Article 100 Definitions

Voltage, Nominal....

Informational Note No. 3: Certain 48-volt DC battery units have a charging float voltage up to 58 volts. In DC applications 60 volts is used to cover the entire range of float voltages.

Article 110

110.27 Guarding of Live Part
(A) Live Parts Guarded Against Accidental Contact. Except as elsewhere required or permitted by this Code, live parts of electrical equipment operating at 50 volts AC/60 volts DC or more shall be guarded against accidental contact by approved enclosures or by any of the following means:

Article 200 Use and Identification of Grounded Conductors

200.7
(B) Circuits of Less Than 50 Volts AC. A conductor with white or gray color insulation or three continuous white stripes or having a marking of white or gray at the termination for circuits of less than 50 volts AC shall be required to be grounded only as required by 250.20(A).

C) Circuits of 50 Volts AC 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 AC or more shall be permitted only as in (1) and (2).

Article 215 Feeders

215.12(C)(2) Feeders Supplied from Direct-Current Systems. Where a feeder is supplied from a dc system operating at more than 50 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 215.12(C)(2)(a) and (b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.

Article 430 Motors, Motor Circuits, and Controllers

430.232 Where Required. Exposed live parts of motors and controllers operating at 50 volts DC or more between terminals shall be guarded against accidental contact by enclosure or by location as follows:

430.233 Guards for Attendants. Where live parts of motors or controllers operating at over 50 volts AC to ground are guarded against accidental contact only by location as specified in 430.232, and where adjustment or other attendance may be necessary during the operation of the apparatus, suitable insulating mats or platforms shall be provided so that the attendant cannot readily touch live parts unless standing on the mats or platforms.

Article 445 Generators

445.14 Protection of Live Parts. Live parts of generators operated at more than 50 volts AC/60 volts DC to ground shall not be exposed to accidental contact where accessible to unqualified persons.

Article 460 Capacitors

460.6 (A) Time of Discharge. The residual voltage of a capacitor shall be reduced to 50 volts DC, nominal, or less within 1 minute after the capacitor is disconnected from the source of supply.

460.28(A) Means for Discharge. A means shall be provided to reduce the residual voltage of a capacitor to 50 volts DC or less within 5 minutes after the capacitor is disconnected from the source of supply.

Article 480 Storage Batteries

480.5 Overcurrent Protection for Prime Movers. Overcurrent protection shall not be required for conductors from a battery with a nominal voltage of 60 volts DC or less if the battery provides power for starting, ignition, or control of prime movers. Section 300.3 shall not apply to these conductors.

480.6 DC Disconnect Methods. (A) Disconnecting Means. A disconnecting means shall be provided for all ungrounded conductors derived from a stationary battery system with a nominal voltage over 60 volts DC. A disconnecting means shall be readily accessible and located within sight of the battery system.

Article 522 Control Systems for Permanent Amusement Attractions

522.25 Ungrounded Control Circuits. Separately derived ac and 2-wire dc circuits and systems 50 volts AC/60 volts DC or greater shall be permitted to be ungrounded, provided that all the following conditions are met:

Article 625

625.18 Interlock. Electric vehicle supply equipment shall be provided with an interlock that de-energizes the electric vehicle connector whenever the electrical connector is uncoupled from the electric vehicle. An interlock shall not be required for portable cord-and-plug-connected electric vehicle supply equipment intended for connection to
receptacle outlets rated at 125 volts, single phase, 15 and 20 amperes. An interlock shall not be required for dc supplies less than 60 volts dc.

625.19 Automatic De-Energization of Cable. The electric vehicle supply equipment or the cable-connector combination of the equipment shall be provided with an automatic means to de-energize the cable conductors and electric vehicle connector upon exposure to strain that could result in either cable rupture or separation of the cable from the electric connector and exposure of live parts. Automatic means to de-energize the cable conductors and electric vehicle connector shall not be required for portable cord-and-plug-connected electric vehicle supply equipment intended for connection to receptacle outlets rated at 125 volts, single phase, 15 and 20 amperes. An interlock shall not be required for dc supplies less than 60 volts dc.

625.44 Electric Vehicle Supply Equipment Connection. Electric vehicle supply equipment shall be permitted to be cord and plug-connected to the premises wiring system in accordance with one of the following:

(A) Connections to 125-Volt, Single-Phase, 15 and 20-Ampere Receptacle Outlets. Electric vehicle supply equipment intended for connection to non-locking, 2-pole, 3-wire grounding-type receptacle outlets rated at 125 V, single phase, 15 and 20 amperes or from a supply of less than 60 volts dc.

(B) Systems Exceeding 50 Volts Direct Current. Insulated conductors shall be permitted to be run without insulated support, provided they are protected from physical damage. Bare copper or aluminum conductors shall be permitted where supported on insulators.

(C) Systems Exceeding 50 Volts Direct Current. Insulated conductors shall be permitted to be run on insulated supports, provided they are protected from physical damage. Bare copper or aluminum conductors shall be permitted where supported on insulators and guarded against accidental contact up to the point of termination in accordance with 110.27.

Article 720 Circuits and Equipment Operating at Less than 50 Volts

720.1 Scope. This article covers installations operating at less than 50 volts, alternating current, or 60 volts direct current or alternating current.

720.11 Mechanical Execution of Work. Circuits operating at less than 50 volts AC or 60 volts DC shall be installed in a neat and workmanlike manner. Cables shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use.

Statement of Problem and Substantiation for Public Comment

Over the past decade numerous code articles have been placed into the NEC as a result of the increased resurgence of DC systems. These systems, similar to their AC counterpart, have mandated code requirements that must be met when the system voltage exceeds a certain threshold. For years the system threshold for many of the requirements has been kept at the 50 volt level. While this is appropriate for AC systems, it can create confusion to the user of the document when applied to a 48 DC batteries during charging where a “float voltage” is common at 58 volts. The float voltage can vary significantly depending on battery chemistry, battery construction, and the actual ambient temperature. This voltage may be constant for the entire duration of the charge or can fluctuate. Some 48 volt DC systems stay above the 50 volt threshold for 99% of the time for applications such as telecommunications, UPS systems and emergency lighting.

This elevated voltage may create confusion since various AHJ’s might see 58 volts and mandate that a code rule must be followed since the 50 volt threshold has been increased. To resolve these issues a DC task group was formed to research the DC systems found in the NEC and to correlate the various DC topics that were being added to the NEC. The task group recommended the use of 60 volt DC throughout the code to eliminate the confusion that could arise from the elevated float voltage. The intent of the task group was to provide a consistent use of the voltage threshold within the NEC document.

For the 2017 NEC Revision Cycle, a task group was formed to correlate the use of the 50/60V threshold and provide public comments for the second draft. The task group members Larry Ayer (Chair), Bill Cantor, Donny Cook, Jim Dollard (Co-Chair), John Kovacik (DC Task Group Chair), Ernie Gallo, Vince Saporita, and Jim White provided input and guidance for these recommendations.

To correlate the use of 50 volts for AC systems and 60 volts for DC systems, the recommended NEC changes are based on the following:
1. Where a code section refers to AC systems only and indicates 50 volts the acronym “AC” was added to provide clarity.

2. Where a code section refers to a requirement used only in a DC system at a 50 volt threshold, the voltage is revised to 60 volts and the term “DC” is added.

3. Where a code section indicates a 50 volt threshold, and the section is a requirement for both AC and DC systems, the text is revised as “50 volts AC/60 volts DC”.

4. When a code section refers to DC systems, and the term “nominal” is used, it will be deleted since the voltage threshold is increased to 60 volts.

5. A fine print note is being recommended in Article 100 below the definition for “Nominal Voltage” to provide additional information on float voltage.

NEC changes are being recommended for the following code sections:

1. *Add informational note after “Voltage, Nominal”. Informational note to read as follows:*

"Informational Note No. 3: Certain 48-volt DC battery units use a charging float voltage up to 58 volts. In DC applications 60 volts is used to cover the entire range of float voltages."

2. For section 110.27, “50 volts” is being changed to “50 volts AC/60 volts DC”. This will clarify the voltage threshold for AC and DC systems.

3. Section 200.7 (B) and (C) applies to conductor marking for AC systems only. “AC” is added after 50 volts to clarify that this requirement is only for AC systems.

4. Section 210.5(C)(2) was revised in the First draft that changed “50 volts” to “60 volts” to correlate with the new microgrid article. Revise section 215.12(C) from “50 volts” to “60 volts” to correlate with section 210.5(C)(2).

5. In section 445.14, revise “50 volts” to 50 volts AC/60 volts DC” to clarify that this requirement pertains to both AC and DC systems.

6. In sections 480.5 and 480.6 “50 volts” was changed to “60 volts” since these pertain to DC batteries and DC systems.

7. In section 522.25, “50 volts” is being changed to “50 volts AC / 60 volts DC” to clarify that this section pertains to both AC and DC systems and distinguishes between the two voltage systems and thresholds.

8. Article 625, Electrical Vehicle Charging System. Revise the text from “50 volts” to “60 volts” since these are DC systems.

9. Section 669.6(A) and (B) are DC systems. Revise the text from “50 volts” to “60 volts”

10. Section 690.71 (B) is a DC system with a threshold of 50 volts. Revise the text from “50 volts” to “60 volts DC”.

11. Article 720 Circuits and Equipment Operating at Less Than 50 Volts covers both AC and DC systems. To correlate the Title has been changed to “50 Volts AC/60 Volts DC”. The Scope 720.1 and section 720.11 have been modified to clarify that this Article applies to both systems with the corresponding voltage.

Related Item
Public Input No. 3681-NFPA 70-2014 [Global Input]

Submitter Information Verification

Submitter Full Name: Lawrence Ayer
Organization: Biz Com Electric, Inc.
Affiliation: IEC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 14:39:50 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Panel 1: See SR 24 Panel 2: Accept. CMP-2 supports consistency in moving from 50V to 60V Panel 3: Reject. Less than 50 volts AC is normally not considered to be a shock hazard based on NFPA 70E. Less than 100 volts DC is not considered to be safe. Pulsating DC is not taken into account but is covered in Table 11(B) in Chapter 9 of the NEC. Panel 4: The hazards associated with 50V AC and 60V dc are in conflict with many safety standards that set limits of 60V DC and 30V ac for accessible circuits in dry locations. The existing code language with nominal 50V allows for
temporary voltage variations above and below 50V. Article 706 addresses energy storage and limits specific to that application would be best addressed there. Panel 5: Reject. The submitter’s substantiation is incorrect. There is no provision in Article 200 to limit these requirements to AC systems only. Each of these requirements applies to both AC and DC systems. Limiting this to AC systems only would result in no identification requirements for grounded DC conductors. Panel 11: Reject. The current wording of 430.232 and 430.233 includes both AC and DC, changing this would limit it to only DC or AC. Panel 12: See Second Revision No. 3319, [also pending revisions to Article 625 on this topic when the Panel reviews] Panel 13: See SRs 3614, 3615, and 3616
Public Comment No. 120-NFPA 70-2015 [ Global Input ]


Statement of Problem and Substantiation for Public Comment

Same standard with new title.

Related Item
Public Input No. 3956-NFPA 70-2014 [Section No. 626.24(B)]
First Revision No. 5110-NFPA 70-2015 [Section No. 406.9(B)(1)]
First Revision No. 5439-NFPA 70-2015 [Section No. 555.19(A)(4)]
First Revision No. 7517-NFPA 70-2015 [New Section after 210.70(B)]

Submitter Information Verification
Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 06 09:10:33 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Statement: Panel 12: Reject but See SR No. 3318
Panel 19: CMP 19 advises an accept of PC 120 to make the change to the reference.
I read with interest the article authored by Wade Elliot in the July issue of Woodalls Campground Management relative to the changes in the upcoming 2017 electric code.

In short, I am in favor of the changes. Good Job!

Relative to the percentage of sites needing 50 amp service, you folks were dead accurate to the effect of all of the “cheaters” campers use to attempt to adapt their new R.V.s to an old campground. The Great Falls, MT KOA Campground recently did (with Loren as the engineer) a 76 site expansion. These 76 new sites were all supplied with 50 amp as well as 30 and 20 amp service. The reason? The bulk of the New Big R.V.s have 50 amp, 240 volt, 4 wire male plugs, and they need an appropriate receptacle to plug into. Relative to increasing the load calculations from the previous 9,600 volt amps (watts) to the 12,000 watts per site, I concur. Especially if they are only going to use 40% of the sites as a 50 amp rated site.

The ground rods at every R.V. pedestal was nothing less than stupid. In fact, stupid is too kind of an adjective. Anyone with a modicum of intelligence knew that putting ground rods at every R.V. site was/is beyond ridiculous. We here at Prairie Kraft Specialties work with a lot of campground around the country and I saw several occasions where the customer was adding an R.V. Site, etc. and ended up having to drive double ground rods; never mind the fact that they had a very sufficient mechanical equipment ground wire. Besides being ridiculous, I saw many cases where it got even worse. Namely, an ignorant inspector or park owner decided to tie the neutral to these ground rods also. Now we had multiple neutrals tied to ground throughout the campground (producing ground currents) which of course was not the intent of the code.

In one particular case the “Electrical Inspector” classified each campsite as a “service entrance” and made them tie the neutrals to the ground rod at each site! Of course, the Electrical Inspector’s justifications was “it’s what the code says”. Fortunately, the Campground Owner, who was way smarter than the Electrical Inspector, only did this long enough to get his inspection approved. He then reconnected the neutrals and equipment grounds as they should be.

Again, I found everything mentioned in Wade’s article to be favorable. Keep up the good work folks. Should anyone have any questions don’t hesitate to contact me.

Sincerely yours,
Loren Smith
PE and Owner of the Great Falls, MT KOA

Statement of Problem and Substantiation for Public Comment

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Sincerely yours,
Loren Smith
PE and Owner of the Great Falls, MT KOA
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<tr>
<th><strong>Submitter Full Name</strong></th>
<th>Loren Smith</th>
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<tr>
<td><strong>Organization</strong></td>
<td>Great Falls KOA</td>
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**Committee Statement**

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<th><strong>Committee Action</strong></th>
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<tr>
<td><strong>Resolution</strong></td>
<td>No code change was proposed. This was an affirmative comment to the First Draft change.</td>
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</table>
Please add reference to TIA Wiring Standards in informational note 1 of sections 800.24, 820.24, and 830.24 and reference to TIA-568-C.1, TIA-569-D, and TIA-570 because TIA Wiring Standards includes these and a few more.

Statement of Problem and Substantiation for Public Comment

Recommendation to add reference to TIA Wiring Standards in informational note 1 of 800.24, 820.24, and 830.24.

Related Public Comments for This Document

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<td>Public Comment No. 194-NFPA 70-2015 [Section No. 820.24]</td>
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<td>First Revision No. 4552-NFPA 70-2015 [Section No. 820.24]</td>
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Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu Jul 09 11:46:42 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4503-NFPA 70-2015
Statement: Telecommunications Industry Association (TIA) in its revision process corrected an error in their numbering scheme. Hence the two new parts are ANSI/TIA-568.0-D (generic) and ANSI/TIA-568.1-D (commercial buildings). Current editions of the documents are also provided. Additional TIA standards are added for completeness. The ANSI designation for TIA standards is retained as these standards utilize the ANSI standards development process and should be so designated.
This is a request for clarification on the panel resolution statement on Public Input 107-NFPA 70-2014.

Statement of Problem and Substantiation for Public Comment

The Resolution on my PI stated: The issue of foreign systems installed in electrical wiring enclosures is addressed in Section 300.8. Electrical equipment enclosures should be installed in accordance with their associated installation instructions. Restricting foreign equipment such as pneumatic piping and other types of systems from entering industrial equipment enclosures and process control equipment is not practical in all instances or conditions.

Section 300.8 states: Raceways Can’t Be Used For Multitasking- which goes on to state that Raceways are to be used only for electrical conductors and cables. Nonelectrical components such as pipes or tubes for Steam, Water, and Gas must not be installed in electrical raceways or cable trays.

Observation from years of experience: Raceways, Cable Trays, Combined Electrical Process Control Panels, and Industrial Equipment Enclosures all have the same common denominator, Remote Power Sources running through them. Where Motor Control Centers main power is fed via Cable Trays, the Motor Control Centers feeds 120v/60hz to pressure switches, transmitters, lightning/surge protection and step down transformers that are located in these process control panels and industrial equipment enclosures via internal terminal blocks. What is also common in all is the wires are installed in conduits. Now when a Pressurized Water Line is installed in a Process Control Panel or an Industrial Equipment Enclosure and it leaks or burst, the water can travel back to the sources such has a Power Panel, Motor Control Center, and even a Power Transformer.

Clarification Request: When the Committee stated restricting foreign equipment such Pneumatic Piping and other types of systems was not practical, was that supposed to have included Pressurized Water Lines? It appeared that Pressurized Water Lines wording was totally omitted from the Resolution.

Related Item

Public Input No. 107-NFPA 70-2014 [Global Input]

Submitter Information Verification

Submitter Full Name: John Robert Davis
Organization: Davis Instrumentation Services
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jul 22 13:19:15 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The Committee Statement from Public Input No. 107 includes the concerns addressed in the statement of problem. Section 300.8 addresses all piping.
Please update all references to ASTM E84 (Standard Test Method for Surface Burning Characteristics of Building Materials) to a date of 2015a.

Statement of Problem and Substantiation for Public Comment

Standard date update

Related Public Comments for This Document

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Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 16:01:44 EDT 2015

Committee Statement

Committee Action: Rejected
Article 100  Definitions

Scope. This article contains only those definitions essential to the application of this Code. It is not intended to include commonly defined general terms or commonly defined technical terms from related codes and standards. In general, only those terms that are used in two or more articles are defined in Article 100. Other definitions are included in the article in which they are used but may be referenced in Article 100.

Part I of this article contains definitions intended to apply wherever the terms are used throughout this Code. Part II contains definitions applicable to installations and equipment operating at over 1000 volts, nominal.

Part I.  General

Accessible (as applied to equipment).
Admitting close approach; not guarded by locked doors, elevation, or other effective means.

Accessible (as applied to wiring methods).
Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in by the structure or finish of the building.

Accessible, Readily (Readily Accessible).
Capable of being easily reached for operation, service, or inspection without requiring actions such as the use of tools, the need to climb over or under, the need to remove obstacles, or the use of portable ladders or similar equipment.

Adjustable Speed Drive.
Power conversion equipment that provides a means of adjusting the speed of an electric motor.

Informational Note: A variable frequency drive is one type of electronic adjustable speed drive that controls the rotational speed of an ac electric motor by controlling the frequency and voltage of the electrical power supplied to the motor.

Adjustable Speed Drive System.
A combination of an adjustable speed drive, its associated motor(s), and auxiliary equipment.

Ampacity.
The maximum current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

Appliance.
Utilization equipment, generally other than industrial, that is normally built in standardized sizes or types and is installed or connected as a unit to perform one or more functions such as clothes washing, air-conditioning, food mixing, deep frying, and so forth.

Approved.
Acceptable to the authority having jurisdiction.

Arc-Fault Circuit Interrupter (AFCI).
A device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected.

Askarel.
A generic term for a group of nonflammable synthetic chlorinated hydrocarbons used as electrical insulating media.

Informational Note: Askarels of various compositional types are used. Under arcing conditions, the gases produced, while consisting predominantly of noncombustible hydrogen chloride, can include varying amounts of combustible gases, depending on the askarel type.

Associated Apparatus [as applied to Hazardous (Classified) Locations].
Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affects the energy in the intrinsically safe circuits and is relied on to maintain intrinsic safety. Such apparatus is one of the following:

1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location.  
2) Electrical apparatus not so protected that shall not be used within a hazardous (classified) location.

Informational Note No. 1: Associated apparatus has identified intrinsically safe connections for intrinsically safe apparatus and also may have connections for nonintrinsically safe apparatus.

Informational Note No. 2: An example of associated apparatus is an intrinsic safety barrier, which is a network designed to limit the energy (voltage and current) available to the protected circuit in the hazardous (classified) location, under specified fault conditions.
Associated Nonincendive Field Wiring Apparatus [as applied to Hazardous (Classified) Locations].

Apparatus in which the circuits are not necessarily nonincendive themselves but that affect the energy in nonincendive field wiring circuits and are relied upon to maintain nonincendive energy levels. Such apparatus are one of the following:

1. Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location

2. Electrical apparatus not so protected that shall not be used in a hazardous (classified) location

Informational Note: Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and may also have connections for other electrical apparatus.

Attachment Plug (Plug Cap) (Plug).

A device that, by insertion in a receptacle, establishes a connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.

Authority Having Jurisdiction (AHJ).

An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

Informational Note: The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

Automatic.

Performing a function without the necessity of human intervention.

Bathroom.

An area including a basin with one or more of the following: a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures.

Battery System.

Interconnected battery subsystems consisting of one or more storage batteries and battery chargers, and can include inverters, converters, and associated electrical equipment.

Bonded (Bonding).

Connected to establish electrical continuity and conductivity.

Bonding Conductor or Jumper.

A reliable conductor to ensure the required electrical conductivity between metal parts required to be electrically connected.

Bonding Jumper, Equipment.

The connection between two or more portions of the equipment grounding conductor.

Bonding Jumper, Main.

The connection between the grounded circuit conductor and the equipment grounding conductor at the service.

Bonding Jumper, System.

The connection between the grounded circuit conductor and the supply-side bonding jumper, or the equipment grounding conductor, or both, at a separately derived system.

Branch Circuit.

The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).

Branch Circuit, Appliance.

A branch circuit that supplies energy to one or more outlets to which appliances are to be connected and that has no permanently connected luminaires that are not a part of an appliance.

Branch Circuit, General-Purpose.

A branch circuit that supplies two or more receptacles or outlets for lighting and appliances.

Branch Circuit, Individual.

A branch circuit that supplies only one utilization equipment.

Branch Circuit, Multiwire.

A branch circuit that consists of two or more ungrounded conductors that have a voltage between them, and a grounded conductor that has equal voltage between it and each ungrounded conductor of the circuit and that is connected to the neutral or grounded conductor of the system.
Building.
A structure that stands alone or that is separated from adjoining structures by fire walls.

Cabinet.
An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.

Cable Routing Assembly.
A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2, Class 3, and Type PLTC cables, and power-limited fire alarm cables in plenum, riser, and general-purpose applications.

Charge Controller.
Equipment that controls dc voltage or dc current, or both, and that is used to charge a battery or other energy storage device.

Circuit Breaker.
A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating.

Informational Note: The automatic opening means can be integral, direct acting with the circuit breaker, or remote from the circuit breaker.

Adjustable (as applied to circuit breakers).
A qualifying term indicating that the circuit breaker can be set to trip at various values of current, time, or both, within a predetermined range.

Instantaneous Trip (as applied to circuit breakers).
A qualifying term indicating that no delay is purposely introduced in the tripping action of the circuit breaker.

Inverse Time (as applied to circuit breakers).
A qualifying term indicating that there is purposely introduced a delay in the tripping action of the circuit breaker, which delay decreases as the magnitude of the current increases.

Nonadjustable (as applied to circuit breakers).
A qualifying term indicating that the circuit breaker does not have any adjustment to alter the value of the current at which it will trip or the time required for its operation.

Setting (of circuit breakers).
The value of current, time, or both, at which an adjustable circuit breaker is set to trip.

Coaxial Cable.
A cylindrical assembly composed of a conductor centered inside a metallic tube or shield, separated by a dielectric material, and usually covered by an insulating jacket.

Clothes Closet.
A nonhabitable room or space intended primarily for storage of garments and apparel.

Combustible Dust [as applied to Hazardous (Classified) Locations].
Dust particles that are 500 microns or smaller (material passing a U.S. No. 35 Standard Sieve as defined in ASTM E 11-13, Standard Specification for Wire Cloth and Sieves for Testing Purposes), and present a fire or explosion hazard when dispersed and ignited in air.


Combustible Gas Detection System [as applied to Hazardous (Classified) Locations].
A protection technique utilizing stationary gas detectors in industrial establishments.

Communications Equipment.
The electronic equipment that performs the telecommunications operations for the transmission of audio, video, and data, and includes power equipment (e.g., dc converters, inverters, and batteries), technical support equipment (e.g., computers), and conductors dedicated solely to the operation of the equipment.

Informational Note: This definition clearly indicates that the dc power equipment as well as computers are considered to be part of the communications equipment. As the telecommunications network transitions to a more data centric network, communications equipment will also include routers and servers essential to the transmission of audio, video, and data.

Communications Raceway.
An enclosed channel of nonmetallic materials designed expressly for holding communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2, Class 3 and Type PLTC cables, and power-limited fire alarm cables in plenums, risers, and general-purpose applications.
Composite Optical Fiber Cable.
A cable containing optical fibers and current-carrying electrical conductors.
Concealed.
Rendered inaccessible by the structure or finish of the building.

Informational Note: Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them.

Conductive Optical Fiber Cable.
A factory assembly of one or more optical fibers having an overall covering and containing non–current-carrying conductive member(s) such as metallic strength member(s), metallic vapor barrier(s), metallic armor or metallic sheath.

Conductor, Bare.
A conductor having no covering or electrical insulation whatsoever.

Conductor, Covered.
A conductor encased within material of composition or thickness that is not recognized by this Code as electrical insulation.

Conductor, Insulated.
A conductor encased within material of composition and thickness that is recognized by this Code as electrical insulation.

Conduit Body.
A separate portion of a conduit or tubing system that provides access through a removable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system.

Boxes such as FS and FD or larger cast or sheet metal boxes are not classified as conduit bodies.

Connector, Pressure (Solderless).
A device that establishes a connection between two or more conductors or between one or more conductors and a terminal by means of mechanical pressure and without the use of solder.

Continuous Load.
A load where the maximum current is expected to continue for 3 hours or more.

Control Circuit.
The circuit of a control apparatus or system that carries the electric signals directing the performance of the controller but does not carry the main power current.

Control Drawing [as applied to Hazardous (Classified) Locations].
A drawing or other document provided by the manufacturer of the intrinsically safe or associated apparatus, or of the nonincendive field wiring apparatus or associated nonincendive field wiring apparatus, that details the allowed interconnections between the intrinsically safe and associated apparatus or between the nonincendive field wiring apparatus or associated nonincendive field wiring apparatus.

Controller.
A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

Cooking Unit, Counter-Mounted.
A cooking appliance designed for mounting in or on a counter and consisting of one or more heating elements, internal wiring, and built-in or mountable controls.

Coordination, Selective (Selective Coordination).
Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the selection and installation of overcurrent protective devices and their ratings or settings for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.

Copper-Clad Aluminum Conductors.
Conductors drawn from a copper-clad aluminum rod, with the copper metallurgically bonded to an aluminum core, where the copper forms a minimum of 10 percent of the cross-sectional area of a solid conductor or each strand of a stranded conductor.

