the term jumper is similar to how Art. 250 of the Code uses four different terms to describe the neutral wire: *grounded conductor*, *neutral conductor*, *common conductor*, and *ground-fault circuit conductor*. Fortunately, the 2014 edition of the Code has removed the term *common conductor* from Art. 250.26 (2011 edition). Unfortunately, in the brand-new Art. 250.186, the Code decided to add the term ground fault circuit conductor instead of just calling it a neutral conductor (the old Art. 250.186 was changed to Art. 250.187). With that said, the differing neutral conductor terminology is fairly easy to straighten out, unlike the jumper terminology.

The 2014 edition of the Code has made no effort to correct or clean up all of the different confusing applications (and in some places downright errors) of its own terminology and has left all of the different jumper terminology in place. The following will try to reduce some of the confusion by identifying the problems.

Article 250 of the NEC uses at least eight different terms related to jumpers and bonding:

- Bonding jumper
- Main bonding jumper
- Equipment-bonding jumper
- Load-side bonding jumper
- Supply-side bonding jumper
- System bonding jumper
- Supply-side equipment-bonding jumper
- Equipment-grounding conductor

Some of these jumpers are used to describe neutral-to-ground bonds, and some of them are simply used to describe the connecting of normally non-current-carrying metal parts. Here is a chart showing the different terminology and the engineering functions they describe:

Jumpers Terms and Their Uses in the NEC

Jumpers that make neutral-to-ground connections	Jumpers that bond metal parts together
Bonding jumper	Bonding jumper
Main bonding jumper	—
System bonding jumper	—
Equipment-bonding jumper	Equipment-bonding jumper
Supply-Side Bonding Jumper	Supply-side bonding jumper
Load-Side Bonding Jumper	—
Supply-side equipment-bonding jumper	Supply-side equipment-bonding jumper
—	Equipment-grounding conductor

As you can see in the chart above, Art. 250 uses the terms bonding jumper, equipment-bonding jumper, supply-side bonding jumper, and supply-side equipment-bonding jumper, to indicate connections that perform two different engineering functions: a neutral-to-ground connection and bonding metal parts together.

For the jumpers that are intended to make neutral-to-ground bonds, the Code tries to separate them into two categories: neutral-to-ground bonds that occur on the supply side of the service and those that occur on the load side of the service. But even here, the Code just cannot seem to get it right. As you can see in the chart below, the terms bonding jumper and main bonding jumper are intermixed between both the neutral-to-ground connections that occur on the supply side of the load and those that occur on the load side, adding additional and unnecessary perplexity.

Terms Used for Neutral-to-Ground Connections

On the supply side of the service	On the load side of the service
Bonding jumper	Bonding jumper
Main bonding jumper	Main bonding jumper
System bonding jumper	—
—	Equipment-bonding jumper
Supply-side bonding jumper	—
—	Load-side bonding jumper
Supply-side equipment-bonding jumper	—

As you can see from the chart above, Art. 250 of the Code uses at least five terms to indicate supply-side, neutral-to-ground connections, and four terms to indicate load-side, neutral-to-ground connections.

I wish I could say that the terminology confusion ended here … but it does not. The Code adds additional uncertainty to the situation by using several of the same terms above to indicate connections that involve equipment-grounding conductors and grounding electrode conductors, and even uses them to describe below-grade (buried) connections between electrodes. Here is a list:

Terms used to describe connections that involve equipment-grounding conductors:

- Equipment-grounding conductor
- Bonding jumper
- Equipment-bonding jumper

Note *There is also the term* intersystem bonding*, which is used to indicate equipment-grounding conductors; however, the application is appropriate.*

Terms used to describe connections that involve grounding electrode conductors:

- Grounding electrode conductor
- Bonding jumper
- Supply-side equipment-bonding jumper (this jumper is actually installed on the load side of the service and is used to describe a connection to a grounding electrode and raceway)

The Code uses the following terms to indicate below-grade (buried) connections between grounding/earthing electrodes:

- Grounding electrode conductor
- Bonding jumper
- Equipotential bonding (Art. 680)

As you can see from the list above, and by no means is this a complete list, the terminology used within Art. 250 of the NEC is very confusing. The terminology used in the Code should really be corrected in the next edition (due out in 2017) by reducing each function to a single term.