Cord Connector [as applied to Hazardous (Classified) Locations].
A fitting intended to terminate a cord or cable to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust-ignitionproof, or a flameproof seal.

Cutout Box.
An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.

Dead Front.
Without live parts exposed to a person on the operating side of the equipment.
Demand Factor.
The ratio of the maximum demand of a system, or part of a system, to the total connected load of a system or the part of the system under consideration.

Device.
A unit of an electrical system, other than a conductor, that carries or controls electric energy as its principal function.

Disconnecting Means.
A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

Dust-Ignitionproof [as applied to Hazardous (Classified) Locations].
Equipment enclosed in a manner that excludes dusts and does not permit arcs, sparks, or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure.


Dusttight.
Enclosures constructed so that dust will not enter under specified test conditions.

Informational Note No. 1: Enclosure Types 3, 3S, 3SX, 4, 4X, 5, 6, 6P, 12, 12K, and 13, per ANSI/NEMA 250-2014, *Enclosures for Electrical Equipment*, are considered dusttight and suitable for use in unclassified locations and in Class II, Division 2; Class III; and Zone 22 hazardous (classified) locations.

Informational Note No. 2: For further information, see ANSI/ISA-12.12.01-2013, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.

Duty, Continuous.
Operation at a substantially constant load for an indefinitely long time.

Duty, Intermittent.
Operation for alternate intervals of (1) load and no load; or (2) load and rest; or (3) load, no load, and rest.

Duty, Periodic.
Intermittent operation in which the load conditions are regularly recurrent.

Duty, Short-Time.
Operation at a substantially constant load for a short and definite, specified time.

Duty, Varying.
Operation at loads, and for intervals of time, both of which may be subject to wide variation.

Dwelling, One-Family.
A building that consists solely of one dwelling unit.

Dwelling, Two-Family.
A building that consists solely of two dwelling units.

Dwelling, Multifamily.
A building that contains three or more dwelling units.

Dwelling Unit.
A single unit, providing complete and independent living facilities for one or more persons, including permanent provisions for living, sleeping, cooking, and sanitation.

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

Electric Power Production and Distribution Network.
Power production, distribution, and utilization equipment and facilities, such as electric utility systems that deliver electric power to the connected loads, that are external to and not controlled by an interactive system.

Electric Sign.
A fixed, stationary, or portable self-contained, electrically operated and/or electrically illuminated utilization equipment with words or symbols designed to convey information or attract attention.

Electric-Discharge Lighting.
Systems of illumination utilizing fluorescent lamps, high-intensity discharge (HID) lamps, or neon tubing.
Electrical Circuit Protective System
A system consisting of components and materials intended for installation as protection for specific electrical wiring systems with respect to the disruption of electrical circuit integrity upon exterior fire exposure.

Electronically Actuated Fuse.
An overcurrent protective device that generally consists of a control module that provides current-sensing, electronically derived time–current characteristics, energy to initiate tripping, and an interrupting module that interrupts current when an overcurrent occurs. Such fuses may or may not operate in a current-limiting fashion, depending on the type of control selected.

Enclosed.
Surrounded by a case, housing, fence, or wall(s) that prevents persons from accidentally contacting energized parts.

Enclosure.
The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage.

Informational Note: See Table 110.28 for examples of enclosure types.

Energized.
Electrically connected to, or is, a source of voltage.

Equipment.
A general term, including fittings, devices, appliances, luminaires, apparatus, machinery, and the like used as a part of, or in connection with, an electrical installation.

Informational Note: In addition to the items listed in the definition, equipment also describes air conditioning units, power outlets (such as recreational vehicle site supply equipment or marine power outlets), transformers, and other enclosures that contain electrical products.

Exclusive Control (as applied to electrical installations).
The party that is responsible for the installation, servicing, maintaining, or repair of electrical conductors, equipment, raceways, signaling and communication conductors, fiber optic cables, and other similar installations.

Explosionproof Equipment.
Equipment enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby.

Informational Note: For further information, see ANSI/UL 1203-2009, Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.

Exposed (as applied to live parts).
Capable of being inadvertently touched or approached nearer than a safe distance by a person.

Informational Note: This term applies to parts that are not suitably guarded, isolated, or insulated.

Exposed (as applied to wiring methods).
On or attached to the surface or behind panels designed to allow access.

Externally Operable.
Capable of being operated without exposing the operator to contact with live parts.

Feeder.
All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit overcurrent device.

Festoon Lighting.
A string of outdoor lights that is suspended between two points.

Field Evaluation Body (FEB).
An organization or part of an organization that performs field evaluations of electrical or other equipment. [NFPA 790, 2012]

Field Labeled (as applied to evaluated products).
Equipment or materials to which has been attached a label, symbol, or other identifying mark of an FEB indicating the equipment or materials were evaluated and found to comply with requirements as described in an accompanying field evaluation report. [NFPA 790, 2012]

Fitting.
An accessory such as a locknut, bushing, or other part of a wiring system that is intended primarily to perform a mechanical rather than an electrical function.
Garage.
A building or portion of a building in which one or more self-propelled vehicles can be kept for use, sale, storage, rental, repair, exhibition, or demonstration purposes.

Informational Note: For commercial garages, repair and storage, see Article 511.

Ground.
The earth.

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

Grounded (Grounding).
Connected (connecting) to ground or to a conductive body that extends the ground connection.

Grounded, Solidly.
Connected to ground without inserting any resistor or impedance device.

Grounded Conductor.
A system or circuit conductor that is intentionally grounded.

Ground-Fault Circuit Interrupter (GFCI).
A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds the values established for a Class A device.

Informational Note: Class A ground-fault circuit interrupters trip when the current to ground is 6 mA or higher and do not trip when the current to ground is less than 4 mA. For further information, see UL 943, Standard for Ground-Fault Circuit Interrupters.

Ground-Fault Circuit Interrupter, Special Purpose (SPGFCI).
A device intended for the protection of personnel that functions to de-energize a circuit or portion of a circuit within an established period of time when a current to ground exceeds the values established for Class C, D, and E devices.

Informational Note: Classes C, D, and E ground-fault circuit interrupters trip when the current to ground is 20 mA or higher and do not trip when the current to ground is less than 15 mA. For further information, see UL 943C, Outline of Investigation for Special Purpose Ground-Fault Circuit Interrupters.

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.

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.

Ground-Fault Protection of Equipment.
A system intended to provide protection of equipment from damaging line-to-ground fault currents by operating to cause a disconnecting means to open all ungrounded conductors of the faulted circuit. This protection is provided at current levels less than those required to protect conductors from damage through the operation of a supply circuit overcurrent device.

Grounding Conductor, Equipment (EGC).
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.

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.

Grounding Electrode.
A conducting object through which a direct connection to earth is established.

Grounding Electrode Conductor.
A conductor used to connect the system grounded conductor or the equipment to a grounding electrode or to a point on the grounding electrode system.

Guarded.
Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.

Guest Room.
An accommodation combining living, sleeping, sanitary, and storage facilities within a compartment.
**Guest Suite.**
An accommodation with two or more contiguous rooms comprising a compartment, with or without doors between such rooms, that provides living, sleeping, sanitary, and storage facilities.

**Handhole Enclosure.**
An enclosure for use in underground systems, provided with an open or closed bottom, and sized to allow personnel to reach into, but not enter, for the purpose of installing, operating, or maintaining equipment or wiring or both.

**Hermetic Refrigerant Motor-Compressor.**
A combination consisting of a compressor and motor, both of which are enclosed in the same housing, with no external shaft or shaft seals, with the motor operating in the refrigerant.

**Hermetically Sealed [as applied to Hazardous (Classified) Locations].**
Equipment sealed against the entrance of an external atmosphere where the seal is made by fusion, for example, soldering, brazing, welding, or the fusion of glass to metal.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

**Hoistway.**
Any shaftway, hatchway, well hole, or other vertical opening or space in which an elevator or dumbwaiter is designed to operate.

**Hybrid System.**
A system comprised of multiple power sources. These power sources could include photovoltaic, wind, micro-hydro generators, engine-driven generators, and others, but do not include electric power production and distribution network systems. Energy storage systems such as batteries, flywheels, or superconducting magnetic storage equipment do not constitute a power source for the purpose of this definition. The energy regenerated by an overhauling (descending) elevator does not constitute a power source for the purpose of this definition.

**Identified (as applied to equipment).**
Recognizable as suitable for the specific purpose, function, use, environment, application, and so forth, where described in a particular Code requirement.

Informational Note: Some examples of ways to determine suitability of equipment for a specific purpose, environment, or application include investigations by a qualified testing laboratory (listing and labeling), an inspection agency, or other organizations concerned with product evaluation.

**In Sight From (Within Sight From, Within Sight).**
Where this Code specifies that one equipment shall be “in sight from,” “within sight from,” or “within sight of,” and so forth, another equipment, the specified equipment is to be visible and not more than 15 m (50 ft) distant from the other.

**Industrial Control Panel.**
An assembly of two or more components consisting of one of the following: (1) power circuit components only, such as motor controllers, overload relays, fused disconnect switches, and circuit breakers; (2) control circuit components only, such as push buttons, pilot lights, selector switches, timers, switches, and control relays; (3) a combination of power and control circuit components. These components, with associated wiring and terminals, are mounted on, or contained within, an enclosure or mounted on a subpanel.

The industrial control panel does not include the controlled equipment.

**Information Technology Equipment (ITE).**
Equipment and systems rated 1000 volts or less, normally found in offices or other business establishments and similar environments classified as ordinary locations, that are used for creation and manipulation of data, voice, video, and similar signals that are not communications equipment as defined in Part I of Article 100 and do not process communications circuits as defined in 800.2.

Informational Note: For information on listing requirements for both information technology equipment and communications equipment, see UL 60950-1-2014, Information Technology Equipment — Safety — Part 1: General Requirements or UL 62368-1-2014, Audio/Video Information and Communication Technology Equipment Part 1: Safety Requirements.

**Innerduct.**
A nonmetallic raceway placed within a larger raceway.

**Interactive Inverter.**
An inverter intended for use in parallel with an electric utility to supply common loads that may deliver power to the utility.

**Interactive System.**
An electric power production system that is operating in parallel with and capable of delivering energy to an electric primary source supply system.

**Interrupting Rating.**
The highest current at rated voltage that a device is identified to interrupt under standard test conditions.

Informational Note: Equipment intended to interrupt current at other than fault levels may have its interrupting rating implied in other ratings, such as horsepower or locked rotor current.

**Intersystem Bonding Termination.**
A device that provides a means for connecting intersystem bonding conductors for communications systems to the grounding electrode system.

**Isolated (as applied to location).**
Not readily accessible to persons unless special means for access are used.

**Intrinsically Safe Apparatus.**
Apparatus in which all the circuits are intrinsically safe.

**Intrinsically Safe System [as applied to Hazardous (Classified) Locations].**
An assembly of interconnected intrinsically safe apparatus, associated apparatus, and interconnecting cables, in that those parts of the system that may be used in hazardous (classified) locations are intrinsically safe circuits.

Informational Note: An intrinsically safe system may include more than one intrinsically safe circuit.

**Kitchen.**
An area with a sink and permanent provisions for food preparation and cooking.

**Labeled.**
Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

**Lighting Outlet.**
An outlet intended for the direct connection of a lampholder or luminaire.

**Lighting Track (Track Lighting).**
A manufactured assembly designed to support and energize luminaires that are capable of being readily repositioned on the track. Its length can be altered by the addition or subtraction of sections of track.

**Listed.**
Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

Informational Note: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. Use of the system employed by the listing organization allows the authority having jurisdiction to identify a listed product.

**Live Parts.**
Energized conductive components.

**Location, Damp.**
Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture.

Informational Note: Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold-storage warehouses.

**Location, Dry.**
A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.

**Location, Wet.**
Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

**Luminaire.**
A complete lighting unit consisting of a light source such as a lamp or lamps, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light. A lampholder itself is not a luminaire.

**Mobile Equipment.**
Equipment with electrical components suitable to be moved only with mechanical aids or is provided with wheels for movement by person(s) or powered devices.
Motor Control Center.
An assembly of one or more enclosed sections having a common power bus and principally containing motor control units.

Multioutlet Assembly.
A type of surface, flush, or freestanding raceway designed to hold conductors and receptacles, assembled in the field or at the factory.

Neutral Conductor.
The conductor connected to the neutral point of a system that is intended to carry current under normal conditions.

Neutral Point.
The common point on a wye-connection in a polyphase system or midpoint on a single-phase, 3-wire system, or midpoint of a single-phase portion of a 3-phase delta system, or a midpoint of a 3-wire, direct-current system.

Informational Note: At the neutral point of the system, the vectorial sum of the nominal voltages from all other phases within the system that utilize the neutral, with respect to the neutral point, is zero potential.

Nonautomatic.
Requiring human intervention to perform a function.

Nonconductive Optical Fiber Cable.
A factory assembly of one or more optical fibers having an overall covering and containing no electrically conductive materials.

Nonincendive Circuit [as applied to Hazardous (Classified) Locations].
A circuit, other than field wiring, in which any arc or thermal effect produced under intended operating conditions of the equipment, is not capable, under specified test conditions, of igniting the flammable gas–air, vapor–air, or dust–air mixture.

Informational Note: Conditions are described in ANSI/ISA-12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Nonincendive Component [as applied to Hazardous (Classified) Locations].
A component having contacts for making or breaking an incendive circuit and the contacting mechanism is constructed so that the component is incapable of igniting the specified flammable gas–air or vapor–air mixture. The housing of a nonincendive component is not intended to exclude the flammable atmosphere or contain an explosion.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Nonincendive Equipment [as applied to Hazardous (Classified) Locations].
Equipment having electrical/electronic circuitry that is incapable, under normal operating conditions, of causing ignition of a specified flammable gas–air, vapor–air, or dust–air mixture due to arcing or thermal means.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Nonincendive Field Wiring [as applied to Hazardous (Classified) Locations].
Wiring that enters or leaves an equipment enclosure and, under normal operating conditions of the equipment, is not capable, due to arcing or thermal effects, of igniting the flammable gas–air, vapor–air, or dust–air mixture. Normal operation includes opening, shorting, or grounding the field wiring.

Nonincendive Field Wiring Apparatus [as applied to Hazardous (Classified) Locations].
Apparatus intended to be connected to nonincendive field wiring.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Nonlinear Load.
A load where the wave shape of the steady-state current does not follow the wave shape of the applied voltage.

Informational Note: Electronic equipment, electronic/electric-discharge lighting, adjustable-speed drive systems, and similar equipment may be nonlinear loads.

Oil Immersion [as applied to Hazardous (Classified) Locations].
Electrical equipment immersed in a protective liquid in such a way that an explosive atmosphere that may be above the liquid or outside the enclosure cannot be ignited.

Optical Fiber Cable.
A factory assembly or field assembly of one or more optical fibers having an overall covering.

Informational Note: A field-assembled optical fiber cable is an assembly of one or more optical fibers within a jacket. The jacket, without optical fibers, is installed in a manner similar to conduit or raceway. Once the jacket is installed, the optical fibers are inserted into the jacket, completing the cable assembly.

Outlet.
A point on the wiring system at which current is taken to supply utilization equipment.
Outline Lighting.
An arrangement of incandescent lamps, electric-discharge lighting, or other electrically powered light sources to outline or call attention to certain features such as the shape of a building or the decoration of a window.

Overcurrent.
Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit, or ground fault.

Informational Note: A current in excess of rating may be accommodated by certain equipment and conductors for a given set of conditions. Therefore, the rules for overcurrent protection are specific for particular situations.

Overcurrent Protective Device, Branch-Circuit.
A device capable of providing protection for service, feeder, and branch circuits and equipment over the full range of overcurrents between its rated current and its interrupting rating. Such devices are provided with interrupting ratings appropriate for the intended use but no less than 5000 amperes.

Overcurrent Protective Device, Supplementary.
A device intended to provide limited overcurrent protection for specific applications and utilization equipment such as luminaires and appliances. This limited protection is in addition to the protection provided in the required branch circuit by the branch-circuit overcurrent protective device.

Overload.
Operation of equipment in excess of normal, full-load rating, or of a conductor in excess of rated ampacity that, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload.

Panelboard.
A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall, partition, or other support; and accessible only from the front.

Photovoltaic (PV) System.
The total components and subsystem that, in combination, convert solar energy into electric energy for connection to a utilization load.

Plenum.
A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.

Portable Equipment.
Equipment with electrical components suitable to be moved by a single person without mechanical aids.

Power Outlet.
An enclosed assembly that may include receptacles, circuit breakers, fuseholders, fused switches, buses, and watt-hour meter mounting means; intended to supply and control power to mobile homes, recreational vehicles, park trailers, or boats or to serve as a means for distributing power required to operate mobile or temporarily installed equipment.

Premises Wiring (System).
Interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all their associated hardware, fittings, and wiring devices, both permanently and temporarily installed. This includes (a) wiring from the service point or power source to the outlets or (b) wiring from and including the power source to the outlets where there is no service point.

Such wiring does not include wiring internal to appliances, luminaires, motors, controllers, motor control centers, and similar equipment.

Informational Note: Power sources include, but are not limited to, interconnected or stand-alone batteries, solar photovoltaic systems, other distributed generation systems, or generators.

Pressurized [as applied to Hazardous (Classified) Locations].
The process of supplying an enclosure with a protective gas with or without continuous flow, at sufficient pressure to prevent the entrance of combustible dust or ignitable fibers/flyings.

Process Seal [as applied to Hazardous (Classified) Locations].
A seal between electrical systems and flammable or combustible process fluids where a failure could allow the migration of process fluids into the premises' wiring system.

Purged and Pressurized [as applied to Hazardous (Classified) Locations].
The process of (1) purging, supplying an enclosure with a protective gas at a sufficient flow and positive pressure to reduce the concentration of any flammable gas or vapor initially present to an acceptable level; and (2) pressurization, supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of a flammable gas or vapor, a combustible dust, or an ignitable fiber.

Informational Note: For further information, see ANSI/NFPA 496-2013, Purged and Pressurized Enclosures for Electrical Equipment.
**Qualified Person.**

One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved.

Informational Note: Refer to NFPA 70E-2012, *Standard for Electrical Safety in the Workplace*, for electrical safety training requirements.

**Raceway.**

An enclosed channel designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this Code.

Informational Note: A raceway is identified within specific article definitions.

**Rainproof.**

Constructed, protected, or treated so as to prevent rain from interfering with the successful operation of the apparatus under specified test conditions.

**Raintight.**

Constructed or protected so that exposure to a beating rain will not result in the entrance of water under specified test conditions.

**Receptacle.**

A contact device installed at the outlet for the connection of an attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke.

**Receptacle Outlet.**

An outlet where one or more receptacles are installed.

**Remote-Control Circuit.**

Any electrical circuit that controls any other circuit through a relay or an equivalent device.

**Retrofit Kit.**

A general term for a complete subassembly of parts and devices for field conversion of utilization equipment.

**Sealable Equipment.**

Equipment enclosed in a case or cabinet that is provided with a means of sealing or locking so that live parts cannot be made accessible without opening the enclosure.

Informational Note: The equipment may or may not be operable without opening the enclosure.

**Separately Derived System.**

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

**Service.**

The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

**Service Cable.**

Service conductors made up in the form of a cable.

**Service Conductors.**

The conductors from the service point to the service disconnecting means.

**Service Conductors, Overhead.**

The overhead conductors between the service point and the first point of connection to the service-entrance conductors at the building or other structure.

**Service Conductors, Underground.**

The underground conductors between the service point and the first point of connection to the service-entrance conductors in a terminal box, meter, or other enclosure, inside or outside the building wall.

Informational Note: Where there is no terminal box, meter, or other enclosure, the point of connection is considered to be the point of entrance of the service conductors into the building.

**Service Drop.**

The overhead conductors between the utility electric supply system and the service point.

**Service-Entrance Conductors, Overhead System.**

The service conductors between the terminals of the service equipment and a point usually outside the building, clear of building walls, where joined by tap or splice to the service drop or overhead service conductors.
Service-Entrance Conductors, Underground System.
The service conductors between the terminals of the service equipment and the point of connection to the service lateral or underground service conductors.

Informational Note: Where service equipment is located outside the building walls, there may be no service-entrance conductors or they may be entirely outside the building.

Service Equipment.
The necessary equipment, usually consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the load end of service conductors to a building or other structure, or an otherwise designated area, and intended to constitute the main control and cutoff of the supply.

Service Lateral.
The underground conductors between the utility electric supply system and the service point.

Service Point.
The point of connection between the facilities of the serving utility and the premises wiring.

Informational Note: The service point can be described as the point of demarcation between where the serving utility ends and the premises wiring begins. The serving utility generally specifies the location of the service point based on the conditions of service.

Short-Circuit Current Rating.
The prospective symmetrical fault current at a nominal voltage to which an apparatus or system is able to be connected without sustaining damage exceeding defined acceptance criteria.

Show Window.
Any window used or designed to be used for the display of goods or advertising material, whether it is fully or partly enclosed or entirely open at the rear and whether or not it has a platform raised higher than the street floor level.

Signaling Circuit.
Any electrical circuit that energizes signaling equipment.

Simple Apparatus [as applied to Hazardous (Classified) Locations].
An electrical component or combination of components of simple construction with well-defined electrical parameters that does not generate more than 1.5 volts, 100 mA, and 25 mW, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.

Informational Note: The following apparatus are examples of simple apparatus:

1. Passive components; for example, switches, junction boxes, resistance temperature devices, and simple semiconductor devices such as LEDs
2. Sources of stored energy consisting of single components in simple circuits with well-defined parameters; for example, capacitors or inductors, whose values are considered when determining the overall safety of the system
3. Sources of generated energy; for example, thermocouples and photocells, that do not generate more than 1.5 volts, 100 mA, and 25 mW

Special Permission.
The written consent of the authority having jurisdiction.

Structure.
That which is built or constructed, other than equipment.

Surge Arrester.
A protective device for limiting surge voltages by discharging or bypassing surge current; it also prevents continued flow of follow current while remaining capable of repeating these functions.

Surge-Protective Device (SPD).
A protective device for limiting transient voltages by diverting or limiting surge current; it also prevents continued flow of follow current while remaining capable of repeating these functions and is designated as follows:

Type 1: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.

Type 2: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

Type 3: Point of utilization SPDs.

Type 4: Component SPDs, including discrete components, as well as assemblies.

Informational Note: For further information on Type 1, Type 2, Type 3, and Type 4 SPDs, see UL 1449, Standard for Surge Protective Devices.
Switch, Bypass Isolation.
A manually operated device used in conjunction with a transfer switch to provide a means of directly connecting load conductors to a power source and of disconnecting the transfer switch.

Switch, General-Use.
A switch intended for use in general distribution and branch circuits. It is rated in amperes, and it is capable of interrupting its rated current at its rated voltage.

Switch, General-Use Snap.
A form of general-use switch constructed so that it can be installed in device boxes or on box covers, or otherwise used in conjunction with wiring systems recognized by this Code.

Switch, Isolating.
A switch intended for isolating an electrical circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means.

Switch, Motor-Circuit.
A switch rated in horsepower that is capable of interrupting the maximum operating overload current of a motor of the same horsepower rating as the switch at the rated voltage.

Switch, Transfer.
An automatic or nonautomatic device for transferring one or more load conductor connections from one power source to another.

Switchboard.
A large single panel, frame, or assembly of panels on which are mounted on the face, back, or both, switches, overcurrent and other protective devices, buses, and usually instruments. These assemblies are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets.

Switchgear.
An assembly completely enclosed on all sides and top with sheet metal (except for ventilating openings and inspection windows) and containing primary power circuit switching, interrupting devices, or both, with buses and connections. The assembly may include control and auxiliary devices. Access to the interior of the enclosure is provided by doors, removable covers, or both.

Informational Note: All switchgear subject to NEC requirements is metal enclosed. Switchgear rated below 1000 V or less may be identified as "low-voltage power circuit breaker switchgear." Switchgear rated over 1000 V may be identified as "metal-enclosed switchgear" or "metal-clad switchgear." Switchgear is available in non–arc-resistant or arc-resistant constructions.

Thermal Protector (as applied to motors).
A protective device for assembly as an integral part of a motor or motor-compressor that, when properly applied, protects the motor against dangerous overheating due to overload and failure to start.

Informational Note: The thermal protector may consist of one or more sensing elements integral with the motor or motor-compressor and an external control device.

Thermally Protected (as applied to motors).
The words Thermally Protected appearing on the nameplate of a motor or motor-compressor indicate that the motor is provided with a thermal protector.

Unclassified Locations [as applied to Hazardous (Classified) Locations].
Locations determined to be neither Class I, Division 1; Class I, Division 2; Class I, Zone 0; Class I, Zone 1; Class I, Zone 2; Class II, Division 1; Class II, Division 2; Class III, Division 1; Class III, Division 2; Zone 20; Zone 21; Zone 22; nor any combination thereof.

Ungrounded.
Not connected to ground or to a conductive body that extends the ground connection.

Uninterruptible Power Supply.
A power supply used to provide alternating current power to a load for some period of time in the event of a power failure.

Informational Note: In addition, it may provide a more constant voltage and frequency supply to the load, reducing the effects of voltage and frequency variations.

Utilization Equipment.
Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes.

Ventilated.
Provided with a means to permit circulation of air sufficient to remove an excess of heat, fumes, or vapors.
Volatile Flammable Liquid.
A flammable liquid having a flash point below 38°C (100°F), or a flammable liquid whose temperature is above its flash point, or a Class II combustible liquid that has a vapor pressure not exceeding 276 kPa (40 psia) at 38°C (100°F) and whose temperature is above its flash point.

Voltage (of a circuit).
The greatest root-mean-square (rms) (effective) difference of potential between any two conductors of the circuit concerned.
Informational Note: Some systems, such as 3-phase 4-wire, single-phase 3-wire, and 3-wire direct current, may have various circuits of various voltages.

Voltage, Nominal.
A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts).
Informational Note No. 1: The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.
Informational Note No. 2: See ANSI C84.1-2011, Voltage Ratings for Electric Power Systems and Equipment (60 Hz).

Voltage to Ground.
For grounded circuits, the voltage between the given conductor and that point or conductor of the circuit that is grounded; for ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit.

Watertight.
Constructed so that moisture will not enter the enclosure under specified test conditions.

Weatherproof.
Constructed or protected so that exposure to the weather will not interfere with successful operation.
Informational Note: Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

Part II. Over 1000 Volts, Nominal

Electronically Actuated Fuse.
An overcurrent protective device that generally consists of a control module that provides current sensing, electronically derived time–current characteristics, energy to initiate tripping, and an interrupting module that interrupts current when an overcurrent occurs. Electronically actuated fuses may or may not operate in a current-limiting fashion, depending on the type of control selected.