So, how can we fix the confusion? The terminology should simply be broken down by the engineering function it is trying to describe. In general, the jumper systems can be broken down into two areas with three functions.

The two areas are: above-grade ground and below-grade grounding/earthing, and the three functions are to provide neutral-to-ground connections, to provide dedicated ground-fault paths, and to interconnect normally non-current-carrying metal parts. Here is a chart showing the proposed breakdown:

Possible Method for Improving Grounding Terminology

	Neutral-to-ground connection	Dedicated ground-fault current path	Normally non-current-carrying metal parts
Above-grade	Use the term *neutral-to-ground*	Use the term *grounding*	Use the term *bonding*
Below-grade	NA	Use the term: *earthing*	Use the term: *equipotential bonding*

The term *jumper* should be used to indicate short lengths of wire used to connect objects (current-carrying or non-current-carrying) that may or may not have dedicated terminals for the connection.

Clearly such a proposal as the one shown above should be given time for extensive debate, and there are almost certainly better terms that could be used than those suggested above. But at least this is a good start.

Hopefully, this section has helped to clarify some of the terminology confusion by identifying the issues within the Code. Perhaps it has only made things worse and has caused you to become disheartened, and for that I am sorry. But ultimately, I believe that knowledge is power and with this information you will be able to better navigate the Code. Good luck!

JUMPER DEFINITIONS

Bonding jumper A reliable conductor sized per Art. 250 to ensure electrical conductivity between metal parts of the electrical installation.

Equipment-bonding jumper or load-side bonding jumper A conductor, screw, or strap that bonds the equipment-grounded conductor (neutral) to the equipment enclosures that are on the load side of the first service disconnect enclosure(s), in accordance with Art. 250.102(D). The term is also used to indicate a conductor, screw, or strap that bonds the equipment-grounding conductor of a circuit to the enclosure or raceway of that circuit, in accordance with Art. 250.146.

Main bonding jumper A conductor, screw, or strap that bonds the neutral (grounded) conductor to a grounding conductor of some type. The term *main bonding jumper* is confusingly used in the Code in various places to indicate both a *supply-side bonding jumper* and a *system bonding jumper* (load side). For more details, see Arts. 250.24(A)(4), 250.24(B), 250.28, and 408.3(C).

Supply-side bonding jumper A conductor installed on the supply (utility) 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; sometimes called a *main bonding jumper*. A conductor, screw, or strap that bonds the neutral (grounded) conductor to the service equipment enclosures on the supply side. The term *supply-side bonding jumper* is used to distinguish the bond at the supply (utility) side of the service from the *system bonding jumper*, which is used on the load side of the service (at the first service disconnect). For more details, see Arts. 250.24(A)(4), 250.24(B), 250.28, 250.28(D)(2), and 408.3(C).

Note *The NEC occasionally uses this term to indicate an equipment-grounding conductor (see Art. 250.30).*

System bonding jumper A conductor, screw, or strap that bonds the equipment-grounding conductor to the neutral (grounded) conductor; sometimes called the *main bonding jumper.* The term *system bonding jumper* is used to distinguish the bond at the load side of the service (at the first service disconnect) from the *supply-side bonding jumper*, which is the bonding used on the utility or supply side of the service. For more details, see Arts. 250.24(A)(4), 250.24(B), 250.28, and 408.3(C).

Neutral-to-ground connection (bond) is where a grounded current-carrying conductor, the neutral, is intentionally bonded to earth/ground. In general, this should only occur at the transformer and at the first service disconnect(s). The Code uses several names for neutral-to-ground connections: system bonding jumper, main bonding jumper, and supply-side bonding jumper.

Equipment-grounding (bonding) conductor The low-impedance fault-current path that is typically run with or encloses the circuit conductors, used to connect the non-current-carrying metal parts of equipment, raceways, and other enclosures to the grounded (neutral) conductor and equipment-grounding (bonding) conductor at service equipment or at the source of a separately derived system. Often called the *green-wire* or *third-wire* ground conductor.

Grounding (earthing) electrode conductor The conductor used to connect the grounding (earthing) electrode(s) to the equipment-grounding (bonding) conductor, to the neutral (grounded) conductor, or to both in accordance with Arts. 250.66 and 250.142.

Grounding (earthing) electrode A device that establishes an electrical connection to the earth/soil.

Grounding (earthing) electrode system Two or more grounding electrodes that are bonded together to form a single system. For a typical building/structure, a grounding electrode system should consist of: two ground rods, water pipe, steel frame of the building, the steel rebar in the concrete foundation, and any ground rings.

Public Input No. 4332-NFPA 70-2017 [Section No. 250.186(A)]

(A) Systems with a ~~Grounded~~ Neutral Conductor at the Service Point.

Where an ac system is grounded at any point and is provided with a ~~grounded~~ neutral conductor at the service point, a ~~grounded~~ neutral conductor(s) shall be installed and routed with the ungrounded (phase) conductors to each service disconnecting means and shall be connected to each disconnecting means ~~grounded~~ grounding conductor(s) terminal or bus. A ~~main bonding jumper shall~~ neutral-to-ground bond may be required to connect the ~~grounded~~ neutral conductor(s) to each service disconnecting means's enclosure, where required under 250 . ~~The grounded~~ 28, as long as this arrangement does not cause objectionable currents (normal operating neutral currents) to flow on exposed metallic parts in violation of 250.6, 250.24(A)(5), 250.30(A)(1), 250.30(A)(5), 250.32(B)(1), and 250.142(B). The neutral conductor(s) shall be installed in accordance with 250.186(A)(1) through (A)(4). The size of the solidly grounded neutral circuit conductor(s) shall be the larger of that determined by 250.184 or 250.186(A)(1) or (A)(2).

Exception: Where 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~~ neutral conductor(s) to the assembly common ~~grounded~~ neutral conductor(s) terminal or bus. The assembly ~~shall include a main bonding jumper~~ may require a neutral-to-ground bond for connecting the ~~grounded~~ neutral conductor(s) to the assembly enclosure as required under 250 .28, but not in volation of 250.6.

(1) Sizing for a Single Raceway or Overhead Conductor.

The ~~grounded~~ neutral conductor shall not be smaller than the required grounding electrode conductor specified in Table 250.102(C)(1)but shall not be required to be larger than the largest ungrounded service-entrance conductor(s).

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

If the ungrounded service-entrance (phase) conductors are installed in parallel in two or more raceways or as overhead parallel conductors, the ~~grounded~~ neutral conductors shall also be installed in parallel. The size of the ~~grounded~~ neutral conductor in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded (phase) conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

Informational Note: See 310.10(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) Impedance Grounded Neutral Systems.

Impedance grounded neutral systems shall be installed in accordance with 250.187.

Statement of Problem and Substantiation for Public Input

The terminology needs to be straightened out and it must be made clear that a neutral-to-ground bond is only applied under certain conditions. Specifically when the feed from the transformer does not have an equipment grounding conductor or other metallic paths. But when there is a metallic path from the service panel to the transformer, the neutral-to-ground bond is illegal and hazardous to persons.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 21:41:09 EDT 2017

Public Input No. 4333-NFPA 70-2017 [Section No. 250.186(B)]

(B) Systems Without a Grounded Conductor at the Service Point.

Where an ac system is grounded at any point and is not provided with a ~~grounded~~ neutral conductor at the service point, ~~a supply-side bonding jumper~~ an equipment grounding conductor (EGC) shall be installed and routed with the ungrounded (phase) conductors to each service disconnecting means and shall be connected to each disconnecting means equipment grounding conductor terminal or bus. The ~~supply-side bonding jumper shall be~~ equipment grounding conductor shall besized in accordance with 250.122 and installed in accordance with 250.186(B)(1) through (B)(3).