Fuse.
An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it.
Informational Note: A fuse comprises all the parts that form a unit capable of performing the prescribed functions. It may or may not be the complete device necessary to connect it into an electrical circuit.

Controlled Vented Power Fuse.
A fuse with provision for controlling discharge circuit interruption such that no solid material may be exhausted into the surrounding atmosphere.
Informational Note: The fuse is designed so that discharged gases will not ignite or damage insulation in the path of the discharge or propagate a flashover to or between grounded members or conduction members in the path of the discharge where the distance between the vent and such insulation or conduction members conforms to manufacturer’s recommendations.

Expulsion Fuse Unit (Expulsion Fuse).
A vented fuse unit in which the expulsion effect of gases produced by the arc and lining of the fuseholder, either alone or aided by a spring, extinguishes the arc.

Nonvented Power Fuse.
A fuse without intentional provision for the escape of arc gases, liquids, or solid particles to the atmosphere during circuit interruption.

Power Fuse Unit.
A vented, nonvented, or controlled vented fuse unit in which the arc is extinguished by being drawn through solid material, granular material, or liquid, either alone or aided by a spring.

Vented Power Fuse.
A fuse with provision for the escape of arc gases, liquids, or solid particles to the surrounding atmosphere during circuit interruption.

Multiple Fuse.
An assembly of two or more single-pole fuses.
Substation.
An assemblage of equipment containing switches, interrupting devices, protection relays, buses, transformers, switchgear, motor control centers, etc... through which electric energy is passed for the purpose of switching or modifying characteristics. A substation is generally of such size or complexity that it incorporates one or more buses and a multiplicity of electrical equipment; is usually the receiving point for more than one supply circuit to transform power from one voltage to another or from one system to another.

Switching Device.
A device designed to close, open, or both, one or more electrical circuits.

Circuit Breaker.
A switching device capable of making, carrying, and interrupting currents under normal circuit conditions, and also of making, carrying for a specified time, and interrupting currents under specified abnormal circuit conditions, such as those of short circuit.

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

Disconnecting Means.
A device, group of devices, or other means whereby the conductors of a circuit can be disconnected from their source of supply.

Disconnecting (or Isolating) Switch (Disconnector, Isolator).
A mechanical switching device used for isolating a circuit or equipment from a source of power.

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

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

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

Regulator Bypass Switch.
A specific device or combination of devices designed to bypass a regulator.

Statement of Problem and Substantiation for Public Comment

The UL 1008M Outline for meter-mounted transfer switches was recently amended by UL to allow for the connection of permanently installed optional standby system generators. The Scope of this outline in Section 1.3 clearly states that these types of devices be under the exclusive control of the serving utility provider, and for that reason are not under the purview of the NEC. UL does not define the term exclusive control, as UL writes product standards, not installation code. By adding this definition to the NEC, the NFPA can be clarity to the meaning of "exclusive control" as applied to the installation of electrical conductors and equipment. Meter mounted transfer switches are UL listed as utility equipment to be under the utilities exclusive control and when these devices are installed by the utility provider. By adding this language, when a contractor attempts to install one of these devices, the device will not be under the utilities exclusive control and will be under the purview of the NEC.

UL 1008M TRANSFER SWITCH EQUIPMENT, METER MOUNTED

1 Scope

1.1 These requirements cover automatic and non-automatic (manual) transfer switch equipment, operating at 600 V ac less, and intended for installation in a utility meter base, in ordinary locations only.

1.2 These devices are intended for use in optional standby systems only, and are intended for cord connection of a portable generator to power a premise wiring system, where the neutral (grounded circuit conductor) of the generator is not bonded to ground or the generator frame. Bonding of the neutral (grounded circuit conductor) to ground will occur within the meter base. These devices are not intended for use in Emergency or Legally Required Standby Systems.

1.3 The installation of these devices is intended to be under the exclusive control of the serving utility, and these are not considered under the purview of the National Electrical Code, NFPA 70.

1.4 An automatic transfer switch as covered by these requirements is a device that automatically transfers a common load from a normal supply to an alternate supply in the event of failure of the normal supply, and automatically returns the load to the normal supply when the normal supply is restored. An automatic transfer switch may be provided with a logic control circuit that inhibits automatic operation of the device from either a normal to an alternate supply, or from an alternate to a normal supply when the switch reverts to automatic operation upon loss of power to the load.

1.5 A non-automatic transfer switch as covered by these requirements is a device, operated manually by a physical action, or
electrically by a remote control, for transferring a common load between a normal and alternate supply.

1.6 A transfer switch may incorporate overcurrent protection for the main power circuits.

1.7 These requirements only cover transfer switches which are completely enclosed when installed in a meter base in conjunction with the electrical utility meter.

1.8 Transfer switches are rated in amperes and are considered to be acceptable for total system transfer, which includes control of motors, electric-heating loads, and transformer loads.

Related Public Comments for This Document

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Related Item
| Public Input No. 2-NFPA 70-2013 [Part VI.] |

Submitter Information Verification

Submitter Full Name: BRIAN BAUGHMAN
Organization: GENERAC POWER SYSTEMS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jul 06 14:29:14 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed definition refers to an individual, group or organization rather than describes what exclusive control is. The definition of exclusive control is not necessary and the need for this definition has not been substantiated.
Article 100  Definitions

Scope. This article contains only those definitions essential to the application of this Code. It is not intended to include commonly defined general terms or commonly defined technical terms from related codes and standards. In general, only those terms that are used in two or more articles are defined in Article 100. Other definitions are included in the article in which they are used but may be referenced in Article 100.

Part I of this article contains definitions intended to apply wherever the terms are used throughout this Code. Part II contains definitions applicable to installations and equipment operating at over 1000 volts, nominal.

Part I. General

Accessible (as applied to equipment).
Admitting close approach; not guarded by locked doors, elevation, or other effective means.

Accessible (as applied to wiring methods).
Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in by the structure or finish of the building.

Accessible, Readily (Readily Accessible).
Capable of being easily reached for operation, service, or inspection without requiring actions such as the use of tools, the need to climb over or under, the need to remove obstacles, or the use of portable ladders or similar equipment.

Adjustable Speed Drive.
Power conversion equipment that provides a means of adjusting the speed of an electric motor.

Adjustable Speed Drive System.
A combination of an adjustable speed drive, its associated motor(s), and auxiliary equipment.

Ampacity.
The maximum current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

Appliance.
Utilization equipment, generally other than industrial, that is normally built in standardized sizes or types and is installed or connected as a unit to perform one or more functions such as clothes washing, air-conditioning, food mixing, deep frying, and so forth.

Approved.
Acceptable to the authority having jurisdiction.

Arc-Fault Circuit Interrupter (AFCI).
A device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected.

Askarel.
A generic term for a group of nonflammable synthetic chlorinated hydrocarbons used as electrical insulating media.

Associated Apparatus [as applied to Hazardous (Classified) Locations]. (Chapter 5)
Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affects the energy in the intrinsically safe circuits and is relied on to maintain intrinsic safety. Such apparatus is one of the following:

(1) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location

(2) Electrical apparatus not so protected that shall not be used within a hazardous (classified) location

Informational Note No. 1: Associated apparatus has identified intrinsically safe connections for intrinsically safe apparatus and also may have connections for nonintrinsically safe apparatus.

Informational Note No. 2: An example of associated apparatus is an intrinsic safety barrier, which is a network designed to limit the energy (voltage and current) available to the protected circuit in the hazardous (classified) location, under specified fault conditions.
Associated Nonincendive Field Wiring Apparatus [as applied to Hazardous (Classified) Locations].

Apparatus in which the circuits are not necessarily nonincendive themselves but that affect the energy in nonincendive field wiring circuits and are relied upon to maintain nonincendive energy levels. Such apparatus are one of the following:

1. Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location
2. Electrical apparatus not so protected that shall not be used in a hazardous (classified) location

Informational Note: Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and may also have connections for other electrical apparatus.

Attachment Plug (Plug Cap) (Plug).

A device that, by insertion in a receptacle, establishes a connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.

Authority Having Jurisdiction (AHJ).

An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

Informational Note: The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief, fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

Automatic.

Performing a function without the necessity of human intervention.

Bathroom.

An area including a basin with one or more of the following: a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures.

Battery System.

Interconnected battery subsystems consisting of one or more storage batteries and battery chargers, and can include inverters, converters, and associated electrical equipment.

Bonded (Bonding).

Connected to establish electrical continuity and conductivity.

Bonding Conductor or Jumper.

A reliable conductor to ensure the required electrical conductivity between metal parts required to be electrically connected.

Bonding Jumper, Equipment.

The connection between two or more portions of the equipment grounding conductor.

Bonding Jumper, Main.

The connection between the grounded circuit conductor and the equipment grounding conductor at the service.

Bonding Jumper, System.

The connection between the grounded circuit conductor and the supply-side bonding jumper, or the equipment grounding conductor, or both, at a separately derived system.

Branch Circuit.

The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).

Branch Circuit, Appliance.

A branch circuit that supplies energy to one or more outlets to which appliances are to be connected and that has no permanently connected luminaires that are not a part of an appliance.

Branch Circuit, General-Purpose.

A branch circuit that supplies two or more receptacles or outlets for lighting and appliances.

Branch Circuit, Individual.

A branch circuit that supplies only one utilization equipment.

Branch Circuit, Multiwire.

A branch circuit that consists of two or more ungrounded conductors that have a voltage between them, and a grounded conductor that has equal voltage between it and each ungrounded conductor of the circuit and that is connected to the neutral or grounded conductor of the system.
Building.
A structure that stands alone or that is separated from adjoining structures by fire walls.

Cabinet.
An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.

Cable Routing Assembly.
A single channel or connected multiple channels, as well as associated fittings, forming a structural system that is used to support and route communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2, Class 3, and Type PLTC cables, and power-limited fire alarm cables in plenum, riser, and general-purpose applications.

Charge Controller.
Equipment that controls dc voltage or dc current, or both, and that is used to charge a battery or other energy storage device.

Circuit Breaker.
A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating.

Adjustable (as applied to circuit breakers).
A qualifying term indicating that the circuit breaker can be set to trip at various values of current, time, or both, within a predetermined range.

Instantaneous Trip (as applied to circuit breakers).
A qualifying term indicating that no delay is purposely introduced in the tripping action of the circuit breaker.

Inverse Time (as applied to circuit breakers).
A qualifying term indicating that there is purposely introduced a delay in the tripping action of the circuit breaker, which delay decreases as the magnitude of the current increases.

Nonadjustable (as applied to circuit breakers).
A qualifying term indicating that the circuit breaker does not have any adjustment to alter the value of the current at which it will trip or the time required for its operation.

Setting (of circuit breakers).
The value of current, time, or both, at which an adjustable circuit breaker is set to trip.

Coaxial Cable.
A cylindrical assembly composed of a conductor centered inside a metallic tube or shield, separated by a dielectric material, and usually covered by an insulating jacket.

Clothes Closet.
A nonhabitable room or space intended primarily for storage of garments and apparel.

Combustible Dust [as applied to Hazardous (Classified) Locations].
Dust particles that are 500 microns or smaller (material passing a U.S. No. 35 Standard Sieve as defined in ASTM E 11-13, Standard Specification for Wire Cloth and Sieves for Testing Purposes), and present a fire or explosion hazard when dispersed and ignited in air.

Explosion protection systems — Part 1: Determination of explosion indices of combustible dusts in air, for procedures for determining the explosibility of dusts.

Combustible Gas Detection System [as applied to Hazardous (Classified) Locations].
A protection technique utilizing stationary gas detectors in industrial establishments.

Communications Equipment.
The electronic equipment that performs the telecommunications operations for the transmission of audio, video, and data, and includes power equipment (e.g., dc converters, inverters, and batteries), technical support equipment (e.g., computers), and conductors dedicated solely to the operation of the equipment.

Communications Raceway.
An enclosed channel of nonmetallic materials designed expressly for holding communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2, Class 3 and Type PLTC cables, and power-limited fire alarm cables in plenums, risers, and general-purpose applications.
Composite Optical Fiber Cable.
A cable containing optical fibers and current-carrying electrical conductors.

Concealed.
Rendered inaccessible by the structure or finish of the building.

Informational Note: Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them.

Conductive Optical Fiber Cable.
A factory assembly of one or more optical fibers having an overall covering and containing non–current-carrying conductive member(s) such as metallic strength member(s), metallic vapor barrier(s), metallic armor or metallic sheath.

Conductor, Bare.
A conductor having no covering or electrical insulation whatsoever.

Conductor, Covered.
A conductor encased within material of composition or thickness that is not recognized by this Code as electrical insulation.

Conductor, Insulated.
A conductor encased within material of composition and thickness that is recognized by this Code as electrical insulation.

Conduit Body.
A separate portion of a conduit or tubing system that provides access through a removable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system.

Boxes such as FS and FD or larger cast or sheet metal boxes are not classified as conduit bodies.

Connector, Pressure (Solderless).
A device that establishes a connection between two or more conductors or between one or more conductors and a terminal by means of mechanical pressure and without the use of solder.

Continuous Load.
A load where the maximum current is expected to continue for 3 hours or more.

Control Circuit.
The circuit of a control apparatus or system that carries the electric signals directing the performance of the controller but does not carry the main power current.

Control Drawing [as applied to Hazardous (Classified) Locations].
A drawing or other document provided by the manufacturer of the intrinsically safe or associated apparatus, or of the nonincendive field wiring apparatus or associated nonincendive field wiring apparatus, that details the allowed interconnections between the intrinsically safe and associated apparatus or between the nonincendive field wiring apparatus or associated nonincendive field wiring apparatus.

Controller.
A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

Cooking Unit, Counter-Mounted.
A cooking appliance designed for mounting in or on a counter and consisting of one or more heating elements, internal wiring, and built-in or mountable controls.

Coordination, Selective (Selective Coordination).
Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the selection and installation of overcurrent protective devices and their ratings or settings for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.

Copper-Clad Aluminum Conductors.
Conductors drawn from a copper-clad aluminum rod, with the copper metallurgically bonded to an aluminum core, where the copper forms a minimum of 10 percent of the cross-sectional area of a solid conductor or each strand of a stranded conductor.

Cord Connector [as applied to Hazardous (Classified) Locations].
A fitting intended to terminate a cord or cable to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust-ignitionproof, or a flameproof seal.

Cutout Box.
An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.

Dead Front.
Without live parts exposed to a person on the operating side of the equipment.
Demand Factor.
The ratio of the maximum demand of a system, or part of a system, to the total connected load of a system or the part of the system under consideration.

Device.
A unit of an electrical system, other than a conductor, that carries or controls electric energy as its principal function.

Disconnecting Means.
A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

Dust-Ignitionproof [as applied to Hazardous (Classified) Locations].
Equipment enclosed in a manner that excludes dusts and does not permit arcs, sparks, or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure.

Informational Note: For further information on dust-ignitionproof enclosures, see ANSI/UL 1202-2013, Enclosures for Electrical Equipment, and ANSI/UL 1203-2013, Explosionproof and Dust-Ignitionproof Electrical Equipment for Hazardous (Classified) Locations.

Dusttight.
Enclosures constructed so that dust will not enter under specified test conditions.

Informational Note No. 1: Enclosure Types 3, 3S, 3SX, 4, 4X, 5, 6, 6P, 12, 12K, and 13, per ANSI/NEMA 250-2014, Enclosures for Electrical Equipment, are considered dusttight and suitable for use in unclassified locations and in Class II, Division 2; Class III; and Zone 22 hazardous (classified) locations.

Informational Note No. 2: For further information, see ANSI/ISA-12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Duty, Continuous.
Operation at a substantially constant load for an indefinitely long time.

Duty, Intermittent.
Operation for alternate intervals of (1) load and no load; or (2) load and rest; or (3) load, no load, and rest.

Duty, Periodic.
Intermittent operation in which the load conditions are regularly recurrent.

Duty, Short-Time.
Operation at a substantially constant load for a short and definite, specified time.

Duty, Varying.
Operation at loads, and for intervals of time, both of which may be subject to wide variation.

Dwelling, One-Family.
A building that consists solely of one dwelling unit.

Dwelling, Two-Family.
A building that consists solely of two dwelling units.

Dwelling, Multifamily.
A building that contains three or more dwelling units.

Dwelling Unit.
A single unit, providing complete and independent living facilities for one or more persons, including permanent provisions for living, sleeping, cooking, and sanitation.

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

Electric Power Production and Distribution Network.
Power production, distribution, and utilization equipment and facilities, such as electric utility systems that deliver electric power to the connected loads, that are external to and not controlled by an interactive system.

Electric Sign.
A fixed, stationary, or portable self-contained, electrically operated and/or electrically illuminated utilization equipment with words or symbols designed to convey information or attract attention.

Electric-Discharge Lighting.
Systems of illumination utilizing fluorescent lamps, high-intensity discharge (HID) lamps, or neon tubing.
Electrical Circuit Protective System

A system consisting of components and materials intended for installation as protection for specific electrical wiring systems with respect to the disruption of electrical circuit integrity upon exterior fire exposure.

Electronically Actuated Fuse.

An overcurrent protective device that generally consists of a control module that provides current-sensing, electronically derived time–current characteristics, energy to initiate tripping, and an interrupting module that interrupts current when an overcurrent occurs. Such fuses may or may not operate in a current-limiting fashion, depending on the type of control selected.

Enclosed.

Surrounded by a case, housing, fence, or wall(s) that prevents persons from accidentally contacting energized parts.

Enclosure.

The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage.

Informational Note: See Table 110.28 for examples of enclosure types.

Energized.

Electrically connected to, or is, a source of voltage.

Equipment.

A general term, including fittings, devices, appliances, luminaires, apparatus, machinery, and the like used as a part of, or in connection with, an electrical installation.

Informational Note: In addition to the items listed in the definition, equipment also describes air conditioning units, power outlets (such as recreational vehicle site supply equipment or marine power outlets), transformers, and other enclosures that contain electrical products.

Explosionproof Equipment.

Equipment enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby.

Informational Note: For further information, see ANSI/UL 1203-2009, Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.

Exposed (as applied to live parts).

Capable of being inadvertently touched or approached nearer than a safe distance by a person.

Informational Note: This term applies to parts that are not suitably guarded, isolated, or insulated.

Exposed (as applied to wiring methods).

On or attached to the surface or behind panels designed to allow access.

Externally Operable.

Capable of being operated without exposing the operator to contact with live parts.

Feeder.

All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit overcurrent device.

Festoon Lighting.

A string of outdoor lights that is suspended between two points.

Field Evaluation Body (FEB).

An organization or part of an organization that performs field evaluations of electrical or other equipment. [NFPA 790, 2012]

Field Labeled (as applied to evaluated products).

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an FEB indicating the equipment or materials were evaluated and found to comply with requirements as described in an accompanying field evaluation report. [NFPA 790, 2012]

Fitting.

An accessory such as a locknut, bushing, or other part of a wiring system that is intended primarily to perform a mechanical rather than an electrical function.

Garage.

A building or portion of a building in which one or more self-propelled vehicles can be kept for use, sale, storage, rental, repair, exhibition, or demonstration purposes.

Informational Note: For commercial garages, repair and storage, see Article 511.
Ground.
The earth.

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

Grounded (Grounding).
Connected (connecting) to ground or to a conductive body that extends the ground connection.

Grounded, Solidly.
Connected to ground without inserting any resistor or impedance device.

Grounded Conductor.
A system or circuit conductor that is intentionally grounded.

Ground-Fault Circuit Interrupter (GFCI).
A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds the values established for a Class A device.

Informational Note: Class A ground-fault circuit interrupters trip when the current to ground is 6 mA or higher and do not trip when the current to ground is less than 4 mA. For further information, see UL 943, Standard for Ground-Fault Circuit Interrupters.

Ground-Fault Circuit Interrupter, Special Purpose (SPGFCI).
A device intended for the protection of personnel that functions to de-energize a circuit or portion of a circuit within an established period of time when a current to ground exceeds the values established for Class C, D, and E devices.

Informational Note: Classes C, D, and E ground-fault circuit interrupters trip when the current to ground is 20 mA or higher and do not trip when the current to ground is less than 15 mA. For further information, see UL 943C, Outline of Investigation for Special Purpose Ground-Fault Circuit Interrupters.

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.

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.

Ground-Fault Protection of Equipment.
A system intended to provide protection of equipment from damaging line-to-ground fault currents by operating to cause a disconnecting means to open all ungrounded conductors of the faulted circuit. This protection is provided at current levels less than those required to protect conductors from damage through the operation of a supply circuit overcurrent device.

Grounding Conductor, Equipment (EGC).
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.

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.

Grounding Electrode.
A conducting object through which a direct connection to earth is established.

Grounding Electrode Conductor.
A conductor used to connect the system grounded conductor or the equipment to a grounding electrode or to a point on the grounding electrode system.

Guarded.
Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.

Guest Room.
An accommodation combining living, sleeping, sanitary, and storage facilities within a compartment.

Guest Suite.
An accommodation with two or more contiguous rooms comprising a compartment, with or without doors between such rooms, that provides living, sleeping, sanitary, and storage facilities.
Handhole Enclosure.
An enclosure for use in underground systems, provided with an open or closed bottom, and sized to allow personnel to reach into, but not enter, for the purpose of installing, operating, or maintaining equipment or wiring or both.

Hermetic Refrigerant Motor-Compressor.
A combination consisting of a compressor and motor, both of which are enclosed in the same housing, with no external shaft or shaft seals, with the motor operating in the refrigerant.

Hermetically Sealed [as applied to Hazardous (Classified) Locations].
Equipment sealed against the entrance of an external atmosphere where the seal is made by fusion, for example, soldering, brazing, welding, or the fusion of glass to metal.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Hoistway.
Any shaftway, hatchway, well hole, or other vertical opening or space in which an elevator or dumbwaiter is designed to operate.

Hybrid System.
A system comprised of multiple power sources. These power sources could include photovoltaic, wind, micro-hydro generators, engine-driven generators, and others, but do not include electric power production and distribution network systems. Energy storage systems such as batteries, flywheels, or superconducting magnetic storage equipment do not constitute a power source for the purpose of this definition. The energy regenerated by an overhauling (descending) elevator does not constitute a power source for the purpose of this definition.

Identified (as applied to equipment).
Recognizable as suitable for the specific purpose, function, use, environment, application, and so forth, where described in a particular Code requirement.

Informational Note: Some examples of ways to determine suitability of equipment for a specific purpose, environment, or application include investigations by a qualified testing laboratory (listing and labeling), an inspection agency, or other organizations concerned with product evaluation.

In Sight From (Within Sight From, Within Sight).
Where this Code specifies that one equipment shall be "in sight from," "within sight from," or "within sight of," and so forth, another equipment, the specified equipment is to be visible and not more than 15 m (50 ft) distant from the other.

Industrial Control Panel.
An assembly of two or more components consisting of one of the following: (1) power circuit components only, such as motor controllers, overload relays, fused disconnect switches, and circuit breakers; (2) control circuit components only, such as push buttons, pilot lights, selector switches, timers, switches, and control relays; (3) a combination of power and control circuit components. These components, with associated wiring and terminals, are mounted on, or contained within, an enclosure or mounted on a subpanel.
The industrial control panel does not include the controlled equipment.

Information Technology Equipment (ITE).
Equipment and systems rated 1000 volts or less, normally found in offices or other business establishments and similar environments classified as ordinary locations, that are used for creation and manipulation of data, voice, video, and similar signals that are not communications equipment as defined in Part I of Article 100 and do not process communications circuits as defined in 800.2.

Informational Note: For information on listing requirements for both information technology equipment and communications equipment, see UL 60950-1-2014, Information Technology Equipment — Safety — Part 1: General Requirements or UL 62368-1-2014, Audio/Video Information and Communication Technology Equipment Part 1: Safety Requirements.

Innerduct.
A nonmetallic raceway placed within a larger raceway.

Interactive Inverter.
An inverter intended for use in parallel with an electric utility to supply common loads that may deliver power to the utility.

Interactive System.
An electric power production system that is operating in parallel with and capable of delivering energy to an electric primary source supply system.

Interrupting Rating.
The highest current at rated voltage that a device is identified to interrupt under standard test conditions.

Informational Note: Equipment intended to interrupt current at other than fault levels may have its interrupting rating implied in other ratings, such as horsepower or locked rotor current.
**Intersystem Bonding Termination.**
A device that provides a means for connecting intersystem bonding conductors for communications systems to the grounding electrode system.

**Isolated (as applied to location).**
Not readily accessible to persons unless special means for access are used.

**Intrinsically Safe Apparatus.**
Apparatus in which all the circuits are intrinsically safe.

**Intrinsically Safe System [as applied to Hazardous (Classified) Locations].**
An assembly of interconnected intrinsically safe apparatus, associated apparatus, and interconnecting cables, in that those parts of the system that may be used in hazardous (classified) locations are intrinsically safe circuits.

Informational Note: An intrinsically safe system may include more than one intrinsically safe circuit.

**Kitchen.**
An area with a sink and permanent provisions for food preparation and cooking.

**Labeled.**
Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

**Lighting Outlet.**
An outlet intended for the direct connection of a lampholder or luminaire.

**Lighting Track (Track Lighting).**
A manufactured assembly designed to support and energize luminaires that are capable of being readily repositioned on the track. Its length can be altered by the addition or subtraction of sections of track.

**Listed.**
Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

Informational Note: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. Use of the system employed by the listing organization allows the authority having jurisdiction to identify a listed product.

**Live Parts.**
Energized conductive components.

**Location, Damp.**
Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture.

Informational Note: Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold-storage warehouses.

**Location, Dry.**
A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.

**Location, Wet.**
Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

**Luminaire.**
A complete lighting unit consisting of a light source such as a lamp or lamps, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light. A lampholder itself is not a luminaire.

**Mobile Equipment.**
Equipment with electrical components suitable to be moved only with mechanical aids or is provided with wheels for movement by person(s) or powered devices.

**Motor Control Center.**
An assembly of one or more enclosed sections having a common power bus and principally containing motor control units.
Multioutlet Assembly.
A type of surface, flush, or freestanding raceway designed to hold conductors and receptacles, assembled in the field or at the factory.

Neutral Conductor.
The conductor connected to the neutral point of a system that is intended to carry current under normal conditions.

Neutral Point.
The common point on a wye-connection in a polyphase system or midpoint on a single-phase, 3-wire system, or midpoint of a single-phase portion of a 3-phase delta system, or a midpoint of a 3-wire, direct-current system.

Informational Note: At the neutral point of the system, the vectorial sum of the nominal voltages from all other phases within the system that utilize the neutral, with respect to the neutral point, is zero potential.