Exception: Where two or more service disconnecting means are located in a single assembly listed for use as service equipment, it shall be permitted to connect the ~~supply-side bonding jumper~~ equipment grounding conductor to the assembly common equipment grounding terminal or bus. Terminating to the neutral bus, if any, is strictly prohibited.

(1) Sizing for a Single Raceway or Overhead Conductor.

The ~~supply-side bonding jumper~~ equipment grounding conductor (EGC) shall not be smaller than the required grounding electrode conductor specified in Table 250.102(C)(1) or Table 250.122 but shall not be required to be larger than the largest ungrounded service-entrance conductor(s).

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

If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or overhead conductors, the ~~supply-side bonding jumper~~ equipment grounding conductor shall also be installed in parallel. The size of the ~~supply-side bonding jumper~~ equipment grounding conductor in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

(3) Impedance Grounded Neutral Systems.

Impedance grounded neutral systems shall be installed in accordance with 250.187.

Statement of Problem and Substantiation for Public Input

Table 250.102(C) is not needed. Table 250.122 is all that is needed.

Again, to many differing terminology for a simple grounding conductor. This should be globally fixed.

Submitter Information Verification

Submitter Full Name: David Stockin

Organization: E S Groundiing Solutions

Street Address:

City:

State:

Zip:

Submittal Date: Thu Sep 07 21:51:24 EDT 2017

Copyright Assignment

Public Input No. 2317-NFPA 70-2017 [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~~ without isolating the protective device, 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:

(1) The neutral conductor shall be identified.

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

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

(C) System Neutral Conductor Connection.

The system neutral 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.

Statement of Problem and Substantiation for Public Input

This statement allows users to find a fault which is on the system without shutting down. The existing clause does not state that the protective device can remain in operation.

Submitter Information Verification

Submitter Full Name: Sergio Panetta

Organization: I Gard Corp

Affiliation: I Gard Corp

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 16 13:06:44 EDT 2017

Copyright Assignment

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

Sections 250.187(B), 250.187(C)

(B) ~~Identified and~~ Insulated.

~~The neutral conductor shall comply with both of the following:~~

- ~~The neutral conductor shall be identified.~~

~~The neutral conductor shall be~~ The grounded system conductor shall be insulated for the maximum neutral voltage.

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

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

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

Statement of Problem and Substantiation for Public Input

This input finishes a job that I started ten years ago in changing the word "neutral" to anything but "neutral" in this section. I'm embarrassed to admit that I forgot to do it here. When the word "neutral" became a defined term in 2008, I made proposals in 250.36 to change the term, and Chuck Mello helped me out by coming up with the term "grounded system conductor." Call it whatever you want, but it most certainly is not a neutral, as defined in Article 100.
I'm also suggesting removing the entire requirement about the conductor being identified, since I don't think the word "identified", as defined in Article 100, is really the intent here. I think perhaps the conductor is supposed to be marked (not identified), but that's already required in 200.6, so there's no reason for the repetition, and in this case, the confusion. Thank you.

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Ryan Jackson
Street Address:
City:
State:
Zip:

Submittal Date: Mon May 22 20:26:19 EDT 2017

Public Input No. 1520-NFPA 70-2017 [Section No. 250.194]

250.194 ~~Grounding and~~ Bonding of Fences and Other Metal Structures.

Metallic fences enclosing, and other metal structures in or surrounding, a substation with exposed electrical conductors and equipment shall be ~~grounded and~~ bonded to limit step, touch, and transfer voltages.

(A) Metal Fences.

Where metal fences are located within 5 m (16 ft) of the exposed electrical conductors or equipment, the fence shall be bonded to the grounding electrode system with wire-type bonding jumpers as follows:

(1) Bonding jumpers shall be installed at each fence corner and at maximum 50 m (160 ft) intervals along the fence.

(2) Where bare overhead conductors cross the fence, bonding jumpers shall be installed on each side of the crossing.

(3) Gates shall be bonded to the gate support post, and each gate support post shall be bonded to the grounding electrode system.

(4) Any gate or other opening in the fence shall be bonded across the opening by a buried bonding jumper.

(5) The grounding grid or grounding electrode systems shall be extended to cover the swing of all gates.

(6) The barbed wire strands above the fence shall be bonded to the grounding electrode system.

Alternate designs performed under engineering supervision shall be permitted for grounding or bonding of metal fences.

Informational Note No. 1: A nonconducting fence or section may provide isolation for transfer of voltage to other areas.

Informational Note No. 2: See IEEE 80-2013, *IEEE Guide for Safety In AC Substation Grounding,* for design and installation of fence grounding.

(B) Metal Structures.

All exposed conductive metal structures, including guy wires within 2.5 m (8 ft) vertically or 5 m (16 ft) horizontally of exposed conductors or equipment and subject to contact by persons, shall be bonded to the grounding electrode systems in the area.

Statement of Problem and Substantiation for Public Input

The rule is only about bonding, so remove the two usages of the term ground.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 01 13:38:30 EDT 2017

Copyright Assignment

I, Mike Holt, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Input (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Input in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this copyright assignment.

☑ By checking this box I affirm that I am Mike Holt, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

Public Input No. 3987-NFPA 70-2017 [New Section after 250.194]

250.194(C) Transformers with High-Side Voltages Exceeding 1000 Volts

Transformers located outside of a structure but within 16 feet of the structure, must be bonded to the structures grounding system via an equipment grounding conductor, generating a 5-wire system for multi-phase systems, or a 4-wire system for single-phase systems. The Main Bonding Jumper (Neutral-to-ground bond) as stated in 250.28 is to be located only in the tranfromer when both an equipment grounding conductor and a neutral conductor are routed from the transformer to the service panel. Placing an additional main bonding jumper (netural-to-ground bond) in teh the main service is strictly prohibited under 250.24(A)(5), 250.30(A)(1), 250.30(A)(5), 250.32(B)(1), 250.142(B) and 250.6.

Transformers located outside of the structure but greater than 16 feet from the structure, may choose to route only normally-current-carrying conductors (phase and neutral conductors), without an equipment grounding conductor. In such cases, an ohm-meter must be used to measure the resistance between the transformer and the structures exposed metal components. A measurement of less than 200 ohms, indicates that the conductivity of the earth or other unintentional path(s) has effectively connected the two systems together, which could allow normal-operating-neutral-currents to flow through the earth back to the trasnformer in violation of 250.4(A)(5) and 250.4(B)(4). In this case, the transformer must be bonded to the structures grounding system via an equipment grounding conductor, as above.

Transformers located outside of the structure but greater than 16 feet from the structure, that measure greater than 200 ohms, as above, may choose to route only normally-current-carrying-conductors. In such cases, the circuit must have two neutral-to-ground bonds, one in the transformer, and one in the main service panel, in accordance with 250.28.

Statement of Problem and Substantiation for Public Input

Touch voltages between the structure and a nearby transformer, utility owned or privately owned, can kill persons. If the transformer is closer than 16-ft, it must be bonded to the grounding system so that the case of the transformer is at the same potential as the structure. However, this means that the neutral-to-ground bond must only be placed in the transformer and NOT in the service panel. Additionally, structures located on highly conductive soils, can have an unintentional path for neutral currents to flow back to the transformer through the earth. In these cases, an equipment grounding conductor should be routed in the circuit to prevent normal operating neutral currents from flowing through the earth. Again, this would mean that the neutral-to-ground bond only belongs in the transformer and NOT in the panel.

Submitter Information Verification

Submitter Full Name: David Stockin
Organization: E S Groundiing Solutions
Street Address:
City:
State:
Zip:

Submittal Date: Thu Sep 07 11:32:42 EDT 2017

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

~~**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:~~

(1) ~~Grounded service conductor~~

(2) ~~Grounding electrode conductor~~

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

(4) ~~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).~~

Additional Proposed Changes

File Name	Description	Approved
Article_242_July_13_2017.docx	New Article 242	✓

Statement of Problem and Substantiation for Public Input

The Correlating Committee reviewed the NEC® for "gaps" and issues where clarity and usability could be improved. The Correlating Committee agreed that combining Articles 280 and 285 in a style similar to that of Article 240 would significantly improve clarity and usability. The Correlating Committee then formed a Task Group, consisting of Larry Ayer (Co-Chair), Joseph DeGregoria, James Dollard, Carl Fredericks, Alan Manche, Michael O'Meara, Daleep Mohla, and Vince Saporita (Co-chair), to (1) confirm if there was merit in developing a more comprehensive article on surge protection similar to Article 240, and (2) if appropriate, submit public inputs for such an article. This Public Input has been generated by the Task Group to address the gap identified by the Correlating Committee.