Nonautomatic.
Requiring human intervention to perform a function.

Nonconductive Optical Fiber Cable.
A factory assembly of one or more optical fibers having an overall covering and containing no electrically conductive materials.

Nonincendive Circuit [as applied to Hazardous (Classified) Locations].
A circuit, other than field wiring, in which any arc or thermal effect produced under intended operating conditions of the equipment, is not capable, under specified test conditions, of igniting the flammable gas–air, vapor–air, or dust–air mixture.

Informational Note: Conditions are described in ANSI/ISA-12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Nonincendive Component [as applied to Hazardous (Classified) Locations].
A component having contacts for making or breaking an incendive circuit and the contacting mechanism is constructed so that the component is incapable of igniting the specified flammable gas–air or vapor–air mixture. The housing of a nonincendive component is not intended to exclude the flammable atmosphere or contain an explosion.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Nonincendive Equipment [as applied to Hazardous (Classified) Locations].
Equipment having electrical/electronic circuitry that is incapable, under normal operating conditions, of causing ignition of a specified flammable gas–air, vapor–air, or dust–air mixture due to arcing or thermal means.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Nonincendive Field Wiring [as applied to Hazardous (Classified) Locations].
Wiring that enters or leaves an equipment enclosure and, under normal operating conditions of the equipment, is not capable, due to arcing or thermal effects, of igniting the flammable gas–air, vapor–air, or dust–air mixture. Normal operation includes opening, shorting, or grounding the field wiring.

Nonincendive Field Wiring Apparatus [as applied to Hazardous (Classified) Locations].
Apparatus intended to be connected to nonincendive field wiring.

Informational Note: For further information, see ANSI/ISA-12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations.

Nonlinear Load.
A load where the wave shape of the steady-state current does not follow the wave shape of the applied voltage.

Informational Note: Electronic equipment, electronic/electric-discharge lighting, adjustable-speed drive systems, and similar equipment may be nonlinear loads.

Oil Immersion [as applied to Hazardous (Classified) Locations].
Electrical equipment immersed in a protective liquid in such a way that an explosive atmosphere that may be above the liquid or outside the enclosure cannot be ignited.

Optical Fiber Cable.
A factory assembly or field assembly of one or more optical fibers having an overall covering.

Informational Note: A field-assembled optical fiber cable is an assembly of one or more optical fibers within a jacket. The jacket, without optical fibers, is installed in a manner similar to conduit or raceway. Once the jacket is installed, the optical fibers are inserted into the jacket, completing the cable assembly.

Outlet.
A point on the wiring system at which current is taken to supply utilization equipment.
Outline Lighting.
An arrangement of incandescent lamps, electric-discharge lighting, or other electrically powered light sources to outline or call attention to certain features such as the shape of a building or the decoration of a window.

Overcurrent.
Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit, or ground fault.

Informational Note: A current in excess of rating may be accommodated by certain equipment and conductors for a given set of conditions. Therefore, the rules for overcurrent protection are specific for particular situations.

Overcurrent Protective Device, Branch-Circuit.
A device capable of providing protection for service, feeder, and branch circuits and equipment over the full range of overcurrents between its rated current and its interrupting rating. Such devices are provided with interrupting ratings appropriate for the intended use but no less than 5000 amperes.

Overcurrent Protective Device, Supplementary.
A device intended to provide limited overcurrent protection for specific applications and utilization equipment such as luminaires and appliances. This limited protection is in addition to the protection provided in the required branch circuit by the branch-circuit overcurrent protective device.

Overload.
Operation of equipment in excess of normal, full-load rating, or of a conductor in excess of rated ampacity that, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload.

Panelboard.
A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall, partition, or other support; and accessible only from the front.

Photovoltaic (PV) System.
The total components and subsystem that, in combination, convert solar energy into electric energy for connection to a utilization load.

Plenum.
A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.

Portable Equipment.
Equipment with electrical components suitable to be moved by a single person without mechanical aids.

Power Outlet.
An enclosed assembly that may include receptacles, circuit breakers, fuseholders, fused switches, buses, and watt-hour meter mounting means; intended to supply and control power to mobile homes, recreational vehicles, park trailers, or boats or to serve as a means for distributing power required to operate mobile or temporarily installed equipment.

Premises Wiring (System).
Interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all their associated hardware, fittings, and wiring devices, both permanently and temporarily installed. This includes (a) wiring from the service point or power source to the outlets or (b) wiring from and including the power source to the outlets where there is no service point.

Such wiring does not include wiring internal to appliances, luminaires, motors, controllers, motor control centers, and similar equipment.

Informational Note: Power sources include, but are not limited to, interconnected or stand-alone batteries, solar photovoltaic systems, other distributed generation systems, or generators.

Pressurized [as applied to Hazardous (Classified) Locations].
The process of supplying an enclosure with a protective gas with or without continuous flow, at sufficient pressure to prevent the entrance of combustible dust or ignitable fibers/flyings.

Process Seal [as applied to Hazardous (Classified) Locations].
A seal between electrical systems and flammable or combustible process fluids where a failure could allow the migration of process fluids into the premises’ wiring system.

Purged and Pressurized [as applied to Hazardous (Classified) Locations].
The process of (1) purging, supplying an enclosure with a protective gas at a sufficient flow and positive pressure to reduce the concentration of any flammable gas or vapor initially present to an acceptable level; and (2) pressurization, supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of a flammable gas or vapor, a combustible dust, or an ignitable fiber.

Informational Note: For further information, see ANSI/NFPA 496-2013, Purged and Pressurized Enclosures for Electrical Equipment.
Qualified Person.
One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved.

Informational Note: Refer to NFPA 70E-2012, Standard for Electrical Safety in the Workplace, for electrical safety training requirements.

Raceway.
An enclosed channel designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this Code.

Informational Note: A raceway is identified within specific article definitions.

Rainproof.
Constructed, protected, or treated so as to prevent rain from interfering with the successful operation of the apparatus under specified test conditions.

Raintight.
Constructed or protected so that exposure to a beating rain will not result in the entrance of water under specified test conditions.

Receptacle.
A contact device installed at the outlet for the connection of an attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke.

Receptacle Outlet.
An outlet where one or more receptacles are installed.

Remote-Control Circuit.
Any electrical circuit that controls any other circuit through a relay or an equivalent device.

Retrofit Kit.
A general term for a complete subassembly of parts and devices for field conversion of utilization equipment.

Sealable Equipment.
Equipment enclosed in a case or cabinet that is provided with a means of sealing or locking so that live parts cannot be made accessible without opening the enclosure.

Informational Note: The equipment may or may not be operable without opening the enclosure.

Separately Derived System.
An electrical source, other than a service, having no direct connection(s) to circuit conductors of any other electrical source other than those established by grounding and bonding connections.

Service.
The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

Service Cable.
Service conductors made up in the form of a cable.

Service Conductors.
The conductors from the service point to the service disconnecting means.

Service Conductors, Overhead.
The overhead conductors between the service point and the first point of connection to the service-entrance conductors at the building or other structure.

Service Conductors, Underground.
The underground conductors between the service point and the first point of connection to the service-entrance conductors in a terminal box, meter, or other enclosure, inside or outside the building wall.

Informational Note: Where there is no terminal box, meter, or other enclosure, the point of connection is considered to be the point of entrance of the service conductors into the building.

Service Drop.
The overhead conductors between the utility electric supply system and the service point.

Service-Entrance Conductors, Overhead System.
The service conductors between the terminals of the service equipment and a point usually outside the building, clear of building walls, where joined by tap or splice to the service drop or overhead service conductors.
Service-Entrance Conductors, Underground System.
The service conductors between the terminals of the service equipment and the point of connection to the service lateral or underground service conductors.

Informational Note: Where service equipment is located outside the building walls, there may be no service-entrance conductors or they may be entirely outside the building.

Service Equipment.
The necessary equipment, usually consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the load end of service conductors to a building or other structure, or an otherwise designated area, and intended to constitute the main control and cutoff of the supply.

Service Lateral.
The underground conductors between the utility electric supply system and the service point.

Service Point.
The point of connection between the facilities of the serving utility and the premises wiring.

Informational Note: The service point can be described as the point of demarcation between where the serving utility ends and the premises wiring begins. The serving utility generally specifies the location of the service point based on the conditions of service.

Short-Circuit Current Rating.
The prospective symmetrical fault current at a nominal voltage to which an apparatus or system is able to be connected without sustaining damage exceeding defined acceptance criteria.

Show Window.
Any window used or designed to be used for the display of goods or advertising material, whether it is fully or partly enclosed or entirely open at the rear and whether or not it has a platform raised higher than the street floor level.

Signaling Circuit.
Any electrical circuit that energizes signaling equipment.

Simple Apparatus [as applied to Hazardous (Classified) Locations].
An electrical component or combination of components of simple construction with well-defined electrical parameters that does not generate more than 1.5 volts, 100 mA, and 25 mW, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.

Informational Note: The following apparatus are examples of simple apparatus:

1. Passive components; for example, switches, junction boxes, resistance temperature devices, and simple semiconductor devices such as LEDs
2. Sources of stored energy consisting of single components in simple circuits with well-defined parameters; for example, capacitors or inductors, whose values are considered when determining the overall safety of the system
3. Sources of generated energy; for example, thermocouples and photocells, that do not generate more than 1.5 volts, 100 mA, and 25 mW

Special Permission.
The written consent of the authority having jurisdiction.

Structure.
That which is built or constructed, other than equipment.

Surge Arrester.
A protective device for limiting surge voltages by discharging or bypassing surge current; it also prevents continued flow of follow current while remaining capable of repeating these functions.

Surge-Protective Device (SPD).
A protective device for limiting transient voltages by diverting or limiting surge current; it also prevents continued flow of follow current while remaining capable of repeating these functions and is designated as follows:

Type 1: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.

Type 2: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

Type 3: Point of utilization SPDs.

Type 4: Component SPDs, including discrete components, as well as assemblies.

Informational Note: For further information on Type 1, Type 2, Type 3, and Type 4 SPDs, see UL 1449, Standard for Surge Protective Devices.
Switch, Bypass Isolation.
A manually operated device used in conjunction with a transfer switch to provide a means of directly connecting load conductors to a power source and of disconnecting the transfer switch.

Switch, General-Use.
A switch intended for use in general distribution and branch circuits. It is rated in amperes, and it is capable of interrupting its rated current at its rated voltage.

Switch, General-Use Snap.
A form of general-use switch constructed so that it can be installed in device boxes or on box covers, or otherwise used in conjunction with wiring systems recognized by this Code.

Switch, Isolating.
A switch intended for isolating an electrical circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means.

Switch, Motor-Circuit.
A switch rated in horsepower that is capable of interrupting the maximum operating overload current of a motor of the same horsepower rating as the switch at the rated voltage.

Switch, Transfer.
An automatic or nonautomatic device for transferring one or more load conductor connections from one power source to another.

Switchboard.
A large single panel, frame, or assembly of panels on which are mounted on the face, back, or both, switches, overcurrent and other protective devices, buses, and usually instruments. These assemblies are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets.

Switchgear.
An assembly completely enclosed on all sides and top with sheet metal (except for ventilating openings and inspection windows) and containing primary power circuit switching, interrupting devices, or both, with buses and connections. The assembly may include control and auxiliary devices. Access to the interior of the enclosure is provided by doors, removable covers, or both.

Informational Note: All switchgear subject to NEC requirements is metal enclosed. Switchgear rated below 1000 V or less may be identified as “low-voltage power circuit breaker switchgear.” Switchgear rated over 1000 V may be identified as “metal-enclosed switchgear” or “metal-clad switchgear.” Switchgear is available in non–arc-resistant or arc-resistant constructions.

Thermal Protector (as applied to motors).
A protective device for assembly as an integral part of a motor or motor-compressor that, when properly applied, protects the motor against dangerous overheating due to overload and failure to start.

Informational Note: The thermal protector may consist of one or more sensing elements integral with the motor or motor-compressor and an external control device.

Thermally Protected (as applied to motors).
The words Thermally Protected appearing on the nameplate of a motor or motor-compressor indicate that the motor is provided with a thermal protector.

Unclassified Locations [as applied to Hazardous (Classified) Locations].
Locations determined to be neither Class I, Division 1; Class I, Division 2; Class I, Zone 0; Class I, Zone 1; Class I, Zone 2; Class II, Division 1; Class II, Division 2; Class III, Division 1; Class III, Division 2; Zone 20; Zone 21; Zone 22; nor any combination thereof.

Ungrounded.
Not connected to ground or to a conductive body that extends the ground connection.

Uninterruptible Power Supply.
A power supply used to provide alternating current power to a load for some period of time in the event of a power failure.

Informational Note: In addition, it may provide a more constant voltage and frequency supply to the load, reducing the effects of voltage and frequency variations.

Utilization Equipment.
Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes.

Ventilated.
Provided with a means to permit circulation of air sufficient to remove an excess of heat, fumes, or vapors.
Volatile Flammable Liquid.
A flammable liquid having a flash point below 38°C (100°F), or a flammable liquid whose temperature is above its flash point, or a Class II combustible liquid that has a vapor pressure not exceeding 276 kPa (40 psia) at 38°C (100°F) and whose temperature is above its flash point.

Voltage (of a circuit).
The greatest root-mean-square (rms) (effective) difference of potential between any two conductors of the circuit concerned.

Informational Note: Some systems, such as 3-phase 4-wire, single-phase 3-wire, and 3-wire direct current, may have various circuits of various voltages.

Voltage, Nominal.
A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts).

Informational Note No. 1: The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.

Informational Note No. 2: See ANSI C84.1-2011, Voltage Ratings for Electric Power Systems and Equipment (60 Hz).

Voltage to Ground.
For grounded circuits, the voltage between the given conductor and that point or conductor of the circuit that is grounded; for ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit.

Watertight.
Constructed so that moisture will not enter the enclosure under specified test conditions.

Weatherproof.
Constructed or protected so that exposure to the weather will not interfere with successful operation.

Informational Note: Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

Part II. Over 1000 Volts, Nominal

Electronically Actuated Fuse.
An overcurrent protective device that generally consists of a control module that provides current sensing, electronically derived time–current characteristics, energy to initiate tripping, and an interrupting module that interrupts current when an overcurrent occurs. Electronically actuated fuses may or may not operate in a current-limiting fashion, depending on the type of control selected.

Fuse.
An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it.

Informational Note: A fuse comprises all the parts that form a unit capable of performing the prescribed functions. It may or may not be the complete device necessary to connect it into an electrical circuit.

Controlled Vented Power Fuse.
A fuse with provision for controlling discharge circuit interruption such that no solid material may be exhausted into the surrounding atmosphere.

Informational Note: The fuse is designed so that discharged gases will not ignite or damage insulation in the path of the discharge or propagate a flashover to or between grounded members or conduction members in the path of the discharge where the distance between the vent and such insulation or conduction members conforms to manufacturer’s recommendations.

Expulsion Fuse Unit (Expulsion Fuse).
A vented fuse unit in which the expulsion effect of gases produced by the arc and lining of the fuseholder, either alone or aided by a spring, extinguishes the arc.

Nonvented Power Fuse.
A fuse without intentional provision for the escape of arc gases, liquids, or solid particles to the atmosphere during circuit interruption.

Power Fuse Unit.
A vented, nonvented, or controlled vented fuse unit in which the arc is extinguished by being drawn through solid material, granular material, or liquid, either alone or aided by a spring.

Vented Power Fuse.
A fuse with provision for the escape of arc gases, liquids, or solid particles to the surrounding atmosphere during circuit interruption.

Multiple Fuse.
An assembly of two or more single-pole fuses.
Substation.

An assemblage of equipment containing switches, interrupting devices, protection relays, buses, transformers, switchgear, motor control centers, etc. . . through which electric energy is passed for the purpose of switching or modifying characteristics. A substation is generally of such size or complexity that it incorporates one or more buses and a multiplicity of electrical equipment; it is usually the receiving point for more than one supply circuit to transform power from one voltage to another or from one system to another.

Switching Device.

A device designed to close, open, or both, one or more electrical circuits.

Circuit Breaker.

A switching device capable of making, carrying, and interrupting currents under normal circuit conditions, and also of making, carrying for a specified time, and interrupting currents under specified abnormal circuit conditions, such as those of short circuit.

Cutout.

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

Disconnecting Means.

A device, group of devices, or other means whereby the conductors of a circuit can be disconnected from their source of supply.

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

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

Interrupter Switch.

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

Oil Cutout (Oil-Filled Cutout).

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

Oil Switch.

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

Regulator Bypass Switch.

A specific device or combination of devices designed to bypass a regulator.

Statement of Problem and Substantiation for Public Comment

Action under several public inputs was made to move a number of defined terms from Articles in Chapter 5 to Chapter 1. Each of these defined terms needs to be ‘tagged’ as typically shown to reflect the origin location of this term as well as the Committee having responsibility for that term.

Additional action is needed to copy back to their original article locations, those defined terms which were moved to provide benefit and correlation for users of this Code in understanding this significant undertaking so that traditionally defined terms can be found.

Related Item

First Revision No. 3910-NFPA 70-2015 [Definition: Dusttight]

Submitter Information Verification

Submitter Full Name: David Wechsler
Organization: [ Not Specified ]
Affiliation: ACC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 08 16:10:03 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The public comment did not provide any recommended text on which the panel could act and is in violation of 4.4.3(C) of the Regulations Governing the Development of NFPA standards. The format of the document is a staff function.
Accessible, Readily (Readily Accessible).
Capable of being easily reached for operation, service, or inspection without requiring those to whom ready access is necessary to actions such as the use of tools, the need to climb over or under, the need to remove obstacles, or the use of portable ladders or similar equipment.

Statement of Problem and Substantiation for Public Comment

Readily accessible should only apply to those who have need to access.

Related Item
First Revision No. 8-NFPA 70-2015 [Definition: Accessible, Readily (Readily Accessible).]

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 10:39:35 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-6-NFPA 70-2015
Statement: The Panel considered the relevant points made in Public Comments 1731, 1039, 199, and 300 and maintains that the definition of Accessible, Readily in the 2014 NEC is appropriate with minor revisions. The new words "other than keys" addresses the concerns about use of keys expressed in Public Comments 1731 and 199. CMP-1 is maintaining the text "to whom ready access is prerequisite" addressing concerns identified in Public Comments 1039, 1731, and 300. CMP-1 affirms that the definition as revised provides consistent and appropriate application of requirements that use the term. The new informational note provides users with clarification about how to treat supervised or controlled conditions that exist in the NEC that modify a general requirement by specific conditions that recognize controlled access, often gained by use of keys.
Accessible, Readily (Readily Accessible).

Capable of being easily reached quickly for operation, service renewal, or inspection without requiring actions such as the use of tools, the need to climb over or under, the need to remove obstacles or the use of portable ladders or similar equipment or to resort to portable ladders, and so forth.

Statement of Problem and Substantiation for Public Comment

Restore the definition as it was in the 2011 NEC. The revision made during the first draft process creates even more problems. It is not clear whether a key is considered a tool in the NEC wording, based on reviewing standard dictionary terms it is. Removing the phrase “to whom ready access is requisite” removes the permission to locate equipment behind locked doors that qualified people have access to. The term accessible is not the same term as readily accessible and is defined differently. CMP10 attempted to fix the problem made by the definition revision in the 2014 NEC but it also does not address all the issues. To address the problem described in the substantiation in the original proposal for the 2014 NEC a much better solution is to require that disconnecting means not be located behind items that need a tool to gain access. The definition of readily accessible is far reaching throughout the NEC.

Related Item
First Revision No. 8-NFPA 70-2015 [Definition: Accessible, Readily (Readily Accessible).]

Submitter Information Verification

Submitter Full Name: Paul Dobrowsky
Organization: Innovative Technology Services
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 20:01:39 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-6-NFPA 70-2015
Statement: The Panel considered the relevant points made in Public Comments 1731, 1039, 199, and 300 and maintains that the definition of Accessible, Readily in the 2014 NEC is appropriate with minor revisions. The new words “other than keys” addresses the concerns about use of keys expressed in Public Comments 1731 and 199. CMP-1 is maintaining the text “to whom ready access is prerequisite” addressing concerns identified in Public Comments 1039, 1731, and 300. CMP-1 affirms that the definition as revised provides consistent and appropriate application of requirements that use the term. The new informational note provides users with clarification about how to treat supervised or controlled conditions that exist in the NEC that modify a general requirement by specific conditions that recognize controlled access, often gained by use of keys.
Public Comment No. 199-NFPA 70-2015 [Definition: Accessible, Readily (Readily Accessible).]

Accessible, Readily (Readily Accessible).
Capable of being easily reached for operation, service, or inspection without requiring actions such as the use of tools, the need to climb over or under, the need to remove obstacles, or the use of portable ladders or similar equipment. A key that is readily available to those who require ready access to equipment shall not be considered a tool.

Statement of Problem and Substantiation for Public Comment

A key is a tool and locked equipment and rooms are not readily accessible. The rule in 110.26(F) says a locked room or locked equipment shall be considered accessible to qualified persons. It does not say that locked rooms or equipment shall be considered readily accessible.

Related Item
First Revision No. 8-NFPA 70-2015 [Definition: Accessible, Readily (Readily Accessible).]
Public Input No. 1300-NFPA 70-2014 [Definition: Accessible, Readily (Readily Accessible).]

Submitter Information Verification
Submitter Full Name: DON GANIERE
Organization: 
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jul 09 14:03:16 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-6-NFPA 70-2015
Statement: The Panel considered the relevant points made in Public Comments 1731, 1039, 199, and 300 and maintains that the definition of Accessible, Readily in the 2014 NEC is appropriate with minor revisions. The new words "other than keys" addresses the concerns about use of keys expressed in Public Comments 1731 and 199. CMP-1 is maintaining the text "to whom ready access is prerequisite" addressing concerns identified in Public Comments 1039, 1731, and 300. CMP-1 affirms that the definition as revised provides consistent and appropriate application of requirements that use the term. The new informational note provides users with clarification about how to treat supervised or controlled conditions that exist in the NEC that modify a general requirement by specific conditions that recognize controlled access, often gained by use of keys.
Public Comment No. 300-NFPA 70-2015 [ Definition: Accessible, Readily (Readily Accessible). ]

**Accessible, Readily (Readily Accessible).**

**Capable of** being easily reached, **being reached quickly** for operation, **service** renewal, or inspection without requiring those to whom ready access is requisite to take actions such as the use of tools, the need to climb over or under, the need to remove obstacles, or the use of portable ladders or similar equipment.

**Statement of Problem and Substantiation for Public Comment**

I am in agreement with the statements made by Mr. Barrios and Mr. Sayler as to the removal of the phrase "to whom ready access is requisite" is more than editorial. There are installations and locations of electrical equipment where we do not want everyone to have "ready access". For example, we use locks on doors and panelboards to keep the non-qualified people out, but allow access to those qualified people who need it. In addition, the interlock on the side of a switch or combination motor starter that prevents the door from opening while the switch is in the "on" position requires a screwdriver to operate to defeat the interlock. Changing the word "renewal" to "service" may cause some unintended consequences. In addition, adding easily and removing quickly may also have some unintended consequences for an "editorial" change. I applaud CMP-1 trying to make the Code better to read, however a change in a basic definition like this one may bring unintended interpretation issues for common practices in the industry for keeping those who should not be in the electrical equipment out. In addition, those qualified people that need to be in the equipment should have quick access as needed.

**Related Item**

First Revision No. 8-NFPA 70-2015 [Definition: Accessible, Readily (Readily Accessible).]

**Submitter Information Verification**

Submitter Full Name: TIMOTHY CROUSHORE  
Organization: FIRSTENERGY  
Affiliation: FirstEnergy  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Mon Jul 27 08:24:47 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR  
Resolution: SR-6-NFPA 70-2015  
Statement: The Panel considered the relevant points made in Public Comments 1731, 1039, 199, and 300 and maintains that the definition of Accessible, Readily in the 2014 NEC is appropriate with minor revisions. The new words "other than keys" addresses the concerns about use of keys expressed in Public Comments 1731 and 199. CMP-1 is maintaining the text "to whom ready access is prerequisite" addressing concerns identified in Public Comments 1039, 1731, and 300. CMP-1 affirms that the definition as revised provides consistent and appropriate application of requirements that use the term. The new informational note provides users with clarification about how to treat supervised or controlled conditions that exist in the NEC that modify a general requirement by specific conditions that recognize controlled access, often gained by use of keys.
**Public Comment No. 5-NFPA 70-2015 [ Definition: Associated Apparatus [as applied to Hazardous (...) ]**

**Associated Apparatus [as applied to Hazardous (Classified) Locations]. Apparatus**

Apparatus in which the circuits are not necessarily intrinsically safe themselves but that affects the energy in the intrinsically safe circuits and is relied on to maintain intrinsic safety. Such apparatus is one of the following:

1. Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location
2. Electrical apparatus not so protected that shall not be used within a hazardous (classified) location

Informational Note No. 1: Associated apparatus has identified intrinsically safe connections for intrinsically safe apparatus and also may have connections for nonintrinsically safe apparatus.

Informational Note No. 2: An example of associated apparatus is an intrinsic safety barrier, which is a network designed to limit the energy (voltage and current) available to the protected circuit in the hazardous (classified) location, under specified fault conditions.

**Statement of Problem and Substantiation for Public Comment**

This and similar revisions for other definitions relocated from Chapter 5 do not belong in Article 100. See NEC Style Manual 2.2.2.1 If it is necessary to include the text in the title referencing Article 500, that is where the definition belongs. I agree completely with CMP14 member Haywood Kines, who objected in his ballot " Definitions that are only applicable to Chapter 5 need to remain within the .2 sections within the Articles in Chapter 5 so that the information needed for the user is readily available. Relocating the definitions to Article 100 and adding the text (as applied to Hazardous (Classified) Locations) so users will understand the definitions only apply to Articles in Chapter 5 unnecessarily expands the text in Article 100 and does add any benefit to the Electrical industry using the National Electrical Code." Couldn’t have said it better myself.

**Related Item**
- First Revision No. 3904-NFPA 70-2015 [Definition: Combustible Gas Detection System ]
- First Revision No. 3906-NFPA 70-2015 [Definition: Control Drawing ]
- First Revision No. 3907-NFPA 70-2015 [Definition: Dust-Ignitionproof ]
- First Revision No. 3909-NFPA 70-2015 [Definition: Dusttight ]
- First Revision No. 3912-NFPA 70-2015 [Definition: Hermetically Sealed ]
- First Revision No. 3915-NFPA 70-2015 [Definition: Purged and Pressurized ]
- First Revision No. 3913-NFPA 70-2015 [Definitions (500.2): Nonincendiv... to Oil Immersi...]