Overvoltage protection and surge protection are presently addressed in two short articles, one for 1000 volts and below (285) and one for above 1000 volts (280). Combining the two articles improves clarity and usability. For clarity a new table similar to 240.3 is added. This public input simply deletes Article 280 and other related public inputs delete Article 285 and combine the two articles without changes to existing requirements into new Article 242. The new article will increase usability for the code user.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1897-NFPA 70-2017 [Article 285]	Deletes Article 285
Public Input No. 1898-NFPA 70-2017 [Global Input]	Adds new Article 242

Submitter Information Verification

Submitter Full Name: Vincent Saporita

Organization: Eatons Bussmann Business

Affilliation: Eatons Bussmann Business

Street Address:

City:

State:

Zip:

Submittal Date: Tue Aug 08 12:01:32 EDT 2017

Key for color scheme

Exact text taken from Articles 280 and 285

Minor changes from Articles 280 and 285 necessary to integrate into one Article

New material

Article 242

Overvoltage Protection

Part I. General

242.1 Scope. This article provides the general requirements, installation requirements, and connection requirements for overvoltage protection and overvoltage protective devices. Part II covers Surge Protective Devices (SPDs) permanently installed on premises wiring systems of not more than 1000 volts, nominal, while Part III covers surge arresters permanently installed on premises wiring systems over 1000 volts, nominal.

242.3 Other Articles. Equipment shall be protected against overvoltage in accordance with the article in this *Code* that covers the type of equipment or location specified in Table 242.3

Table 242.3 Other Articles

Equipment	Article
Class I locations	501
Class II locations	502
Community antenna television and radio distribution systems	820
Critical operations power systems	708
Elevators, dumbwaiters, escalators, moving walks, platform lifts, and stairway chairlifts	620
Emergency systems	700
Equipment over 1000 volts nominal	490
Fire pumps	695
Industrial Machinery	670
Information Technology Equipment	645
Modular data centers	646
Outdoor overhead conductors over 1000 volts	399
Radio and television equipment	810

Receptacles, Cord Connectors, and Attachment Plugs (Caps)	406
Wind electric systems	694

Part II Surge-Protective Devices (SPDs), 1000 Volts or Less

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

242.6 Uses Not Permitted. An SPD device shall not be installed in the following:

(1) Circuits over 1000 volts

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

(3) 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

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

242.9 Listing. An SPD shall be a listed device.

242.11 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.

242.13 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.

242.15 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.

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

242.19 Connection. Where an SPD device is installed, it shall comply with 242.21 through 242.29.

242.21 Type 1 SPDs. Type 1 SPDs shall be installed in accordance with 242.21(A) and (B).

(A) Installation. Type 1 SPDs shall be installed as follows:

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

(2) Type 1 SPDs shall be pemitted to be connected as specfied in 242.23

(B) At the Service. When installed at Services, Type 1 SPDs shall be connected to one of the following:

(1) Grounded service conductor

(2) Grounding electrode conductor

(3) Grounding electrode for the service

(4) Equipment grounding terminal in the service equipment

242.23 Type 2 SPDs. Type 2 SPDs shall be installed in accordance with 242.23 (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 Derrived System. The SPD shall be connected on the load side of the first overcurrent device in a separately derrived system.

242.25 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 derrived system disconnect.

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

242.29 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.

242.31 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).

Part III Surge Arresters, Over 1000 Volts

242.41 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.

242.43 Surge Arrester Selection. The surge arresters shall comply with 242.43(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 242.43(A).

Informational Noet 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 amd 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.

242.45 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.

242.47 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.

242.49 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 242.51 shall not be any longer than necessary and shall avoid unnecessary bends.

242.51 Connection. The arrester shall be connected to one of the following:

(1) Grounded service conductor

(2) Grounding electrode conductor

(3) Grounding electrode for the service

(4) Equipment grounding terminal in the service equipment

242.53 Surge-Arrester Conductors. The conductor between the surge arrester and the lilne and the surge arrester and the grounding connection shall not be smaller than 6 AWG copper or aluminum.

242.55 Interconnections. The surge arrester protecting a transformer that supplies a secondary distribution system shall be interconnected as specified in 242.55(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 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 242.55(A), or where the secondary is not grounded as in 242.55(A) but is otherwise grounded as in 250.52, an interconnection shall be made through a spark gap or listed device as required by 242.55(B)(1) or (B)(2).

(1) Ungrounded or Unigrounded Primary System. For ungrounded or unigrounded primary systems, the spark gap for 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 3kV, 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 242.55(A) or (B), shall be permitted to be made only by special permission.

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

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

280.14 Routing of Surge Arrester Equipment Grounding Conductors.

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

Statement of Problem and Substantiation for Public Input

Grounding and bonding still continues to be one of the most misunderstood and misapplied sections of the NEC. Most of the problems can be traced back to using undefined terminology (trade slang in many cases) or incorrect terminology. The term “grounding conductor” is one that is no longer defined. As part of a Correlating Committee Task Force activity on grounding and bonding in general, this term and its related definition was removed from the NEC during the 2008 NEC cycle. The term had been found to be misapplied in a number of instances and the definition of “grounding conductor” was determined to be very close to the definition of “grounding electrode conductor” yet, many uses of the term in previous editions of the NEC were found to be more correctly to be either “equipment grounding conductor”, “grounding electrode conductor” or one of the several types of “bonding jumper”.

The revised text uses terms defined in the Code and is consistent with the context of the meaning of the section where the revisions are made. The revisions are made to provide clarity, and consistency in terminology usage.

It is requested the Correlating Committee consider a policy or procedures that require a review when a term under the responsibility of a specific Code panel is used by another Code panel. The panel responsible for the term is to review the application to ensure correct usage. It is further requested that when new terms are created that would be identified as under the responsibility of another Code panel that the new term and application be reviewed by the Code panel that would have responsibility for use and application.

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: Cdcmello Consulting Llc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 16 20:01:38 EDT 2017

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

~~**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:~~

(1) ~~Circuits over 1000 volts~~

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

(3) ~~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:~~

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

(2) ~~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:~~

(1) ~~Grounded service conductor~~

(2) ~~Grounding electrode conductor~~

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

(4) ~~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) .~~

Additional Proposed Changes

File Name	Description	Approved
Article_242_July_13_2017.docx	New proposed Article 242	✓

Statement of Problem and Substantiation for Public Input

The Correlating Committee reviewed the NEC® for "gaps" and issues where clarity and usability could be improved. The Correlating Committee agreed that combining Articles 280 and 285 in a style similar to that of Article 240 would significantly improve clarity and usability. The Correlating Committee then formed a Task Group, consisting of Larry Ayer (Co-Chair), Joseph DeGregoria, James Dollard, Carl Fredericks, Alan Manche, Michael O'Meara, Daleep Mohla, and Vince Saporita (Co-chair), to (1) confirm if there was merit in developing a more comprehensive article on surge protection similar to Article 240, and (2) if appropriate, submit public inputs for such an article. This Public Input has been generated by the Task Group to address the gap identified by the Correlating Committee.