**Submitter Information Verification**

Submitter Full Name: J GRANT HAMMETT
Organization: COLORADO STATE ELECTRICAL BOARD
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jun 22 13:39:07 EDT 2015

**Committee Statement**

Committee Action: Rejected
Resolution: This definition, as well as the other definitions found in Articles 500 thru 516, that appear in more than one article of the NEC® have been relocated to Article 100 as mandated by Section 2.2.2.1 of the 2011 NEC® Style manual. This was done as a part of a Task Group under the direction of the Correlating Committee. Compliance with the NEC® style manual helps ensure consistency.
Authority Having Jurisdiction (AHJ).

An organization, office, or individual qualified to act, that is responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

Informational Note: The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

Statement of Problem and Substantiation for Public Comment

The NEC has a definition of qualified person so for the panel to say it does not qualify individuals is incorrect. I have change the wording from my original PI, This new text is should to be part of the AHJ definition because it also identifies and defines the AHJ has someone knowledgeable in electrical. Not having this distinction could lead to unqualified approvals creating an electrical hazard. Webster dictionary, AUTHORITY - One appealed to as an expert.

Related Item

Public Input No. 4101-NFPA 70-2014 [Definition: Authority Having Jurisdiction (AHJ)]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 13:26:12 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed revisions in Public Comment 549 are unnecessary and do not add clarity or improve usability of the current definition. Definitions shall not contain requirements as indicated in Section 2.2.2 of the NEC Style Manual. Annex H, Section 80.13 provides guidelines on credentials of authorities having jurisdiction that are typically designated by an applicable governing body. The proposed definition creates confusion in that it would imply that an entire organization or office would have to be qualified, which is beyond the intent of the current definition. This term is also defined in other NFPA standards and this revision would create a conflict and confusion the term is applied in requirements in the NEC and beyond. CMP-1 reaffirms its actions on PI 2663 which was resolved since there are circumstances where inspection or government agencies don’t exist to verify the role of the authority having jurisdiction. In those situations a property owner or designated agent may assume that role. The Code is not a document used to qualify individuals for an occupation.
Definition: Building.

A structure that is enclosed by walls and a roof and stands alone or that is separated from adjoining structures by fire walls.

Statement of Problem and Substantiation for Public Comment

The existing definition does not make sense. A billboard or pole that is not attached to a building is presently defined as a building. Buildings typically have walls and a roof.

Related Item
First Revision No. 9-NFPA 70-2015 [Definition: Building.]

Submitter Information Verification

Submitter Full Name: Paul Dobrowsky
Organization: Innovative Technology Services
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 20:13:20 EDT 2015

Committee Statement

Committee Action: Rejected but held
Resolution: The proposed revision of the definition of “Building” is new material that has not had public review and is a violation of sections 4.4.4.2 and 4.4.8.3 of the Regulations Governing Development of Standards. The definition is being held for the 2020 NEC development process. CMP-1 recognizes this term is defined within other NFPA Codes and Standards and thereby requests that the NEC Correlating Committee establish a Task Group to coordinate companion proposals for submission to the other Codes and Standards that include this term and definition.
Public Comment No. 1742-NFPA 70-2015 [ Definition: Combustible Dust [as applied to Hazardous (Classified) Locations].

Dust particles that are 500 microns or smaller (material passing a U.S. No. 35 Standard Sieve as defined in ASTM E 11-13, Standard Specification for Wire Cloth and Sieves for Testing Purposes), and present a fire or explosion hazard when dispersed and ignited in air.


Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to revise the Informational Note No. 1 to comply with the NEC Style Manual with respect to “are considered” and “suitable.”

Related Item

First Revision No. 3929-NFPA 70-2015 [Definition: Combustible Dust]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 14:21:35 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The NEC Style Manual addresses unenforceable terms in section 3.2.1, however neither term is used in the definition or the informational note.
Public Comment No. 204-NFPA 70-2015 [Definition: Combustible Dust [as applied to Hazardous (Classified) Locations].]

Dust particles that are 500 microns or smaller (material passing a U.S. No. 35 Standard Sieve as defined in ASTM E 11-13, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves, for Testing Purposes), and present a fire or explosion hazard when dispersed and ignited in air.


Statement of Problem and Substantiation for Public Comment

Referenced current title and edition.

Related Item

First Revision No. 3929-NFPA 70-2015 [Definition: Combustible Dust.]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 09 15:35:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3912-NFPA 70-2015
Combustible Dust [as applied to Hazardous (Classified) Locations].
Dust particles that are 500 microns or smaller (material passing a U.S. No. 35 Standard Sieve as defined in ASTM E 11-13, Standard Specification for Wire Cloth and Sieves for Testing Purposes), and present a fire, A finely divided combustible particulate solid that presents a flash fire hazard, or explosion hazard when dispersed, and ignited, in air, over a range of concentrations;


Statement of Problem and Substantiation for Public Comment

The committee's response to my Public Input 1311, did not address my substantiation which was based solely on the particle-size criterion in the current definition. The committee statement provided no justification for including a particle-size criterion in the definition. The particle-size criterion should be removed from the definition. The committee statement responding to my public input discussed the inclusion of oxidizing media other than air in NFPA 654's definition. I have now removed reference to oxidizing media other than air in my proposed definition, which addresses the committee response. However, whether or not material is handled in air or other oxidizing media, the 500-micron criterion is not valid as is explained below.

There is no universal particle-size criterion that determines whether a material is a combustible dust, i.e. whether it is exploisable and presents a flash fire or explosion hazard when dispersed in air. Some dusts have to be much finer than 500 microns to be exploisable in air, while others can be greater than 500 microns and still be exploisable in air. The particle-size criterion should be removed from the definition as it excludes some dust that are larger than 500 microns, exploisable, and present a hazard that may require classified electrical equipment. Incorrectly excluding these materials from the definition of combustible dust creates an unnecessary safety hazard. As described in the current informational note associated with the definition, determination of whether or not a material is a combustible dust should be based upon a test like ASTM E1226 and ISO 6184-1. These standards measure the flash fire and explosion hazards of dusts in air. Neither the informational note or committee statement provide any basis for using a particle-size criterion for the determination of explosibility.

Lastly, the particle-size criterion should be removed to create greater consistency amongst NFPA standards. The definition of combustible dust in NFPA 70 was added in the 2014 edition, and so does not have a long history in the standard. Over the last decade, an increasing number of NFPA combustible dust standards have removed particle-size criterion from definitions of combustible dust. Review of the 2014 NFPA Glossary of Terms (updated September 16, 2014) lists "combustible dust" definitions in the following standards that do not include particle-size criterion: 1, 68, 69, 77, 400, 499, 654 and the following standards that do include a particle size criterion NFPA 70 (500 microns), NFPA 5000 (420 microns). Additionally, the definition in the recently published NFPA 652 Standard on the Fundamentals of Combustible Dust does not include a particle-size criterion.

Related Item
Public Input No. 1311-NFPA 70-2014 [Definition: Combustible Dust.]
Public Comment No. 805-NFPA 70-2015 [Definition: Combustible Dust [as applied to Hazardous (Classified) Locations]]

Combustible Dust [as applied to Hazardous (Classified) Locations].

Dust particles that are 500 microns or smaller (material passing a U.S. No. 35 Standard Sieve as defined in ASTM E11-13, Standard Specification for Wire Cloth and Sieves for Testing Purposes), and present a fire or explosion hazard when dispersed and ignited in air.


Statement of Problem and Substantiation for Public Comment

standard date update

Related Item

Public Input No. 1730-NFPA 70-2014 [Definition: Combustible Dust]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 19:47:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3912-NFPA 70-2015
Communications Equipment

The electronic equipment that performs the telecommunications operations for the transmission of audio, video, and data, and includes power equipment (e.g., dc converters, inverters, and batteries), technical support equipment (e.g., computers), and conductors dedicated solely to the operation of the equipment.

Informational Note: This definition clearly indicates that the dc power equipment as well as computers are considered to be part of the communications equipment. As the telecommunications network transitions to a more data centric network, communications equipment will also include routers and servers essential to the transmission of audio, video, and data.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that the panel reconsider the text of the Informational Note to comply with the NEC Style Manual with regard to the words “This definition clearly indicates,” “are considered to be” and “will also include.”

Related Item

First Revision No. 4505-NFPA 70-2015 [Definition: Communications Equipment]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 14:22:43 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4506-NFPA 70-2015
Statement: The informational note has been revised to remove the phrases “This definition clearly indicates”, “are considered to be” and “will also include” in compliance with the NEC Style Manual, Section 3.1.3.
Communications Raceway.
An enclosed channel of nonmetallic materials designed expressly for holding communications wires and cables, optical fiber cables, data cables associated with information technology and communications equipment, Class 2, Class 3 and Type PLTC cables, and power-limited fire alarm cables in plenums, risers, and general-purpose applications.

Statement of Problem and Substantiation for Public Comment
This is an editorial Public Comment. The end of the definition should read “in plenum, riser and general-purpose applications” not read “in plenums, risers and general-purpose applications”

Related Item
First Revision No. 4504-NFPA 70-2015 [Definition: Communications Raceway]

Submitter Information Verification
Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address: CCCA
City:
State:
Zip:
Submittal Date: Sat Jul 25 19:25:49 EDT 2015

Committee Statement
Committee Action: Accepted
Resolution: SR-4505-NFPA 70-2015
Statement: This revision clarifies that the text “plenum” and “riser” modify the text “applications”.

National Fire Protection Association Report http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
Public Comment No. 1734-NFPA 70-2015 [Definition: Cord Connector [as applied to Hazardous (Classified) Locations]]

Cord Connector [as applied to Hazardous (Classified) Locations].
A fitting intended to terminate a cord or cable to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust-ignitionproof, or a flameproof seal.

Statement of Problem and Substantiation for Public Comment

Delete this definition.
The term "cord connector" is used to describe a wiring device in many places in the NEC. Defining it as a fitting for use in hazardous locations is problematic because it creates a situation where a term has different meanings. The rules where that term is used as a fitting should be revised to state that fitting needs to accomplish what the rule intends.

Related Item
First Revision No. 3997-NFPA 70-2015 [New Definition after Definition: Copper-Clad Aluminum Condu...]

Submitter Information Verification

Submitter Full Name: Paul Dobrowsky
Organization: Innovative Technology Services
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 21:43:14 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Inclusion of TC-ER and TC-ER-HL as a wiring method in Articles 501, 502, 503, 505, and 506 requires a method of termination that currently is identified as a Cord Connector. The current term for this device, as used in the industry and within the product standards, is "cord connector", which should not be confused with the term also used by the wiring device industry, indicating a receptacle. The differentiation has been addressed by denoting "(as applied to hazardous (classified) locations)". The term is currently used (19) times in these articles. The panel disagrees that a term with different meaning has been created. The definition proposed for article 100 is specifically qualified for hazardous (classified) locations. The definition cannot be in Chapter 5 as this would conflict with the NEC Style Manual.
Cord Connector [as applied to Hazardous (Classified) Locations].

A fitting product intended to terminate a cord or cable to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust-ignition proof, or a flameproof seal.

Statement of Problem and Substantiation for Public Comment

Replace text with the following: A product intended to terminate a cord or cable to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust-ignition proof, or a flameproof seal.

While it is understood that confusion may exist with the term "cord connector" used in product standards it is felt that complete resolution resides not within the NEC, but in product standards. To reduce this impact it is strongly suggested that the term "cord fitting" be used since in fact the method of termination is incorporated often with a fitting. Therefore, the revised defined term should be as reflected above and in this comment.

Related Item

First Revision No. 3997-NFPA 70-2015 [New Definition after Definition: Copper-Clad Aluminum Condu...]

Submitter Information Verification

Submitter Full Name: David Wechsler
Organization: [ Not Specified ]
Affiliation: ACC
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 05 13:55:07 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The term product is too broad and could inadvertently permit use of inappropriate devices to terminate the cord or cable. In addition, FR 1883 reads as follows: 336.6 Listing Requirements. Type TC cables and associated fittings shall be listed and labeled. The term fitting as defined in Article 100 is appropriate.
Cord Connector [as applied to Hazardous (Classified) Locations].
A fitting intended to terminate a cord or cable to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust-ignitionproof, or a flameproof seal.

Statement of Problem and Substantiation for Public Comment
The committee statement indicated that this definition needed to be added for use with TC-ER and TC-ER-HL cable. However, TC-ER and TC-ER-HL are both variations on Type TC cable, which is a Chapter 3 wiring method. It is not a "cord", which would be covered under Article 400. Connectors for Type TC (and variations like TC-ER and TC-ER-HL) are required by the new language in 336.6 (FR 1833) to be listed.

Related Item
First Revision No. 3997-NFPA 70-2015 [New Definition after Definition: Copper-Clad Aluminum Condu...]

Submitter Information Verification
Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 17 18:11:17 EDT 2015

Committee Statement
Committee Action: Accepted
Resolution: SR-3913-NFPA 70-2015
Statement: The definition is consistent with the use of the term “cord connector” in Chapter 5.
Public Comment No. 1520-NFPA 70-2015 [Definition: Equipment.]

**Equipment.**
A general term, including fittings, devices, appliances, luminaires, apparatus, machinery, and the like used as a part of, or in connection with, an electrical installation.

**Informational Note:** In addition to the items listed in the definition, equipment also describes air conditioning units, power outlets (such as recreational vehicle site supply equipment or marine power outlets), transformers, and other enclosures that contain electrical products.

**Statement of Problem and Substantiation for Public Comment**
FR-10, which added a new Informational Note, should not have been accepted.
The addition of an Informational Note to the definition of "equipment" in order to provide additional examples to the growing laundry list of examples is not necessary. The definition already includes the phrase "and the like" to cover other examples. The proposed Informational Note adds no additional clarity to the existing examples and does not additionally clarify what is or what is not a structure, which was the original intent of the FR.

**Related Item**
First Revision No. 10-NFPA 70-2015 [Definition: Equipment]

**Submitter Information Verification**
Submitter Full Name: Louis Barrios
Organization: Shell Global Solutions
Affiliation: American Chemistry Council
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:31:51 EDT 2015

**Committee Statement**
Committee Action: Accepted
Resolution: SR-7-NFPA 70-2015
Statement: CMP-1 accepts the recommendation in Public Comment 1520 thereby removing the informational note that resulted from FR 10.
Public Comment No. 1744-NFPA 70-2015 [Definition: Equipment.]

Equipment.
A general term, including fittings, devices, appliances, luminaires, apparatus, machinery, and the like used as a part of, or in connection with, an electrical installation.

Informational Note: In addition to the items listed in the definition, equipment also describes air conditioning units, power outlets (such as recreational vehicle site supply equipment or marine power outlets), transformers, and other enclosures that contain electrical products.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to revise the Informational Note to comply with the NEC style manual.

Related Item
First Revision No. 10-NFPA 70-2015 [Definition: Equipment]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 14:23:48 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: CMP-1 acknowledges the Correlating Committee note and emphasizes that the suggested Style Manual compliance issue is no longer needed as a result of the creation of SR 7.
**Ground-Fault Circuit Interrupter, Special Purpose (SPGFCI):**  
A device intended for the protection of personnel that functions to de-energize a circuit or portion of a circuit within an established period of time when a current to ground exceeds the values established for Class C, D, and E devices.  

*Informational Note:* Classes C, D, and E ground-fault circuit interrupters trip when the current to ground is 20 mA or higher and do not trip when the current to ground is less than 15 mA. For further information, see UL 943C, Outline, Outline of Investigation for Special Purpose Ground-Fault Circuit Interrupters.

### Statement of Problem and Substantiation for Public Comment

Reference update.  

**Related Item**  
First Revision No. 339-NFPA 70-2015 [New Definition after Definition: Ground-Fault Circuit Inter...]

### Submitter Information Verification

**Submitter Full Name:** Aaron Adamczyk  
**Organization:** [ Not Specified ]  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Mon Jul 06 19:25:52 EDT 2015

### Committee Statement

**Committee Action:** Rejected  
**Resolution:** Adding the word “outline” is redundant.
Statement of Problem and Substantiation for Public Comment

The word "trip" is changed to "open" in two places to more clearly identify the action. Not all of these devices "trip", but all of these devices do "open".

Related Item
First Revision No. 339-NFPA 70-2015 [New Definition after Definition: Ground-Fault Circuit Inter...]

Submitter Information Verification

Submitter Full Name: Vincent Saporita
Organization: Eaton, Bussmann Division
Affiliation: Eaton, Bussmann Division
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 08 14:22:11 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Requirements for these devices have been removed from Articles 210 and 215, thus the definition is unnecessary.
Ground-Fault Circuit Interrupter, Special-Purpose (SPGFCI).

A device intended for the protection of personnel that functions to de-energize a circuit or portion of a circuit within an established period of time when a current to ground exceeds the values established for Class C, D, and E devices.

Informational Note: Classes C, D, and E ground-fault circuit interrupters trip when the current to ground is 20 mA or higher and do not trip when the current to ground is less than 15 mA. For further information, see UL 943C, Outline of Investigation for Special Purpose Ground-Fault Circuit Interrupters.

Statement of Problem and Substantiation for Public Comment

This change is to add a hyphen to "special purpose" to be consistent with how SPGFCIs were referenced in FR-347.

Committee Statement

Committee Action: Rejected
Resolution: Requirements for these devices have been removed from Articles 210 and 215, thus the definition is unnecessary.
Ground-Fault Circuit Interrupter, Special Purpose (SPGFCI):
A device intended for the protection of personnel that functions to de-energize a circuit or portion of a circuit within an established period of time when a current to ground exceeds the values established for Class C, D, and E devices.

Informational Note: Classes C, D, and E ground-fault circuit interrupters trip when the current to ground is 20 mA or higher and do not trip when the current to ground is less than 15 mA. For further information, see UL 943C, Outline of Investigation for Special Purpose Ground-Fault Circuit Interrupters.

Statement of Problem and Substantiation for Public Comment
Due to the unacceptable language proposed in FR 347, the addition of this definition is not appropriate for the installation of Special Purpose Ground-Fault Circuit Interrupters in 210.8(B) [FR 347].

Related Item
First Revision No. 339-NFPA 70-2015 [New Definition after Definition: Ground-Fault Circuit Inter...]

Submitter Information Verification
Submitter Full Name: Ed Larsen
Organization: Schneider Electric USA
Affiliation: Schneider Electric USA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 14:37:56 EDT 2015

Committee Statement
Committee Action: Accepted
Statement: Requirements for these devices have not been added to Articles 210 and 215, thus the definition is unnecessary.
Public Comment No. 497-NFPA 70-2015 [Definition: In Sight From (Within Sight From, Within Sight).]

In Sight From (Within Sight From, Within Sight).
Where this Code specifies that one equipment shall be “in sight from,” “within sight from,” or “within sight of,” and so forth, from or to another equipment, the specified equipment is to be visible and not more than 15 m (50 ft) distant from the other.

Statement of Problem and Substantiation for Public Comment

In response to your Committee Statement, use of the terms that are being defined that are in the definition is an existing condition and was not a part of my Public Input.
As I recall, this definition formerly contained similar words that were removed some time ago. The present definition reads awkwardly at best.
The definition is incomplete without the additional words that are proposed. Please add them.

Related Item
Public Input No. 3135-NFPA 70-2014 [Definition: In Sight From (Within Sight From, Within Sight).]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 02 16:30:12 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed revision does not add clarity or improve usability of the existing text.
Labeled.

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Informational Note: When a listed product is of such a size, shape, material or surface texture that it is not possible to apply legibly the complete label to the product, the complete label will appear on the smallest unit container in which the product is packaged.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition_Labeled_PC.JPG</td>
<td>334.6 Requires NM cable to be listed, the UL Guide Information indicates the UL Mark (Label) is on the attached tag, coil, reel, or on the smallest unit container in which the product is packaged.</td>
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<tr>
<td>Definition_Labeled_PC_2.JPG</td>
<td>358.6 requires that EMT fittings are to be listed, the UL Guide Information indicates that the UL symbol is on the product and the Mark of UL is on the smallest unit container in which the product is packaged.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

Based on CMP1’s comment to PI 881; “Labeling of listed equipment is not possible in all cases or conditions such as if products are too small to be labeled or for some severe environmental conditions” and CMP 8’s comment to PI 895; “Some Listed products are marked or require markings on the smallest shipping package” it appears this informational note may be necessary. Both the concerns of CMP1 and CMP 8 appear to be in agreement with the substantiation of PI 881.

By adding this informational note, it explains to an AHJ that even though a section of the NEC may require a product to be labeled, it is acceptable to have the label, symbol, or other identifying mark applied to the packaging or a tag in some instances. Without this informational note, if interpreted verbatim by the AHJ, this definition requires the label, symbol, or other identifying mark to be attached to the equipment or material. Without this informational note, AHJ’s may not accept a label that is affixed to the packaging where permitted by the certification organization.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 533-NFPA 70-2015 [Section No. 355.6]</td>
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<tr>
<td>Public Comment No. 1123-NFPA 70-2015 [Section No. 314.28(E)(1)]</td>
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<td>Public Comment No. 1130-NFPA 70-2015 [Section No. 342.6]</td>
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<td>Public Comment No. 1131-NFPA 70-2015 [Section No. 344.6]</td>
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<td>Public Comment No. 1214-NFPA 70-2015 [Section No. 358.6]</td>
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<td>Public Comment No. 1221-NFPA 70-2015 [Section No. 362.6]</td>
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<td>Public Comment No. 1223-NFPA 70-2015 [Section No. 376.56(B)(1)]</td>
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<td>Public Comment No. 1233-NFPA 70-2015 [Section No. 386.6]</td>
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<td>Public Comment No. 1247-NFPA 70-2015 [Section No. 410.6]</td>
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<td>Public Comment No. 1250-NFPA 70-2015 [Section No. 422.15(A)]</td>
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<td>Public Comment No. 1251-NFPA 70-2015 [Section No. 422.50]</td>
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Public Comment No. 1287-NFPA 70-2015 [Section No. 600.22(A)]
Public Comment No. 1289-NFPA 70-2015 [Section No. 600.23(A)]
Public Comment No. 1291-NFPA 70-2015 [Section No. 600.24(A)]
Public Comment No. 1294-NFPA 70-2015 [Section No. 600.42(H)]
Public Comment No. 1330-NFPA 70-2015 [Sections 411.4(A), 411.4(B)]
Public Comment No. 1333-NFPA 70-2015 [Section No. 600.3]
Public Comment No. 1423-NFPA 70-2015 [Section No. 725.135(A)]
Public Comment No. 1429-NFPA 70-2015 [Section No. 760.135(A)]
Public Comment No. 1439-NFPA 70-2015 [Section No. 770.179]

Related Item
Public Input No. 881-NFPA 70-2014 [Section No. 110.3(B)]
Public Input No. 1072-NFPA 70-2014 [Definition: Labeled]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 03 20:36:54 EDT 2015

Committee Statement
Committee Action: Rejected but held
Resolution: The inconsistent actions on Public Inputs to globally change the term “listed or labeled” to “listed and labeled” resulted in multiple inconsistencies through the NEC and created conflicts with other Codes and Standards that use the term. CMP-1 understands that the NEC Correlating Committee took action to develop a first revision that restores the NEC rules using the term listed or labeled to how those rules appeared in the 2014 edition. CMP-1 also understands that the NEC Correlating Committee has formed a Task Group to globally review the use of the term “listed or labeled” throughout the NEC and determine a simplified solution that addresses the terms listed, labeled, and their associated informational notes. The Task Group is to address the concerns and input from multiple qualified electrical testing laboratories and work toward a simple solution that resides within Article 100 and perhaps Article 110. The work of that task group is just getting started and may include proposed revisions to these existing definitions and associated informational notes. CMP-1 recognizes it is premature to incorporate the proposed revisions and informational note at this time.
Receptacle.
A contact device installed at the outlet for the connection of an attachment plug or attachment fitting. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke.

Statement of Problem and Substantiation for Public Comment

This Comment seeks to further modify the definition of "receptacle" that was modified in First Revision No. 5114. This change reflects the suggestion in the CMP 18 ballot comment where it was noted that the definition of "receptacle" should've been expanded further, as follows:

"...should have been expanded to account for changes in technology that would use the receptacle to accept things beyond the classical attachment plug. As was demonstrated, electrical connectors other than attachment plugs as defined in Article 100 should be allowed to use the receptacle."

Additionally, new text was proposed and approved for 314.27(E) by CMP 9 in FR 2411 that read as follows:

(E) Separable Attachment Fittings. Outlet boxes shall be permitted to support listed locking support and mounting receptacles used in combination with compatible attachment fittings designed for the support of equipment covered within and subject to all weight and orientation limits contemplated by the listing. Where such fittings are used, the equipment mounted shall comply with 314.27(A) through (D) as applicable. Where the supporting receptacle is installed within a box, it shall be included in the fill calculation covered in 314.16(B)(4).

CMP 9 has appropriately used the word "receptacle" in the context of accepting an attachment fitting. The definition of receptacle needs to be modified to coordinate with this new section 314.27(E). There is also a complementary public comment to add a new definition of attachment fitting that is also needed for the same reasons.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 661-NFPA 70-2015 [New Definition after Definition: Associated Nonincendive Fi...]</td>
<td>Definition of &quot;attachment fitting&quot; is one of two definitions that should be added as a result of the new text added in FR 2411.</td>
</tr>
<tr>
<td>Public Comment No. 661-NFPA 70-2015 [New Definition after Definition: Associated Nonincendive Fi...]</td>
<td></td>
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<tr>
<td>First Revision No. 5114-NFPA 70-2015 [Definition: Receptacle.]</td>
<td></td>
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<tr>
<td>First Revision No. 2411-NFPA 70-2015 [Section No. 314.27]</td>
<td></td>
</tr>
</tbody>
</table>

Submitter Information Verification

Submitter Full Name: AMY CRONIN
Organization: Strategic Code Solutions, LLC
Affiliation: Safety Quick Lighting and Fans Corp.
Street Address:
City: 
State: 
Zip: 
Submittal Date: Tue Sep 15 13:10:09 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5128-NFPA 70-2015
Statement: The definition of Receptacle was modified to accommodate electrical utilization equipment employing a means, other than a traditional attachment plug cap, to connect directly to the corresponding contact device. This change was made to correlate with 314.27(E) and to recognize the existence of equipment such as direct plug-in transformers, and other devices that do not employ a traditional attachment plug cap.
Show Window.
Any window or window above a glass door that will likely be used or designed to be used for the display of goods or advertising material, whether it is fully or partly enclosed or entirely open at the rear and whether or not it has a platform raised higher than the street floor level.

Statement of Problem and Substantiation for Public Comment
Windows above glass doors may be electrified and should be required to meet the power receptacle requirement for show windows.