Overvoltage protection and surge protection are presently addressed in two short articles, one for 1000 volts and below (285) and one for above 1000 volts (280). Combining the two articles improves clarity and usability. For clarity a new table similar to 240.3 is added. This public input simply deletes Article 285 and related public inputs delete Article 280 and combine the two articles without changes to existing requirements (new Article 242). This new article will increase usability for the code user.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1896-NFPA 70-2017 [Article 280]	Deletes Article 280
Public Input No. 1898-NFPA 70-2017 [Global Input]	Adds New Article 242

Submitter Information Verification

Submitter Full Name: Vincent Saporita
Organization: Eatons Bussmann Business
Affilliation: Eatons Bussmann Business
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 08 12:12:37 EDT 2017

Key for color scheme

Exact text taken from Articles 280 and 285

Minor changes from Articles 280 and 285 necessary to integrate into one Article

New material

Article 242

Overvoltage Protection

Part I. General

242.1 Scope. This article provides the general requirements, installation requirements, and connection requirements for overvoltage protection and overvoltage protective devices. Part II covers Surge Protective Devices (SPDs) permanently installed on premises wiring systems of not more than 1000 volts, nominal, while Part III covers surge arresters permanently installed on premises wiring systems over 1000 volts, nominal.

242.3 Other Articles. Equipment shall be protected against overvoltage in accordance with the article in this *Code* that covers the type of equipment or location specified in Table 242.3

Table 242.3 Other Articles

Equipment	Article
Class I locations	501
Class II locations	502
Community antenna television and radio distribution systems	820
Critical operations power systems	708
Elevators, dumbwaiters, escalators, moving walks, platform lifts, and stairway chairlifts	620
Emergency systems	700
Equipment over 1000 volts nominal	490
Fire pumps	695
Industrial Machinery	670
Information Technology Equipment	645
Modular data centers	646
Outdoor overhead conductors over 1000 volts	399
Radio and television equipment	810

Receptacles, Cord Connectors, and Attachment Plugs (Caps)	406
Wind electric systems	694

Part II Surge-Protective Devices (SPDs), 1000 Volts or Less

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

242.6 Uses Not Permitted. An SPD device shall not be installed in the following:

(1) Circuits over 1000 volts

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

(3) 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

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

242.9 Listing. An SPD shall be a listed device.

242.11 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.

242.13 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.

242.15 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.

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

242.19 Connection. Where an SPD device is installed, it shall comply with 242.21 through 242.29.

242.21 Type 1 SPDs. Type 1 SPDs shall be installed in accordance with 242.21(A) and (B).

(A) Installation. Type 1 SPDs shall be installed as follows:

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

(2) Type 1 SPDs shall be pemitted to be connected as specfied in 242.23

(B) At the Service. When installed at Services, Type 1 SPDs shall be connected to one of the following:

(1) Grounded service conductor

(2) Grounding electrode conductor

(3) Grounding electrode for the service

(4) Equipment grounding terminal in the service equipment

242.23 Type 2 SPDs. Type 2 SPDs shall be installed in accordance with 242.23 (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 Derrived System. The SPD shall be connected on the load side of the first overcurrent device in a separately derrived system.

242.25 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 derrived system disconnect.

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

242.29 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.

242.31 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).

Part III Surge Arresters, Over 1000 Volts

242.41 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.

242.43 Surge Arrester Selection. The surge arresters shall comply with 242.43(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 242.43(A).

Informational Noet 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 amd 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.

242.45 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.

242.47 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.

242.49 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 242.51 shall not be any longer than necessary and shall avoid unnecessary bends.

242.51 Connection. The arrester shall be connected to one of the following:

(1) Grounded service conductor

(2) Grounding electrode conductor

(3) Grounding electrode for the service

(4) Equipment grounding terminal in the service equipment

242.53 Surge-Arrester Conductors. The conductor between the surge arrester and the lilne and the surge arrester and the grounding connection shall not be smaller than 6 AWG copper or aluminum.

242.55 Interconnections. The surge arrester protecting a transformer that supplies a secondary distribution system shall be interconnected as specified in 242.55(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 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 242.55(A), or where the secondary is not grounded as in 242.55(A) but is otherwise grounded as in 250.52, an interconnection shall be made through a spark gap or listed device as required by 242.55(B)(1) or (B)(2).

(1) Ungrounded or Unigrounded Primary System. For ungrounded or unigrounded primary systems, the spark gap for 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 3kV, 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 242.55(A) or (B), shall be permitted to be made only by special permission.

242.57 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).