Related Item
First Revision No. 1-NFPA 70-2015 [Section No. 90.2(A)]

Submitter Information Verification
Submitter Full Name: GLENN CLAYDEN
Organization: CLAYDEN AND ASSOC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 17 18:05:31 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-302-NFPA 70-2015
Statement: The window above doors has been added to the definition for show windows since they may require power similar to a show window under certain use conditions.
Substation.
An assemblage of equipment containing switches, interrupting devices, protection relays, buses, transformers, switchgear, motor control centers, etc… through which electric energy is passed for the purpose of switching or modifying characteristics. A substation is generally of such size or complexity that it incorporates one or more buses and a multiplicity of electrical equipment; is usually the receiving point for more than one supply circuit to transform power from one voltage to another or from one system to another.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs the panel to give further consideration to the comments expressed in voting on FR 2429.

Related Item
First Revision No. 2429-NFPA 70-2015 [Definition: Substation.]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 14:32:04 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-2413-NFPA 70-2015
Statement: This wording is reflective of CMP 9 action at the First Draft Meeting and clarifies our intent for the definition. This change addresses the concern noted by the Correlating Committee in PC # 1745
Public Comment No. 428-NFPA 70-2015 [Definition: Substation.]

Substation.
An assemblage of equipment containing (e.g., switches, interrupting devices, protection relays, circuit breakers, buses, transformers, switchgear, motor control centers, etc., and transformers) through which electric energy is passed for the purpose of switching, distribution, switching, or modifying characteristics. A substation is generally of such size or complexity that it incorporates one or more buses and a multiplicity of electrical equipment; it is usually the receiving point for more than one supply circuit to transform power from one voltage to another or from one system to another, its characteristics.

Statement of Problem and Substantiation for Public Comment

The wording of this definition as presented in the First Draft does not reflect the final action of CMP 9 on the revision. Numerous comments submitted by Panel Members during balloting highlight this issue, as well as the Committee Statement which is inconsistent with the First Revision as recorded. This Public Comment is intended to restore the Code text to the panel action established during the First Revision meeting.

Related Item
First Revision No. 2429-NFPA 70-2015 [Definition: Substation.]

Submitter Information Verification

Submitter Full Name: ROBERT OSBORNE
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 24 13:33:28 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2413-NFPA 70-2015
Statement: This wording is reflective of CMP 9 action at the First Draft Meeting and clarifies our intent for the definition. This change addresses the concern noted by the Correlating Committee in PC # 1745.
Public Comment No. 687-NFPA 70-2015 [Definition: Substation.]

Substation.
An assemblage of equipment containing switches, interrupting devices, protection relays, buses, transformers, switchgear, motor control centers, etc, through which electric energy is passed for the purpose of switching or modifying characteristics. A substation is generally of such size or complexity that it incorporates one or more buses and a multiplicity of electrical equipment; is usually the receiving point for more than one supply circuit to transform power from one voltage to another or from one system to another.
Add Informational Note: While substations typically contain voltages greater than 1000V, voltages less than 1000V may be present.
Add definition of Power Distribution Center in Part I of Art. 100 to replace the removal of Substation.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDC_definition.docx</td>
<td>This is a new definition to cover those instances where Substation doesn't apply due to voltage level.</td>
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</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

I was part of the task group that removed the term "Substation" from Part I. While I'm in agreement with this change, this has left a void for large enclosures, similar to a building and substations, that are found throughout the world containing voltages less than 1000V.
If "Substation" is now going to mean that voltages greater than 1000V must exist within the enclosure or outdoor installation, then we need to fill the void left by removing the term from Part I of Art. 100.
There are "Power Distribution Centers" also known in the industry as substations that only contain voltages less than 1000V. Also, it's a little misleading by placing the term "Substation" in Part II, as there are typically other voltages present such as SCADA, DCS, Instrumentation, station control power, lighting and HVAC circuits that are less than 1000V. Adding the informational note to the new definition of Substation in Part II would clarify that voltages less than 1000V may be present in addition to the medium and high voltages.

Related Item
First Revision No. 2429-NFPA 70-2015 [Definition: Substation.]

Submitter Information Verification

Submitter Full Name: Paul Guidry
Organization: Fluor Enterprises, Inc.
Affiliation: Associated Builders and Contractors
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 17 09:53:46 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CMP 9 does not agree with adding a definition for “Power Distribution Centers” since this is not a term used in the Code (as required by paragraph 2.2.2.1 of the NEC Style Manual). In addition, the Informational Note is not needed since the definition does not stipulate that substations contain circuits with specific voltages, and such a limitation would not be appropriate since definitions should not include requirements. See SR 2413.
Definitions (100): Fitting... to Garage...

Fitting.
An accessory such as a locknut, bushing, or other part of a wiring system that is intended primarily to perform a mechanical rather than an electrical function.

Flood Definitions. The following definitions apply to Article 110.11 (B).

(Note: The followings sources cited in brackets [ ] are included information for only and are intended to be used by the Committee considering these revisions. They are not intended to be made part of the Code.):

Base Flood. The flood having a 1 percent chance of being equaled or exceeded in any given year. [Source NFPA 5000]

Base Flood Elevation (BFE). The elevation of the base flood, including wave height, relative to the datum specified on a jurisdiction’s flood hazard map. [Source NFPA 5000]

Design Flood. The greater of either (1) the base flood or (2) the flood so designated by the jurisdiction as its regulatory flood, with a 1 percent chance, or less, of being equaled or exceeded in any given year. [Source NFPA 5000]

Design Flood Elevation (DFE). The elevation of the design flood, including wave height, relative to the datum specified on a jurisdiction’s flood hazard map. [Source NFPA 5000]

Dry Floodproofing. A combination of design modifications that results in a building or structure, including the attendant utility and sanitary facilities, being watertight, with walls substantially impermeable to the passage of water, and with structural components having the capacity to resist loads and load combinations associated with the design flood. [Source NFPA 5000]

Flood Hazard Area. The greater of either (1) the special flood hazard area shown on the flood insurance rate map or (2) the area subject to flooding during the design flood and shown on a jurisdiction’s flood hazard map, or otherwise legally designated. [Source NFPA 5000]

Special Flood Hazard Area. The land area subject to flooding by the base flood, and depicted on the flood insurance rate map or other flood hazard map as Zone A, Zone AE, Zone A1-30, Zone A99, Zone AO, Zone AR, Zone AH, Zone V, Zone VE, Zone V1-30, or Zone VO. (See also 39.2.1.3, Coastal A Zone.) [Source NFPA 5000]

Garage.
A building or portion of a building in which one or more self-propelled vehicles can be kept for use, sale, storage, rental, repair, exhibition, or demonstration purposes.

Informational Note: For commercial garages, repair and storage, see Article 511.

Statement of Problem and Substantiation for Public Comment

These definitions are needed for PC-1248-NFPA-70-2015 which revises Article 110.11 Deteriorating Agents

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 1248-NFPA 70-2015 [Section No. 110.11]</td>
<td>1248 introduces terms to Art 110.11 (B) that require definitions</td>
</tr>
<tr>
<td>Public Comment No. 1253-NFPA 70-2015 [Section No. 110.11]</td>
<td></td>
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<tr>
<th>Related Item</th>
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<tbody>
<tr>
<td>Public Input No. 4144-NFPA 70-2014 [New Definition after Definition: Automatic.]</td>
<td></td>
</tr>
<tr>
<td>Public Input No. 4142-NFPA 70-2014 [New Section after 110.3(B)]</td>
<td></td>
</tr>
<tr>
<td>First Revision No. 35-NFPA 70-2015 [Section No. 110.11]</td>
<td></td>
</tr>
</tbody>
</table>

Submitter Information Verification

Submitter Full Name: David Low
Organization: DK Low & Associates, LLC
Affiliation: DHS/FEMA
Street Address:
City:
State:
Zip:
<table>
<thead>
<tr>
<th>Committee Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Committee Action:</strong> Rejected</td>
</tr>
<tr>
<td><strong>Resolution:</strong> CMP-1 reaffirms its actions on PI 4142 and FR 35 presented at first draft. The definitions of these terms are not necessary, do not enhance clarity and are not essential to the application of the NEC. See related action on PC 1248 and 1263.</td>
</tr>
</tbody>
</table>
Attachment Fitting. A fitting that by insertion in a receptacle establishes a connection between the conductors of the utilization device and the conductors connected permanently to the receptacle.

Statement of Problem and Substantiation for Public Comment

New text was proposed and approved for 314.27(E) by CMP 9 in FR 2411 that read as follows:

(E) Separable Attachment Fittings. Outlet boxes shall be permitted to support listed locking support and mounting receptacles used in combination with compatible attachment fittings designed for the support of equipment covered within and subject to all weight and orientation limits contemplated by the listing. Where such fittings are used, the equipment mounted shall comply with 314.27(A) through (D) as applicable. Where the supporting receptacle is installed within a box, it shall be included in the fill calculation covered in 314.16(B) (4).

CMP 9 has appropriately used the word “receptacle” in the context of accepting an attachment fitting. The definition of attachment fitting needs to be added to coordinate with this new section 314.27(E). The definition for “attachment fitting” was also previously submitted in PI 4316. There is also a complementary Public Comment to add a revised definition of “receptacle” that is also needed for the same reasons.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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</thead>
<tbody>
<tr>
<td>Public Comment No. 660-NFPA 70-2015 [Definition: Receptacle.]</td>
<td>Definition of &quot;receptacle&quot; is one of two definitions that should be added as a result of the new text added in FR 2411.</td>
</tr>
<tr>
<td>Public Comment No. 663-NFPA 70-2015 [Section No. 422.33]</td>
<td>This Public Comment adds the term &quot;attachment fitting&quot; to 422.33 to coordinate with changes made in FR 2411. The term &quot;attachment fittings&quot; must be defined.</td>
</tr>
<tr>
<td>Public Comment No. 660-NFPA 70-2015 [Definition: Receptacle.]</td>
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</tr>
<tr>
<td>Public Comment No. 663-NFPA 70-2015 [Section No. 422.33]</td>
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Related Item

Public Input No. 4316-NFPA 70-2014 [New Definition after Definition: Attachment Plug (Plug Cap)...]

Submitter Information Verification

Submitter Full Name: AMY CRONIN
Organization: STRATEGIC CODE SOLUTIONS LLC
Affiliation: Safety Quick Lighting and Fans Corp.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 15 13:18:34 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: An attachment fitting is not a stand-alone listed device but rather is a component in a listed assembly such as a luminaire or ceiling fan, therefore does not need to be defined.
Dormitory. Any occupancy containing a number of beds with common areas and bathroom facilities where people are housed temporarily.

Statement of Problem and Substantiation for Public Comment

Requirements for AFCI protection in 210.12 and tamper-resistant receptacles in 406.12 now apply to dormitories. Without an NEC definition of the word “dormitory” installers and inspectors find this section problematic. Perhaps the code-making panel will provide some guidance on whether this requirement should apply to bunkhouses, church camps, summer-camp cabins, lodges, homeless shelters, etc., which will greatly help with the application of the rule. Accepting the original proposal for the 2014 NEC the panel specifically removed the word “college” from the new AFCI requirement, however many dictionaries specifically reference “colleges” in their definition of the term. The lack of a definition appears to make broad application of those rules appropriate.

Related Item
First Revision No. 5112-NFPA 70-2015 [Section No. 406.12]
First Revision No. 350-NFPA 70-2015 [Section No. 210.12(B)]

Submitter Information Verification

Submitter Full Name: MARCUS SAMPSON
Organization: MINNESOTA DEPARTMENT OF LABOR & INDUSTRY
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:24:40 EDT 2015

Committee Statement

Committee Action: Rejected but held
Resolution: The proposed definition of “Dormitory” is new material that has not had public review and is a violation of sections 4.4.4.2 and 4.4.8.3 of the Regulations Governing Development of Standards. The definition is being held for the 2020 NEC development process. CMP-1 requests that this PC be sent to CMP-2 and CMP-18 for information. This new definition will likely fall under the purview of CMP 2. It should be noted that there is a definition of dormitory in NFPA 5000.
**Equipment Ground-Fault Protective Device (EGFPD).**
A device identified for use as an Equipment Ground-Fault Protective Device or EGFPD that operates to disconnect the electric circuit from the source of supply when ground-fault current exceeds the ground-fault pick-up level marked on the device.

Informational Note: Ground-fault current pick-up level of equipment ground-fault protective devices is adjustable from 6 to 100 mA.

**Statement of Problem and Substantiation for Public Comment**
This new definition is needed for a proposed change to Article 590.6(B) that was submitted to CMP 3.

**Related Public Comments for This Document**
- **Related Comment**
  - Public Comment No. 615-NFPA 70-2015 [Section No. 590.6(B)]
- **Related Item**
  - Public Input No. 2191-NFPA 70-2014 [New Definition after Definition: Ground-Fault Protection of...]
  - Public Input No. 2197-NFPA 70-2014 [New Section after 590.6(B)(2)]

**Submitter Information Verification**
- **Submitter Full Name:** NEHAD EL-SHERIF
- **Organization:** Littelfuse Startco
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Sat Sep 12 16:41:19 EDT 2015

**Committee Statement**
- **Committee Action:** Rejected
- **Resolution:** Action on the proposed definition belongs to Panel 1 and is predicated on an action to be taken by Panel 3 (covering Art 590). In any case, from the perspective of Panel 17 the definition is confusing and unnecessary as it is difficult to distinguish it from the existing Art 100 definition of Ground-Fault Protection of Equipment (GFPE) and it appears to represent a subset of GFPE already covered by the GFPE definition.
Approval.
The conductors and equipment required or permitted by this Code shall be acceptable only if approved. Approval shall not extend to the internal wiring of a manufactured or listed equipment.

Informational Note: See 90.7, Examination of Equipment for Safety, and 110.3, Examination, Identification, Installation, and Use of Equipment. See definitions of Approved, Identified, Labeled, and Listed.

Statement of Problem and Substantiation for Public Comment

Please read 300.1(B) which is contrary to the panels statement, this is not within the AHJ's purview, only the installation of this product is approved by the AHJ following 110.3(B) not the internal wiring which has already been delegated to a third party inspection service.

300.1 ( B) Integral Parts of Equipment. The provisions of this article are not intended to apply to the conductors that form an integral part of equipment, such as motors, controllers, motor control centers, or factory assembled control equipment or listed utilization equipment.

However the placement and labeling instructions for the equipment are within the AHJ approval

Related Item
Public Input No. 2890-NFPA 70-2014 [Section No. 110.2]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: master
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 13:12:37 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The second paragraph of Section 90.7 already addresses the concerns expressed in PI 2890. The proposed text does not enhance clarity or usability of the NEC.
110.3 Examination, Identification, Installation, and Use of Equipment.

(A) Examination.

In judging equipment, considerations such as the following shall be evaluated:

(1) Suitability for installation and use in conformity with the provisions of this Code

   Informational Note

No. 1

Equipment may be new, reconditioned, refurbished, or remanufactured. Informational Note No. 2:

Suitability of equipment use may be identified by a description marked on or provided with a product to identify the suitability of the product for a specific purpose, environment, or application. Special conditions of use or other limitations and other pertinent information may be marked on the equipment, included in the product instructions, or included in the appropriate listing and labeling information. Suitability of equipment may be evidenced by listing or labeling.

(2) Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided

(3) Wire-bending and connection space

(4) Electrical insulation

(5) Heating effects under normal conditions of use and also under abnormal conditions likely to arise in service

(6) Arcing effects

(7) Classification by type, size, voltage, current capacity, and specific use

(8) Other factors that contribute to the practical safeguarding of persons using or likely to come in contact with the equipment

(B) Installation and Use.

Listed or labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling.

(C) Listed.

Where equipment, conductors, raceways, devices, fittings and other materials are required to be listed elsewhere in this code, the listing shall be compatible with product listing documents recognized within the country, state, and/or municipality of the installation.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>110.3PI2839-5fu-revised.docx</td>
<td>110.3 -PI2839 - document for review</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

Informational Note is existing text.

The requested changes from PI 2839 should have been incorporated into a First Revision.

The North American electrical system is the safest in the world, built upon the coordinated workings of: 1) Product standards aligned with; 2) the Installation Code; enforced by; 3) a Strong inspection community. Weakening of ANY of these basic tenants threatens the overall safety of our electrical system.

As the submitter of PI 2839 stated, there are increasing requests for equipment which has not been 3rd party evaluated to verify its performance, nor its alignment with the requirements of the NEC. This puts a tremendous burden upon the AHJ to judge and determine its applicability. The requested change will give the AHJ much needed clarity to assure that Listed equipment is judged in accordance with requirements aligned to the NEC. This is critical to the safe installation & operation of NEMA equipment.

The committee's resolution statement to PI 2839 refers to Section 90.7, which indeed has some overall introduction statements for "Examination of Equipment for Safety." It must also be noted that in the Informational Note 1 to 90.7, it indeed refers over to 110.3 for the requirements. Hence the location suggested by the submitter is acceptable. The additional committee comments about testing laboratories are non-germane as they are not mentioned in PI 2839. Maybe the intent was misunderstood.
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2-NFPA 70-2015
Statement: In exercising their approving authority in 90.4, the AHJ depends on listing and product certification as the most common basis for approvals of installations in accordance with the National Electrical Code. The additional list item (C) Listing provides clarification about requirements for listing (product certification) being accomplished by qualified electrical testing laboratories and that the product testing and certification process is in accordance with appropriate product standards.

The new informational note provides users with information about a list of nationally recognized testing laboratories that meet or exceed OSHA criteria. Product listing (certification) is the most common basis for AHJ approvals and the product listing must meet or exceed the minimum product safety requirements developed by recognized standards development organizations.

With regard to PC 814, Panel 1 did not agree that Informational Note 1 should be deleted. The committee reaffirms the need for the new Informational Note No. 1 following 110.3(A) to clarify that the general term equipment can apply to new equipment and also used, refurbished, or reconditioned, remanufactured equipment.

With regard to PC 949, the intent of the submitter is met with the acceptance of SR 2.
Public Comment No. 938-NFPA 70-2015 [Section No. 110.3]

110.3 Examination, Identification, Installation, and Use, and Listing (Product Certification), of Equipment.

(A) Examination.

In judging equipment, considerations such as the following shall be evaluated:

1. Suitability for installation and use in conformity with the provisions of this Code

   Informational Note No. 1: Equipment may be new, reconditioned, refurbished, or remanufactured.

   Informational Note No. 2: Suitability of equipment use may be identified by a description marked on or provided with a product to identify the suitability of the product for a specific purpose, environment, or application. Special conditions of use or other limitations and other pertinent information may be marked on the equipment, included in the product instructions, or included in the appropriate listing and labeling information. Suitability of equipment may be evidenced by listing or labeling.

2. Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided

3. Wire-bending and connection space

4. Electrical insulation

5. Heating effects under normal conditions of use and also under abnormal conditions likely to arise in service

6. Arcing effects

7. Classification by type, size, voltage, current capacity, and specific use

8. Other factors that contribute to the practical safeguarding of persons using or likely to come in contact with the equipment

(B) Installation and Use.

Listed or labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling.

(C) Listing. Product testing, evaluation, listing (product certification) shall be performed by recognized qualified electrical testing laboratories and shall be in accordance with applicable product standards recognized as achieving equivalent and effective safety for equipment installed to comply with this Code.

Informational Note: The Occupational Safety and Health Administration recognizes qualified electrical testing organizations (NRTLs) that perform evaluations, testing, and certification of certain products to ensure that they meet the requirements of both the construction and general industry OSHA electrical standards. If the listing (product certification) is done under a qualified electrical testing laboratory program, this listing mark signifies that the tested and certified the product complies with the requirements of one or more appropriate product safety test standards.

Statement of Problem and Substantiation for Public Comment

In exercising their approving authority in 90.4, the AHJ depends on listing and product certification as the most common basis for approvals of installations in accordance with the National Electrical Code. The additional list item (C) Listing provides clarification about requirements for listing (product certification) being accomplished by qualified electrical testing laboratories and that the product testing and certification process is in accordance with appropriate product standards. The new informational note provides users with information about a list of nationally recognized testing laboratories that meet or exceed OSHA criteria. Product listing (certification) is the most common basis for AHJ approvals and the product listing must meet or exceed the minimum product safety requirements developed by recognized standards development organizations.

Related Item

Public Input No. 2839-NFPA 70-2014 [Section No. 110.3]

Submitter Information Verification

Submitter Full Name: Michael Johnston
Organization: National Electrical Contractor
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 13:53:06 EDT 2015
### Committee Statement

**Committee Action:** Rejected but see related SR

**Resolution:** SR-2-NFPA 70-2015

**Statement:**

In exercising their approving authority in 90.4, the AHJ depends on listing and product certification as the most common basis for approvals of installations in accordance with the National Electrical Code. The additional list item (C) Listing provides clarification about requirements for listing (product certification) being accomplished by qualified electrical testing laboratories and that the product testing and certification process is in accordance with appropriate product standards. The new informational note provides users with information about a list of nationally recognized testing laboratories that meet or exceed OSHA criteria. Product listing (certification) is the most common basis for AHJ approvals and the product listing must meet or exceed the minimum product safety requirements developed by recognized standards development organizations.

With regard to PC 814, Panel 1 did not agree that Informational Note 1 should be deleted. The committee reaffirms the need for the new Informational Note No. 1 following 110.3(A) to clarify that the general term equipment can apply to new equipment and also used, refurbished, or reconditioned, remanufactured equipment.

With regard to PC 949, the intent of the submittor is met with the acceptance of SR 2.
Public Comment No. 1366-NFPA 70-2015 [Section No. 110.3(A)]

(A) Examination.

In judging equipment, considerations such as the following shall be evaluated:

1. Suitability for installation and use in conformity with the provisions of this Code

   Informational Note No. 1: Equipment may be new, reconditioned, refurbished, or remanufactured.

   Informational Note No. 2: Suitability of equipment use may be identified by a description marked on or provided with a product to identify the suitability of the product for a specific purpose, environment, or application. Special conditions of use or other limitations and other pertinent information may be marked on the equipment, included in the product instructions, or included in the appropriate listing and labeling information. Suitability of equipment may be evidenced by listing or labeling.

2. Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided

3. Wire-bending and connection space

4. Electrical insulation

5. Heating effects under normal conditions of use and also under abnormal conditions likely to arise in service

6. Arcing effects

7. Classification by type, size, voltage, current capacity, and specific use

8. Other factors that contribute to the practical safeguarding of persons using or likely to come in contact with the equipment

Statement of Problem and Substantiation for Public Comment

The Correlating Committee note directing the committee to rewrite the language to remove permissive language in Informational Note 1 is unclear. It appears that the Note is indicating that the panel should remove the word "may", although the style manual does not prohibit, or in fact mention, the use of the word "may" when used in an informational note. The term "may" is only prohibited in mandatory rules, and informational notes are prohibited from containing any rules whatsoever. The wording accepted in FR-31 seems clear, informs the code user about available equipment, and complies with the style manual. Interestingly, IN 2 contains the word "may" three times.

Related Item
Correlating Committee Note No. 107-NFPA 70-2015 [Section No. 110.3(A)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 00:18:27 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The Public Comment did not comply with Section 4.4.4.3(c) of the “Regulations Governing the Development of NFPA Standards” which requires that the Public Comment include the wording to be added, revised, or deleted.
Public Comment No. 1529-NFPA 70-2015 [Section No. 110.3(A)]

(A) Examination.
In judging equipment, considerations such as the following shall be evaluated:

1. Suitability for installation and use in conformity with the provisions of this Code

   Informational Note No. 1: Equipment may be new, reconditioned, refurbished, or remanufactured.

2. Suitability of equipment use may be identified by a description marked on or provided with a product to identify
   the suitability of the product for a specific purpose, environment, or application. Special conditions of use or other
   limitations and other pertinent information may be marked on the equipment, included in the product instructions, or
   included in the appropriate listing and labeling information. Suitability of equipment may be evidenced by listing or
   labeling.

3. Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of
   the protection thus provided

4. Wire-bending and connection space

5. Electrical insulation

6. Heating effects under normal conditions of use and also under abnormal conditions likely to arise in service

7. Arcing effects

8. Classification by type, size, voltage, current capacity, and specific use

9. Other factors that contribute to the practical safeguarding of persons using or likely to come in contact with the equipment

Statement of Problem and Substantiation for Public Comment

FR-31, which added new Informational Note 1, should not have been accepted. The committee statement to FR-31 provided no substantiation for the change. The addition of this Informational Note may have unintended consequences and be misinterpreted to indicate that the Code is retroactive to reconditioned, refurbished and remanufactured equipment.

Related Item
First Revision No. 31-NFPA 70-2015 [Section No. 110.3(A)]

Submitter Information Verification

Submitter Full Name: Louis Barrios
Organization: Shell Global Solutions
Affiliation: American Chemistry Council
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:40:57 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The committee reaffirms the need for the new Informational Note No. 1 following 110.3(A) to clarify that the general term equipment can apply to new equipment and also used, refurbished, reconditioned, or remanufactured equipment.
Public Comment No. 1671-NFPA 70-2015 [Section No. 110.3(A)]

(A) Examination.

In judging equipment, considerations such as the following shall be evaluated:

(1) Suitability for installation and use in conformity with the provisions of this Code

Informational Note

No. 1: Informational Note No. 2:

- Equipment may be new, reconditioned, refurbished, or remanufactured.

Suitability of equipment use may be identified by a description marked on or provided with a product to identify the suitability of the product for a specific purpose, environment, or application. Special conditions of use or other limitations and other pertinent information may be marked on the equipment, included in the product instructions, or included in the appropriate listing and labeling information. Suitability of equipment may be evidenced by listing or labeling.

(2) Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided

(3) Wire-bending and connection space

(4) Electrical insulation

(5) Heating effects under normal conditions of use and also under abnormal conditions likely to arise in service

(6) Arcing effects

(7) Classification by type, size, voltage, current capacity, and specific use

(8) Other factors that contribute to the practical safeguarding of persons using or likely to come in contact with the equipment

Statement of Problem and Substantiation for Public Comment

Informational Note No. 1 is not necessary and does not add clarity to the code. The current language does not restrict the use of reconditioned, refurbished or remanufactured equipment in electrical installations.

Related Item

First Revision No. 31-NFPA 70-2015 [Section No. 110.3(A)]

Submitter Information Verification

Submitter Full Name: JAY BURRIS
Organization: JMC STEEL GROUP
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:08:27 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The committee reaffirms the need for the new Informational Note No. 1 following 110.3(A) to clarify that the general term equipment can apply to new equipment and also used, refurbished, reconditioned, or remanufactured equipment.
Public Comment No. 1746-NFPA 70-2015 [Section No. 110.3(A)]

(A) Examination.

In judging equipment, considerations such as the following shall be evaluated:

(1) Suitability for installation and use in conformity with the provisions of this Code

Informational Note No. 1: Equipment may be new, reconditioned, refurbished, or remanufactured.

Informational Note No. 2: Suitability of equipment use may be identified by a description marked on or provided with a product to identify the suitability of the product for a specific purpose, environment, or application. Special conditions of use or other limitations and other pertinent information may be marked on the equipment, included in the product instructions, or included in the appropriate listing and labeling information. Suitability of equipment may be evidenced by listing or labeling.

(2) Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided

(3) Wire-bending and connection space

(4) Electrical insulation

(5) Heating effects under normal conditions of use and also under abnormal conditions likely to arise in service

(6) Arcing effects

(7) Classification by type, size, voltage, current capacity, and specific use

(8) Other factors that contribute to the practical safeguarding of persons using or likely to come in contact with the equipment

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to rewrite Informational Note No. 1 to remove permissive language

Related Item

First Revision No. 31-NFPA 70-2015 [Section No. 110.3(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 28 14:44:52 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Panel 1 concludes that the text of First Revision 31 is not in violation of the NEC Style Manual.
(C) Listed. Where equipment, conductors, raceways, devices, fittings and other materials are required to be listed elsewhere in this code, the listing shall be compatible with applicable product standards recognized within the country, state, and/or municipality of the installation.

Statement of Problem and Substantiation for Public Comment

CMP-1 resolved PI 2839 with a statement that essentially agreed with the proposed revision. As the original submitter of PI 2839, I have submitted a similar public comment for CMP-1 to reconsider.

The statement to resolve this proposed revision states that section 90.7 addresses the concerns of the submitter. That is not true. The intent of this new first level subdivision is to simply require that the “applicable” listing or product standard be applied. This is a very simple concept that is essential for proper application of the NEC.

We all know that in order to achieve safe electrical installations in the U.S. we need three things. It is a three-legged stool, remove one leg and you have a “house of cards” that falls down in spite of all of your efforts.

One, we need a comprehensive “installation code” that is practical, easy to read and enforceable. We have that in the NEC.

Two, we need robust “product standards” that literally “build-in” required safety features for equipment required in the “installation code.” We have that in the existing U.S. product standards.

Three, we need comprehensive electrical inspections that enforce the “installation code” and the applicable “product standards”. We do have excellent inspections in the U.S. The question is “which listing” or “which product standard” should apply?

This proposed new first level subdivision accomplishes several things.

First, it ensures that the “applicable” listing or product standard is applied. Product standards will differ from country to country. If there is a U.S. product standard that given equipment must meet in the U.S. to be listed, then it makes sense that only products listed to the U.S. product standard be permitted. To do otherwise eliminates the “built-in” safety requirements and creates a “wild, wild west” atmosphere.

Second, this revision will promote adoption in other countries that have their own product standards.

Third, this revision enhances safety by ensuring the applicable listing is applied.

Fourth, this is essential for the authority having jurisdiction. This revision provides clarity, and assists the AHJ in enforcement of the applicable listing.

OSHA does recognize various NRTL’s. It is imperative to note that OSHA will require the applicable U.S. product standard and listing be applied where one exists.

This proposed revision aids the enforcement community, ensures “applicable” listings are applied, makes the NEC work for adoption by other countries and significantly improves safety by requiring the applicable listing or product standard be applied.

The original substantiation for PI 2839 is located below for your information:

The NEC presently has many individual requirements that particular products be listed. When these listed products are required, it is important that they are properly evaluated, and that they be listed to product standards that are compatible with this code. From a safety viewpoint it is also critical that the listing organization have a follow up surveillance program in place to assure continued compliance. The electrical industry has seen requests to accept CE marked equipment, which merely indicates a one-time, “self-certified” declaration by the manufacturer to European regulations which have not been evaluated to meet the requirements of this code. In some cases tremendous political pressure on an AHJ to accept equipment that is labeled and self certified outside of the United States. This can create many serious safety issues including but not limited to; color code requirements in the NEC that are ignored by the IEC, and overcurrent protective device opening times for similar devices may be significantly expanded. Both the North American system and the European systems work very well when implemented independently of each other. However, they cannot be mixed together and still achieve the necessary level of safety to protect persons and property from the hazards of electricity. It is imperative to clarify this with a requirement in the NEC and a new second level subdivision in 110.3 is the appropriate location to get it done.

Related Item

Public Input No. 2839-NFPA 70-2014 [Section No. 110.3]

Submitter Information Verification

Submitter Full Name: James Dollard
Organization: IBEW Local Union 98
Street Address: City:
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2-NFPA 70-2015
Statement: In exercising their approving authority in 90.4, the AHJ depends on listing and product certification as the most common basis for approvals of installations in accordance with the National Electrical Code. The additional list item (C) Listing provides clarification about requirements for listing (product certification) being accomplished by qualified electrical testing laboratories and that the product testing and certification process is in accordance with appropriate product standards. The new informational note provides users with information about a list of nationally recognized testing laboratories that meet or exceed OSHA criteria. Product listing (certification) is the most common basis for AHJ approvals and the product listing must meet or exceed the minimum product safety requirements developed by recognized standards development organizations.

With regard to PC 814, Panel 1 did not agree that Informational Note 1 should be deleted. The committee reaffirms the need for the new Informational Note No. 1 following 110.3(A) to clarify that the general term equipment can apply to new equipment and also used, refurbished, or reconditioned, remanufactured equipment.

With regard to PC 949, the intent of the submitter is met with the acceptance of SR 2.
Public Comment No. 531-NFPA 70-2015 [Section No. 110.3(B)]

(B) Installation and Use.
Listed or listed and labeled equipment shall be installed and used in accordance with any instructions included in the listing or listing and labeling.

Additional Proposed Changes

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<th>Description</th>
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Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
Public Input No. 881-NFPA 70-2014 [Section No. 110.3(B)]
Public Input No. 1072-NFPA 70-2014 [Definition: Labeled]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
Committee Statement

Committee Action: Rejected but held

Resolution: The inconsistent actions on Public inputs to globally change the term “listed or labeled” to “listed and labeled” resulted in multiple inconsistencies through the NEC and created conflicts with other Codes and Standards that use the term. CMP-1 understands that the NEC Correlating Committee took action to develop a first revision that restores the NEC rules using the term listed or labeled to how those rules appeared in the 2014 edition. CMP-1 also understands that the NEC Correlating Committee has formed a Task Group to globally review the use of the term “listed or labeled” throughout the NEC and determine a simplified solution that addresses the terms listed, labeled, and their associated informational notes. The Task Group is to address the concerns and input from multiple qualified electrical testing laboratories and work toward a simple solution that resides within Article 100 and perhaps Article 110. The work of that task group is just getting started and may include proposed revisions to these existing definitions and associated informational notes. CMP-1 recognizes it is premature to incorporate the proposed revisions and informational note at this time.
110.11 Deteriorating Agents.

(A) Unless identified for use in the operating environment, no conductors or equipment shall be located in damp or wet locations; in locations prone to flooding; where exposed to gases, fumes, vapors, liquids, or other agents that have a deteriorating effect on the conductors or equipment; or where exposed to excessive temperatures.

Informational Note No. 1: See 300.6 for protection against corrosion.

Informational Note No. 2: Some cleaning and lubricating compounds can cause severe deterioration of many plastic materials used for insulating and structural applications in equipment.

Equipment not identified for outdoor use and equipment identified only for indoor use, such as “dry locations,” “indoor use only,” “damp locations,” or enclosure Types 1, 2, 5, 12, 12K, and/or 13, shall be protected against damage from the weather during construction.

Informational Note No. 3: See Table 110.28 for appropriate enclosure-type designations.

(B) Installations in Flood Hazard Areas. For installations in Flood Hazard Areas, conductors and equipment shall be elevated to or above the Base Flood Elevation plus one foot (BFE plus 1) or the Design Flood Elevation (DFE) whichever is higher.

Exception No. 1: Conductors and equipment shall be permitted to be located below the elevation specified above provided they are designed and installed to prevent flood waters from entering or accumulating within components during design flood conditions and all equipment is designed and installed to resist flood loads resulting from inundation to the elevation specified above.

Exception No. 2: Where conductors and equipment are suitable for submerged applications and are designed and installed to resist flood loads resulting from inundation to the elevation specified above.

Exception No. 3: When located in areas protected by dry floodproofing to the elevation specified above.

Exception No. 4: Where allowed by Article 682.

Informational Note No. 4: Minimum flood provisions are provided in NFPA 5000-2015 Building Construction and Safety Code, the International Building Code (IBC), and the International Residential Code for One- and Two-Family Dwellings (IRC).

Additional Proposed Changes

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<td>PI_1st_Draft_Substantiation_2017_NEC_as_submitted.pdf</td>
<td>This file contains background and substantiation. I chose to upload a file since it should preserve highlighting, fonts and format that will make the document easier for the Committee to review</td>
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Statement of Problem and Substantiation for Public Comment

Background (Note - this text is included for substantiation - a pdf of it has been attached - The proponent believes that the pdf may be clearer and easier for the Committee to read)

This language included in these Public Inputs was presented in October 2014 as Public Input 4142 and Public Input 4144. PI 4142 created a new sub-section (C) of Art 110.3 Installations in Flood Hazard Areas. PI 4144 added new definitions into Article 100 for terms used in the new Art 110.3 (C).

PI 4142 included the following substantiation for the proposed Art 110.3(C) language

1. This change includes the minimum flood provisions that already exist in the 2015 Edition of NFPA 5000 Building Construction and Safety Code, the 2015 International Building Code (IBC) and the 2015 International Residential Code for One- and Two-Family Dwellings (IRC).

2. The change will make the minimum flood provisions more assessable to practicing electrical engineers, electrical inspectors and electricians.

Code Making Panel (CMP-1), the Committee responsible for Articles 100 and 110, chose not to incorporate the proposed material. Rather, they developed FR-35 which added the following Informational Note 4 to Art 110-11 Deteriorating Agents.

“Informational Note No. 4: Minimum flood provisions are provided in NFPA 5000 -2015 Building Construction and Safety Code, the International Building Code (IBC), and the International Residential Code for One- and Two-Family Dwellings (IRC).”
In their reason statement, CMP-1 stated the new Informational Note was more appropriate in Article 110.11 Deteriorating Agents than in the originally proposed Article 110.3 Examination, Identification, Installation, and Use of Equipment. They also stated the following two reasons for not incorporating PI 4142.

1. The proposed requirement would apply generally and may cause conflict with other requirements throughout the Code. And.
2. Accessibility to information alone is not sufficient substantiation for inclusion of a requirement.

PI-4144 was rejected since, without PI-4142 being incorporated, the proposed flood definitions were no longer needed.

The proponent agrees with the Committee on the placing the new language in Article 110.11 Deteriorating Agents instead of creating a new Article 110.3(C) but disagrees with the committee’s reason statement for disapproving the PI-4142. The proponent is submitting two new PIs for the 1st Draft of the 2017 NEC which are nearly identical to those submitted previously except they request changes to Art 110.11 instead of Art 110.3 and they include responses to the Committee’s reasons for disapproval. The committee listed two reasons for disapproval. In the response, the proponent has considered the issue of the general nature of the proposed language and the issue of potential conflict with other portions of the code separately.

Reason for Rejection #1a General Nature of the Proposed Requirements:

The PI proposes the following language be introduced into Art 110

110.11 Deteriorating Agents. (A) Unless identified for use in the operating environment, no conductors or equipment shall be located in damp or wet locations; in locations prone to flooding; where exposed to gases, fumes, vapors, liquids, or other agents that have a deteriorating effect on the conductors or equipment; or where exposed to excessive temperatures.

“(B) Installations in Flood Hazard Areas. For installations in Flood Hazard Areas, conductors and equipment shall be elevated to or above the Base Flood Elevation plus one foot (BFE 1) or the Design Flood Elevation (DFE) whichever is higher.”

Proponent’s Response – The proponent wishes to split the existing Article 110.11 Deteriorating Agents into two subsections “(A)” and “(B)”. Subsection A would remain general and like the existing language would apply to all installations. The new subsection (B) would not be general in nature and would “only” apply to installations in Flood Hazard Areas.

The language “in locations prone to flooding” proposed for “(A)” is intentionally left undefined to provide the AHJ with discretion on interpretation and enforcement. The proponent envisions that “locations prone to flooding” would include areas that could be exposed to flooding from piping failures, operation of sprinkler systems, sump pumps, etc. On the other hand, the language in (B) Installations in Flood Hazard Areas is limited to installations in areas that are well defined and previously identified.

Reason for Rejection #1b Potential Conflict with Other Code Requirements


• Two of those occur in Article 540 Motion Picture Projection Rooms and one in Article 640 Electric Signs and Lighting where the term “flood” pertains to “flood” lights or “flood” lamps. Neither of those uses of the term flood pertains to the risk for flooding addressed by the proposed changes to Article 110.

• One instance occurs in Article 690 Solar Photovoltaic (PV) Systems which contains the term “flooded” but the use of that term pertains to “flooded” lead-acid batteries. It does not pertain to the risk of flooding addressed by the proposed changes to Article 110.

• There are other 11 instances where the terms “flood”, “flooded”, “flooding” or “floodplain” are used and, like the language proposed for Art 110, pertain to the risk of flooding or flood hazards. These instances are:
  1. Article 517 Health Care Facilities Art 517.35(C) Health Care Facilities – Essential Electrical Systems for Hospitals - Sources of Power
  2. Article 517 Health Care Facilities Art 517.44(C) Essential Electrical Systems for Nursing Homes and Limited Care Facilities - Sources of Power
  3. Article 626.22(B) Electrified Truck Parking Spaces
  4. Article 682.2(3) Natural and Artificially Made Bodies of Water
  5. Article 695.12(C) Fire Pumps
  6. Article 700 – Emergency Systems Art 700.10(C) Emergency Systems
  7. Article 700 – Emergency Systems Part III Art 700.12 General Requirements
  8. Article 701.12 – Legally Required Standby Systems Part III Sources of Power Art 701.12 General Requirements
  10. Article 708 – Critical Operations Power Systems (COPS) (3) Floodplain Protection
  11. Article 708 – Critical Operations Power Systems (COPS) and Art 708.11 Branch Circuit and Feeder Distribution Equipment

In all of these nine of the eleven instances, the language proposed for Article 110.10 does not conflict with existing requirements. In those cases, the proposed language contains more definitive and more enforceable methods to address flood risks than what exists in the present code. In other cases, requirements will differ. In those cases, the most stringent requirement will apply. The following contains excerpts from the 2014 NEC and lists the eleven instances where the terms “flood”, “flooded”, “flooding” or
"floodplain" are used. For each instance, the proponent has provided discussions on the effects of the proposed changes to Art 110. The terms flood, flooded, flooding or floodplain have been emphasized for clarity. These discussion were developed to assist the Committee in considering the proposed changes to Article 110.11

Article 517 Health Care Facilities

35 (C)  
"Location of Essential Electrical System Components. Careful consideration shall be given to the location of the spaces housing the components of the essential electrical system to minimize interruptions caused by natural forces common to the area (e.g., storms, floods, earthquakes, or hazards created by adjoining structures or activities). Consideration shall also be given to the possible interruption of normal electrical services resulting from similar causes as well as possible disruption of normal electrical service due to internal wiring and equipment failures. Consideration shall be given to the physical separation of the main feeders of the alternate source from the main feeders of the normal electrical source to prevent possible simultaneous interruption."

Proponent’s Response - This provision of the NEC Art 517 Sect 35(C) requires that floods be considered (carefully) when determining the location of Essential Systems in hospitals. NEC Art 517 Sect 44(C) contains nearly identical requirements for Nursing Homes and Limited Care Facilities. These articles do not state "how" floods should be considered when locating those systems but rather that floods need to be considered.

The proposed changes to Art 110 do not conflict with Art 517. Rather they contain more definitive, and more enforceable, methods to address flood risks. Those definitive and enforceable methods are consistent with those in the IBC, IRC and NFPA 5000.

Article 626.22(B) Electrified Truck Parking Spaces

"(B) Mounting Height. Post, pedestal, and raised concrete pad types of electrified truck parking space supply equipment shall be not less than 600 mm (2 ft) above ground or above the point identified as the prevailing highest water level mark or an equivalent benchmark based on seasonal or storm-driven flooding from the authority having jurisdiction."

Proponent’s Response - Article 626.22(B) requires post, pedestal, and raised concrete pad types of equipment supplying electrified truck parking spaces be elevated 2 feet above grade or to an elevation determined by the AHJ. The proposed changes to Art 110 require that, when located in a Flood Hazard Area, equipment supplying electrified truck parking spaces be elevated but the proposed changes to Art 110 also allow other methods of providing flood protection. Namely electrical equipment can be (1) designed and installed equipment to prevent flood waters from entering components and designed and installed to resist flood loads, or (2) by selecting equipment suitable for submerged use or (3) by protecting equipment by dry floodproofing.

Adopting the recommended changes to Art 110 will not create conflict but rather an instance where more stringent criteria would apply. The dry-floodproofing option, the option to use equipment suitable for submerged applications and the option of installing equipment that prevents floodwater entry allowed by Art 110 would not meet the requirements of Art 626 for post, pedestal, and raised concrete pad types of equipment that supply electrified truck parking spaces so the more stringent criteria of Art 626 would apply.

Article 682.2 (3) Natural and Artificially Made Bodies of Water

"Electrical Datum Plane". The electrical datum plane as used in this article is defined as follows:

(1) In land areas subject to tidal fluctuation, the electrical datum plane is a horizontal plane 600 mm (2 ft) above the highest tide level for the area occurring under normal circumstances, that is, highest high tide.

(2) In land areas not subject to tidal fluctuation, the electrical datum plane is a horizontal plane 600 mm (2 ft) above the highest water level for the area occurring under normal circumstances.

(3) In land areas subject to flooding, the electrical datum plane based on (1) or (2) above is a horizontal plane 600 mm (2 ft) above the point identified as the prevailing high water mark or an equivalent benchmark based on seasonal or storm-driven flooding from the authority having jurisdiction."

"682.10 Electrical Equipment and Transformers. Electrical equipment and transformers, including their enclosures, shall be specifically approved for the intended location. No portion of an enclosure for electrical equipment not identified for operation while submerged shall be located below the electrical datum plane."

"682.11 Location of Service Equipment. On land, the service equipment for floating structures and submersible electrical equipment shall be located no closer than 1.5 m (5 ft) horizontally from the shoreline and live parts shall be elevated a minimum of 300 mm (12 in.) above the electrical datum plane. Service equipment shall disconnect when the water level reaches the height of the established electrical datum plane."

Proponent’s Response –Art 682 requires electrical equipment, transformers and service equipment be elevated 2 feet above the Electrical Datum Plane - an elevation defined within that article. The elevation specified in Article 110.11 – the Based Flood Elevation - may be different from the Electrical Datum Plane so, in Flood Hazard Areas, a conflict could arise. However, the proposed language for Art 110 excludes wiring installed under Art 626 so no conflict will arise.
Article 695.12(C) – Fire Pumps

“(C) Storage Batteries. Storage batteries for fire pump engine drives shall be supported above the floor, secured against displacement, and located where they are not subject to physical damage, flooding with water, excessive temperature, or excessive vibration”.

Proponent’s Response - The elevation and dry floodproofing criteria proposed for Art 110 will protect storage batteries from being flooded with water – at least during a design flood. The proposed changes to Art 110 would allow storage batteries to be placed below the flood elevation and thus exposed to being flooded with water but only if they were sealed to prevent water entry or designed for submerged use. In those cases, Art 110 could expose storage batteries to flooding with water. In those instances, Art 695 would be more stringent and its criteria would supersede that of Art 110.

Article 700.10(C) – Emergency Systems Part II Circuit Wiring - Emergency System.

“(C) Wiring Design and Location. Emergency wiring circuits shall be designed and located so as to minimize the hazards that might cause failure due to flooding, fire, icing, vandalism, and other adverse conditions.”

Proponent’s Response – Article 700 requires wiring in emergency systems be designed to minimize flood hazards. Adopting the proposed changes to Article 110 will not create a conflict with Art 700. Rather, it will provide the protection required by Art 700 using substantive, quantifiable and enforceable criteria.

Article Emergency Systems Part III. Sources of Power 700.12 – General Requirements

“700.12 General Requirements. Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings concerned, emergency lighting, emergency power, or both shall be available within the time required for the application but not to exceed 10 seconds. The supply system for emergency purposes, in addition to the normal services to the building and meeting the general requirements of this section, shall be one or more of the types of systems described in 700.12(A) through (E). Unit equipment in accordance with 700.12(F) shall satisfy the applicable requirements of this article.

In selecting an emergency source of power, consideration shall be given to the occupancy and the type of service to be rendered, whether of minimum duration, as for evacuation of a theater, or longer duration, as for supplying emergency power and lighting due to an indefinite period of current failure from trouble either inside or outside the building.

Equipment shall be designed and located so as to minimize the hazards that might cause complete failure due to flooding, fires, icing, and vandalism….”

Proponent’s Response – Art 700.12 requires that sources of emergency power sources be designed to minimize the risk of a complete failure from numerous hazards one hazard being flooding. Adopting the proposed changes to Article 110 will not conflict with Art 700.12. Rather it will protect emergency sources from flooding using language that is more substantive, quantifiable and enforceable than the existing language.

Article Legally Required Standby Systems Part II Circuit Wiring 701.12 – Sources of Power

“701.12 General Requirements. Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings concerned, legally required standby power will be available within the time required for the application but not to exceed 60 seconds. The supply system for legally required standby purposes, in addition to the normal services to the building, shall be permitted to comprise one or more of the types of systems described in 701.12(A) through (F). Unit equipment in accordance with 701.12(G) shall satisfy the applicable requirements of this article.

In selecting a legally required standby source of power, consideration shall be given to the type of service to be rendered, whether of short-time duration or long duration.

Consideration shall be given to the location or design, or both, of all equipment to minimize the hazards that might cause complete failure due to floods, fires, icing, and vandalism.”

Proponent’s Response – Art 701.12 requires that flooding (and other hazards) be considered when locating sources for legally required standby systems. Adopting the proposed changes to Article 110 will not conflict with Art 701.12. Rather it will protect sources for legally required standby systems from flooding using language that is more substantive, quantifiable and enforceable than the existing language.

Article 708 Critical Operations Power Systems (COPS)

Art 708.10(C)(3) Circuit Wiring and Equipment “(3) Floodplain Protection. Where COPS feeders are installed below the level of the 100-year floodplain, the insulated circuit conductors shall be listed for use in a wet location and be installed in a wiring method that is permitted for use in wet locations.
Proponent’s Response - Article 708 allows feeders to be installed below the 100-year floodplain (i.e. the BFE) but only requires the feeds to be suitable for wet locations. In installations located in Flood Hazard Areas, Article 110 allows feeders to be installed below the BFE but requires them to be either (1) designed and installed to prevent flood waters from entering or accumulating within them and be designed to resist flood forces, or (2) suitable for submerged applications and be designed to resist flood forces or (3) protected by dry floodproofing that provides protection to one foot above the BFE. For installation in flood hazard areas, the proposed changes to Article 110 are more stringent than those of Art 708.

Article 708.11 – Circuit Wiring and Equipment

“(A) Branch Circuit Distribution Equipment. COPS branch circuit distribution equipment shall be located within the same DCOA as the branch circuits it supplies.

(B) Feeder Distribution Equipment. Equipment for COPS feeder circuits (including transfer equipment, transformers, and panelboards) shall comply with (1) and (2).

(1) Be located in spaces with a 2-hour fire resistance rating

(2) Be located above the 100-year floodplain.”

Proponent’s Response - Article 708 requires equipment for COPS feeder circuits be elevated above the 100-year floodplain (the BFE). The elevation criteria proposed for Article 110 require electrical equipment to be elevated a minimum of one foot above the

Related Public Comments for This Document

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<tr>
<td>Public Comment No. 1253-NFPA 70-2015 [Section No. 110.11]</td>
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Related Item

| Public Input No. 4142-NFPA 70-2014 [New Section after 110.3(B)] |              |
| Public Input No. 4144-NFPA 70-2014 [New Definition after Definition: Automatic] |              |
| First Revision No. 35-NFPA 70-2015 [Section No. 110.11] |              |

Submitter Information Verification

Submitter Full Name: David Low
Organization: DK Low & Associates, LLC
Affiliation: DHS/FEMA
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 15:51:03 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: These recommendations do not enhance clarity and are not essential to the application of the NEC.
Public Comment No. 1253-NFPA 70-2015 [Section No. 110.11]

110.11 Deteriorating Agents.

Unless identified for use in the operating environment, no conductors or equipment shall be located in damp or wet locations; in locations prone to flooding; where exposed to gases, fumes, vapors, liquids, or other agents that have a deteriorating effect on the conductors or equipment; or where exposed to excessive temperatures.

Informational Note No. 1: See 300.6 for protection against corrosion.

Informational Note No. 2: Some cleaning and lubricating compounds can cause severe deterioration of many plastic materials used for insulating and structural applications in equipment.

Equipment not identified for outdoor use and equipment identified only for indoor use, such as “dry locations,” “indoor use only,” “damp locations,” or enclosure Types 1, 2, 5, 12, 12K, and/or 13, shall be protected against damage from the weather during construction.

Informational Note No. 3: See Table 110.28 for appropriate enclosure-type designations.

Informational Note No. 4: Minimum flood provisions are provided in NFPA 5000-2015 Building Construction and Safety Code, the International Building Code (IBC), and the International Residential Code for One- and Two-Family Dwellings (IRC).

Statement of Problem and Substantiation for Public Comment

Note: This PC is an alternate Public Comment to PC 1248 and PC 1242. I am submitting it in case the Committee elects not to incorporate the language contained those two Public Comments. If the Committee incorporates those PCs (1248 and 1242), I respectfully request that this PC be disapproved since it would no longer be needed.

Related Public Comments for This Document

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Submitter Information Verification

Submitter Full Name: David Low
Organization: DK Low & Associates, LLC
Affiliation: DHS/FEMA
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 16:14:14 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: These recommendations do not enhance clarity and are not essential to the application of the NEC.
Electrical equipment shall be installed in a neat and workmanlike manner.

Informational Note: Accepted industry practices are described in ANSI/NECA 1-2010, Standard for Good Workmanship in Electrical Construction, and other ANSI-approved installation standards.

Statement of Problem and Substantiation for Public Comment

The 2015 edition has been reaffirmed by ANSI.

Related Item
Public Input No. 2416-NFPA 70-2014 [Section No. 110.12 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: Michael Johnston
Organization: National Electrical Contractor
Street Address: City: State: Zip:

Submittal Date: Wed Sep 02 13:52:07 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3-NFPA 70-2015
Statement: The 2015 edition has been reaffirmed by ANSI.
Public Comment No. 1551-NFPA 70-2015 [Section No. 110.14 [Excluding any Sub-Sections]]

Because of different characteristics of dissimilar metals, devices such as pressure terminal or pressure splicing connectors and soldering lugs shall be identified for the material of the conductor and shall be properly installed and used. Conductors of dissimilar metals shall not be intermixed in a terminal or splicing connector where physical contact occurs between dissimilar conductors (such as copper and aluminum, copper and copper-clad aluminum, or aluminum and copper-clad aluminum), unless the device is identified for the purpose and conditions of use. Materials such as solder, fluxes, inhibitors, and compounds, where employed, shall be suitable for the use and shall be of a type that will not adversely affect the conductors, installation, or equipment.

(Exception) Where the connection is protected against any galvanic corrosion by incasing connection from an electrolyte.

Connectors and terminals for conductors more finely stranded than Class B and Class C stranding as shown in Chapter 9, Table 10, shall be identified for the specific conductor class or classes.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017_NEC_Change_Proposal.pdf</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

As a Master electrician for over 30 years, I have witnessed and dealt with the effects of poor grounding. A large part of this stems from the connection point of the GEC to the Grounding Electrode. Section 110.14 of the NEC Handbook describes this issue, yet does not address it completely. Dissimilar metal connections are used frequently in the electrical industry. Copper to galvanized ground rods, copper to steel rebar, aluminum to copper ground rods.

Even with "listed" connectors the industry does not address the facts that to dissimilar metals create a battery of such to sacrifices the anode to the cathode.

(see attached article)

This is creating a loose and unstable connection point that can lead to a great hazard to both life and property.

The industry also has been led to believe by the creators of exothermic welding that their connections are 100% free from galvanic corrosion. This is proving not to be the case, thus companies such as Century Link, civil engineering firms in St. Louis, Mo and US Dept. of the Interior – Mining and others are requiring a sealant over their exothermic welding connections which are then either buried deep beneath the soil or in concrete. Many companies such as Enbridge and Monsanto require annual inspections of these connections to check that the connection is still sound.

Since the grounding system is dormant a large part of it’s life we as electricians tend to over look it till it’s too late. Once the grounding system is needed do to a fault or lightning strike occurs we want to have the peace of mind knowing our grounding system is working properly.

Studies show that nearly 86% of all electrical problems stem from poor grounding. While proper installation of grounding equipment is closely regulated, post installation inspection has been largely overlooked. Recent growth spurts in the electrical industry have been bringing attention to these issues, with safety being the utmost concern.

All electrical systems rely on a good ground connection to ensure safe and reliable operation. Making sure there is minimal resistance at the grounding point ensures that any potential hazards are avoided.

The safest and simplest way to achieve these goals are by encapsulating the connection point. As read in the attached paper "Galvanic Corrosion in the Electrical Industry" put together by John Langholtz EE/PE graduate of South Dakota State University.

Related Item

Public Input No. 4181-NFPA 70-2014 [Section No. 250.10]

Submitter Information Verification

Submitter Full Name: dan tharp
Organization: Big D Electric
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:04:20 EDT 2015
### Committee Statement

<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>Encapsulation of connection to grounding electrode conductor connections is not practical in all cases and the integrity of grounding electrode connections to electrodes is already addressed in 110.11, 250.8, and Part III of Article 250.</td>
</tr>
</tbody>
</table>
Public Comment No. 976-NFPA 70-2015 [Section No. 110.14(B)]

(B) Splices.
Conductors shall be spliced or joined with splicing devices identified for the use or by brazing, welding, or soldering with a fusible metal or alloy. Soldered splices shall first be spliced or joined so as to be mechanically and electrically secure without solder and then be soldered. All splices and joints and the free ends of conductors shall be covered with an insulation equivalent to that of the conductors or with an identified insulating device.

Wire connectors or splicing means installed on conductors for direct burial shall be listed and labeled for such use.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

CMP 1 within the committee statement stated "This section currently aligns with common labeling requirements in product safety standards," the product safety standards do not include requirements for certification (listing) labels. The statement also stated "Labeling of listed equipment is not possible in all cases or conditions such as if products are too small to be labeled or for some severe environmental conditions. Manufacturers require the flexibility afforded for listed products relative to when labels should be applied and when the information on the smallest package is sufficient, and practical." This statement seems to reinforce the need for an informational note to the definition of labeled as submitted under PI 1072.

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term "and labeled" was added after "listed" during the First Revision Stage, the words "and labeled" after "listed" be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms "listed" and "labeled," most importantly, to clarify and establish a distinction between the terms "listed" and "labeled" which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of "listed and labeled." As such, UL is submitting comments to request that the words "and labeled" be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer's attestation that the product is in compliance with the appropriate standard. NRTL's conduct factory surveillance of products, surveillance is one method to validate the manufacturer's attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the "Listing" is not impacted, as the "listing" is created at the completion of the "original" certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a "listing" has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL's do not consider a product as being listed unless it is also labeled. The UL White Book states that "Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards." Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL's have similar requirements.

Related Item

101 of 2282
Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 17:36:12 EDT 2015

Committee Statement

Committee Action: Rejected but held
Resolution: The inconsistent actions on Public inputs to globally change the term “listed or labeled” to “listed and labeled” resulted in multiple inconsistencies through the NEC and created conflicts with other Codes and Standards that use the term. CMP-1 understands that the NEC Correlating Committee took action to develop a first revision that restores the NEC rules using the term listed or labeled to how those rules appeared in the 2014 edition. CMP-1 also understands that the NEC Correlating Committee has formed a Task Group to globally review the use of the term “listed or labeled” throughout the NEC and determine a simplified solution that addresses the terms listed, labeled, and their associated informational notes. The Task Group is to address the concerns and input from multiple qualified electrical testing laboratories and work toward a simple solution that resides within Article 100 and perhaps Article 110. The work of that task group is just getting started and may include proposed revisions to these existing definitions and associated informational notes. CMP-1 recognizes it is premature to incorporate the proposed revisions and informational note at this time.
Public Comment No. 1078-NFPA 70-2015 [Section No. 110.14(C)(1)]

(1) Equipment Provisions.
The determination of termination provisions of equipment shall be based on 110.14(C)(1)(a) or (C)(1)(b). Unless the equipment is listed and marked otherwise, conductor ampacities used in determining equipment termination provisions shall be based on Table 310.15(B)(16) as appropriately modified by 310.15(B)(7).

(a) Termination provisions of equipment for circuits rated 100 amperes or less, or marked for 14 AWG through 1 AWG conductors, shall be used only for one of the following:

(2) Conductors rated 60°C (140°F).

(3) Conductors with higher temperature ratings, provided the ampacity of such conductors is determined based on the 60°C (140°F) ampacity of the conductor size used.

(4) Conductors with higher temperature ratings if the equipment is listed and identified for use with such conductors.

(5) For motors marked with design letters B, C, or D, conductors having an insulation rating of 75°C (167°F) or higher shall be permitted to be used, provided the ampacity of such conductors does not exceed the 75°C (167°F) ampacity.

(f) Termination provisions of equipment for circuits rated over 100 amperes, or marked for conductors larger than 1 AWG, shall be used only for one of the following:

(7) Conductors rated 75°C (167°F)

(8) Conductors with higher temperature ratings, provided the ampacity of such conductors does not exceed the 75°C (167°F) ampacity of the conductor size used, or up to their ampacity if the equipment is listed and identified for use with such conductors.

Statement of Problem and Substantiation for Public Comment

Justification: The wording deleted by this proposed change was added in the 2002 code (proposed by the Square D Company) as a means to clarify or simplify equipment termination calculations. It was argued that the change and I quote “This proposal does not have any new impact on the equipment or wiring methods”.

In fact this code change has been interpreted by some, to have a significant impact by excluding the use of Cable Bus and Cable tray in most applications, as these wiring methods are not dictated or based on table 310.16. Cable tray and Cable Bus systems have been valued wiring methods, connecting to equipment, without issue for nearly 50 years.

If equipment is designed based on cable ampacities listed in table 310.16 this specific requirement needs to be stated in the manufacturer’s equipment specifications and provided on the equipment terminations. This design criteria should not be imposed with a broad brush for all “equipment” as currently written in this section of the code.

Related Item

Public Input No. 1104-NFPA 70-2014 [Section No. 110.14(C) [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: Barry Schuster
Organization: S&S Engineering
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 15:44:36 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Removing the reference to 310.15(B)(7) is not technically substantiated.
Public Comment No. 690-NFPA 70-2015 [Section No. 110.14(C)(1)]

(1) Equipment Provisions.
The determination of termination provisions of equipment shall be based on 110.14(C)(1)(a) or (C)(1)(b). Unless the equipment is listed and marked otherwise, conductor ampacities used in determining equipment termination provisions shall be based on Table 310.15(B)(16) as appropriately modified by 310.15(B)(7).

(a) Termination provisions of equipment for circuits rated 100 amperes or less, or marked for 14 AWG through 1 AWG conductors, shall be used only for one of the following:

(2) Conductors rated 60°C (140°F).

(3) Conductors with higher temperature ratings, provided the ampacity of such conductors is determined based on the 60°C (140°F) ampacity of the conductor size used.

(4) Conductors with higher temperature ratings if the equipment is listed and identified for use with such conductors.

(5) For motors marked with design letters B, C, or D, conductors having an insulation rating of 75°C (167°F) or higher shall be permitted to be used, provided the ampacity of such conductors does not exceed the 75°C (167°F) ampacity.

(f) Termination provisions of equipment for circuits rated over 100 amperes, or marked for conductors larger than 1 AWG, shall be used only for one of the following:

(7) Conductors rated 75°C (167°F)

(8) Conductors with higher temperature ratings, provided the ampacity of such conductors does not exceed the 75°C (167°F) ampacity of the conductor size used, or up to their ampacity if the equipment is listed and identified for use with such conductors.

Statement of Problem and Substantiation for Public Comment

Justification: The wording deleted by this proposed change was added in the 2002 code (proposed by the Square D Company) as a means to clarify or simplify equipment termination calculations. It was argued that the change and I quote "This proposal does not have any new impact on the equipment or wiring methods".

In fact this code change in 2002 has been interpreted by some, to have a significant impact by excluding the use of Cable Bus and Cable tray in most applications, as these wiring methods are not dictated or based on table 310.16. Cable tray and Cable Bus systems have been valued wiring methods, connecting to equipment, without issue for nearly 50 years.

If equipment is designed based on cable ampacities listed in table 310.16 this specific requirement needs to be stated in the manufacturer’s equipment specifications and provided on the equipment terminations. This design criteria should not be imposed with a broad brush for all “equipment” as currently written in this section of the code.

Related Item
Public Input No. 1323-NFPA 70-2014 [New Section after 110.14(C)]

Submitter Information Verification
Submitter Full Name: Barry Schuster
Organization: S&S Engineering, LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 11:26:24 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Removing the reference to 310.15(B)(7) is not technically substantiated.
Public Comment No. 87-NFPA 70-2015 [ Section No. 110.14(C)(1) ]

(1) Equipment Provisions.

The determination of termination provisions of equipment shall be based on 110.14(C)(1)(a) or (C)(1)(b). Unless the equipment is listed and marked otherwise, conductor ampacities used in determining equipment termination provisions shall be based on from either Table 310.15(B)(16) as appropriately modified by 310.15(B)(7) or Table 310.15(B)(17) as appropriate.

(a) Termination provisions of equipment for circuits rated 100 amperes or less, or marked for 14 AWG through 1 AWG conductors, shall be used only for one of the following:

(2) Conductors rated 60°C (140°F).

(3) Conductors with higher temperature ratings, provided the ampacity of such conductors is determined based on the 60°C (140°F) ampacity of the conductor size used.

(4) Conductors with higher temperature ratings if the equipment is listed and identified for use with such conductors.

(5) For motors marked with design letters B, C, or D, conductors having an insulation rating of 75°C (167°F) or higher shall be permitted to be used, provided the ampacity of such conductors does not exceed the 75°C (167°F) ampacity.

(f) Termination provisions of equipment for circuits rated over 100 amperes, or marked for conductors larger than 1 AWG, shall be used only for one of the following:

(7) Conductors rated 75°C (167°F)

(8) Conductors with higher temperature ratings, provided the ampacity of such conductors does not exceed the 75°C (167°F) ampacity of the conductor size used, or up to their ampacity if the equipment is listed and identified for use with such conductors.

Statement of Problem and Substantiation for Public Comment

The current wording is limiting the methods by which equipment may be connected by implying all equipment connections are limited to the ampacities stated within table 310.15(B)(16). Where as this rule may apply to some equipment applying it to all equipment is being overly restrictive, by inserting this additional table it will not limit the use of other traditional wiring methods such as cable tray and cable bus.

This simply allows the use of table 310.15(B)(17) for wiring methods without special marking or labeling as was the standard prior to the insertion of only table 310.15(B)(16) in the 2002 NEC. Either table when used in conjunction with section 110.14 C should have no new impact on wiring or equipment. Section 110.14 C clearly indicates that "The temperature rating associated with the ampacity of a conductor shall be selected and coordinated so as not to exceed the lowest temperature rating of any connected termination, conductor, or device."

Related Item
Public Input No. 1104-NFPA 70-2014 [Section No. 110.14(C) [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: Mike Miller
Organization: MDF Cable Bus Systems LLC
Affiliation: SELF
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 29 12:12:12 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Adding the reference to 310.15(B)(17) is not technically substantiated.
Public Comment No. 1458-NFPA 70-2015 [Section No. 110.14(D)]

(D) Installation.

Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, a calibrated torque tool shall be used to achieve the indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque. Documentation shall be provided, by the installing entity, to the AHJ certifying that the required tightening torque values for such equipment have been met, prior to energizing the equipment.

Statement of Problem and Substantiation for Public Comment

Fr 40 clearly identifies the fact that following the manufacturer's guidelines for tightening torque is a safety issue. As such, the inspection community should have a method to provide assurance that the installer followed the guidelines needed to ensure the installation is safe. Simply looking at the connections is not an option.

Related Item

First Revision No. 40-NFPA 70-2015 [New Section after 110.14(C)]

Submitter Information Verification

Submitter Full Name: John Simmons
Organization: Florida East Coast JATC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 12:27:01 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The additional requirement proposed in PC 1458 is overly restrictive and not practical. Documenting terminations in equipment have been tightened to manufacturer’s requirements in accordance with the marked values on equipment is an increased awareness of what was already required under the installation and use requirements in 110.3(B). There was no substantiation provided to indicate there is a problem for enforcement if documented torque values are not provided.
110.16 Arc-Flash Hazard Warning.

(A) General.

Electrical equipment, such as switchboards, switchgear, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that is in other than dwelling units, and is likely to require examination, adjustment, servicing, or maintenance while energized, shall be field or factory marked to warn qualified persons of potential electric arc flash hazards. The marking shall meet the requirements in 110.21(B) and shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

(B) Service Equipment.

In addition to the requirements in (A), service equipment shall contain the following information:

(1) Nominal system voltage
(2) Arc flash boundary
(3) At least one of the following:
   (c) Available incident energy and the corresponding working distance
   (c) Minimum arc rating of clothing
   (c) Site-specific level of PPE

Informational Note No. 1: NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-1998, Product Safety Signs and Labels, provides guidelines for the design of safety signs and labels for application to products.

Statement of Problem and Substantiation for Public Comment

The Correlation Committee directs the panel to review the action taken on FR 55 and clarify the correct edition dates. Informational Note No. 1 references the 2012 edition of NFPA 70E; however, the Committee Statement indicates the revisions were made based on the 2015 edition. Informational Note No. 2 references the 1998 edition of ANSI Z535.4 but FR 43 references the 2011 edition.

Related Item

First Revision No. 55-NFPA 70-2015 [Section No. 110.16]

Statement

Committee Statement

Submitted by: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 14:45:53 EDT 2015

Committee Action: Rejected but see related SR
Resolution: SR-11-NFPA 70-2015
Statement: This Second Revision makes installation-related revisions and clarifications to FR55 as suggested in First Revision Public Input, First Revisions and ballot comments.

The addition of available fault current and clearing time has been added. This, like all revisions in this SR, does not represent new material. FR55 contained a requirement to label incident-energy which is based upon current and time.

Changing from incident energy to available fault current and clearing time simplifies the installation for the installer. In order to get an incident energy value both the available fault current and clearing time are determined and then a calculation is performed. It is simply the requirement to calculate incident energy with known values of current and time that is removed, thereby removing from the installer the requirement to calculate.
The label is permitted to be either field or factory applied.

Clarifying language has also been added to recognize that (B) only applies to “other than dwelling units.”

Language was added for the label to contain the date the label was applied.

An equipment rating was established to limit the installations in which this requirement would apply. FR55 would have applied at any equipment rating, including those below 1,200 amperes. The addition of the 1200-amp threshold is not new material as it does not increase the application of this requirement, it significantly reduces the number of installations in which it would apply.

Informational Note No. 3 was added to provide guidance on acceptable industry practices for developing arc-flash labels, incident energy levels, arc-flash boundaries, and minimum required levels of personal protective equipment and so forth.

Dates were edited to reflect current editions.
Public Comment No. 1058-NFPA 70-2015 [Section No. 110.16(B)]

(B) Service Equipment.
In addition to the requirements in (A), service equipment shall contain the following field or factory marked information:

1. Nominal system voltage
2. Arc flash boundary
3. At least one of the following:
   a. Available incident energy and the corresponding working distance
   b. Minimum arc rating of clothing
   c. Site-specific level of PPE

Informational Note No. 1: NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-1998, Product Safety Signs and Labels, provides guidelines for the design of safety signs and labels for application to products.

Statement of Problem and Substantiation for Public Comment

The marking requirement in 110.16(B) needs to be consistent with the marking requirement in 110.16(A). The current marking requirements for service equipment could be misunderstood to be only the manufacturer’s responsibility and should be clarified for appropriate enforcement.

Related Item
First Revision No. 55-NFPA 70-2015 [Section No. 110.16]

Submitter Information Verification
Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 13:22:07 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-11-NFPA 70-2015
Statement: This Second Revision makes installation-related revisions and clarifications to FR55 as suggested in First Revision Public Input, First Revisions and ballot comments.

The addition of available fault current and clearing time has been added. This, like all revisions in this SR, does not represent new material. FR55 contained a requirement to label incident-energy which is based upon current and time.

Changing from incident energy to available fault current and clearing time simplifies the installation for the installer. In order to get an incident energy value both the available fault current and clearing time are determined and then a calculation is performed. It is simply the requirement to calculate incident energy with known values of current and time that is removed, thereby removing from the installer the requirement to calculate.

The label is permitted to be either field or factory applied.

Clarifying language has also been added to recognize that (B) only applies to “other than dwelling units.”
Language was added for the label to contain the date the label was applied.

An equipment rating was established to limit the installations in which this requirement would apply. FR55 would have applied at any equipment rating, including those below 1,200 amperes. The addition of the 1200-amp threshold is not new material as it does not increase the application of this requirement, it significantly reduces the number of installations in which it would apply.

Informational Note No. 3 was added to provide guidance on acceptable industry practices for developing arc-flash labels, incident energy levels, arc-flash boundaries, and minimum required levels of personal protective equipment and so forth.

Dates were edited to reflect current editions.
Public Comment No. 1701-NFPA 70-2015 [Section No. 110.16(B)]

(B) Service Equipment.
In addition to the requirements in (A), service equipment shall contain the following information:

1. Nominal system voltage
2. Arc flash boundary
3. At least one of the following:
   4. Available incident energy and the corresponding working distance
   5. Minimum arc rating of clothing
   6. Site-specific level of PPE

Informational Note No. 1: NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-1998, Product Safety Signs and Labels, provides guidelines for the design of safety signs and labels for application to products.

Statement of Problem and Substantiation for Public Comment

Section 110.16 of the NEC is titled “Arc Flash Hazard Warning” so the information contained in this section should relate to a general warning for qualified persons. In previous NEC cycles, Code-Making-Panel 1 determined that the warning should remain general in nature and should not include information about how to protect against arc flash using Personal Protective Equipment (PPE). The NEC is an installation Code that provides information and requirements for electrical installations that essentially protect persons and property from hazards arising from use of electricity. The NEC should not include workplace safety requirements on how to protect against electric shock, arc-flash and arc-blast events that could occur when workers are performing energized work. The NEC does not have any of the information that is contained in NFPA 70E, including definitions for personal protective systems, for determining the arc flash energy of a completed electrical system.

If an electrical contractor’s work was only for the service and power to a disconnecting means for each piece of electrical equipment and was not involved in the actual electrical equipment connection, an arc fault calculation for the service and at each disconnect would not include motor contribution or overcurrent protection interruption values that ultimately may affect the amount of arcing energy available to determine the level of protection necessary for the service person. Would the electrical contractor who installed the electrical equipment be responsible for the arc energy calculation or the original electrical contractor? There also may be two clearing times, one at the service and one on the load side of service at the actual equipment on which the values on such a mark or label should be based, further complicating the proposed marking requirement. The values of energy provided on the arcing flash hazard label may not be accurate and may compromise worker safety. These proposed requirements appear to be beyond the NEC scope and should be provided only in NFPA 70E where all of the necessary information already resides. The owner of the facility is responsible for having the arc energy calculations done and for maintaining the accuracy and validity of these calculations and appropriate labels. The arc energy calculation and marking should not become an installation requirement in the NEC.

Related Item
First Revision No. 55-NFPA 70-2015 [Section No. 110.16]

Submitter Information Verification

Submitter Full Name: HOWARD HERNDON
Organization: SOUTHWEST ELECTRITECH SVCS LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:43:21 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: See SR 11. CMP-1 reaffirms the need to retain the concepts of 110.16(B). Based on the comments received, the panel has revised the text to address the concerns noted in these PCs.
Public Comment No. 266-NFPA 70-2015 [Section No. 110.16(B)]

(B) Service Equipment.

In addition to the requirements in (A), service equipment, in other than dwelling units, shall contain the following information:

The calculations for the information required by (B)(2) and (B)(3) shall be based on the available fault current and clearing time for the utility supply where there are exposed service conductors in the service equipment. Where there are no exposed service conductors, the calculations shall be permitted to be based on the available fault current on the load side of the service overcurrent protective device.

1. Nominal system voltage
2. Arc flash boundary
3. At least one of the following:
   - Available incident energy and the corresponding working distance
   - Minimum arc rating of clothing
   - Site-specific level of PPE

Informational Note No. 1: NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-1998, Product Safety Signs and Labels, provides guidelines for the design of safety signs and labels for application to products.

Statement of Problem and Substantiation for Public Comment

It is not clear if (B) applies to dwelling unit service equipment. Since (A) clearly does not apply to dwelling unit service equipment, I don’t see why (B) would apply to dwelling unit service equipment.

The basis for the arc flash and incident energy calculations are also not clear in the first draft language. It appears to me that where there are exposed service conductors or bus, that the calculations should be based on the utility fault current and clearing time. If an fault would occur on the line side of the service OCPD, the utility OCPD must clear that fault and the posted information should reflect that. Where there are no exposed service conductors within the service equipment a fault on the line side of the service OCPD is much less likely and the calculations should be permitted to be based on the available fault current and clearing time on the load side of the service OCPD.

I understand that this will require the calculation for service equipment with multiple service disconnects to be based on the utility available fault current and clearing time and that is the intent of this comment.

Related Item
Public Input No. 1491-NFPA 70-2014 [Section No. 110.16]

Submitter Information Verification

Submitter Full Name: DON GANIHERE
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 18 12:47:50 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-11-NFPA 70-2015
Statement: This Second Revision makes installation-related revisions and clarifications to FR55 as suggested in First Revision Public Input, First Revisions and ballot comments.

The addition of available fault current and clearing time has been added. This, like all revisions in this SR, does not represent new material. FR55 contained a requirement to label incident-energy which is based upon current and time.
Changing from incident energy to available fault current and clearing time simplifies the installation for the installer. In order to get an incident energy value both the available fault current and clearing time are determined and then a calculation is performed. It is simply the requirement to calculate incident energy with known values of current and time that is removed, thereby removing from the installer the requirement to calculate.

The label is permitted to be either field or factory applied.

Clarifying language has also been added to recognize that (B) only applies to “other than dwelling units.”

Language was added for the label to contain the date the label was applied.

An equipment rating was established to limit the installations in which this requirement would apply. FR55 would have applied at any equipment rating, including those below 1,200 amperes. The addition of the 1200-amp threshold is not new material as it does not increase the application of this requirement, it significantly reduces the number of installations in which it would apply.

Informational Note No. 3 was added to provide guidance on acceptable industry practices for developing arc-flash labels, incident energy levels, arc-flash boundaries, and minimum required levels of personal protective equipment and so forth.

Dates were edited to reflect current editions.
Public Comment No. 327-NFPA 70-2015 [Section No. 110.16(B)]

(B) Service Equipment.

In addition to the requirements in (A), service equipment shall contain the following information:

1. Nominal system voltage
2. Arc flash boundary
3. At least one of the following:
   a. Available incident energy and the corresponding working distance
   b. Minimum arc rating of clothing
   c. Site-specific level of PPE

(d) The incident energy and corresponding working distance will be calculated on the load side of the breaker.

Informational Note No. 1: NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-1998, Product Safety Signs and Labels, provides guidelines for the design of safety signs and labels for application to products.

Statement of Problem and Substantiation for Public Comment

The incident energy must be at the panel and not upstream to understand the electrical hazard. The new language in NFPA 70 2014 for the label and the information on it is GREAT! We just need to improve it a bit. THANK YOU.

Related Item
First Revision No. 1-NFPA 70-2015 [Section No. 90.2(A)]

Submitter Information Verification

Submitter Full Name: TERRANCE MCKINCH
Organization: SLIFCO ELECTRIC
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City:
State:
Zip:
Submittal Date: Fri Jul 31 08:07:44 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-11-NFPA 70-2015
Statement: This Second Revision makes installation-related revisions and clarifications to FR55 as suggested in First Revision Public Input, First Revisions and ballot comments.

The addition of available fault current and clearing time has been added. This, like all revisions in this SR, does not represent new material. FR55 contained a requirement to label incident-energy which is based upon current and time.

Changing from incident energy to available fault current and clearing time simplifies the installation for the installer. In order to get an incident energy value both the available fault current and clearing time are determined and then a calculation is performed. It is simply the requirement to calculate incident energy with known values of current and time that is removed, thereby removing from the installer the requirement to calculate.

The label is permitted to be either field or factory applied.
Clarifying language has also been added to recognize that (B) only applies to “other than dwelling units.”

Language was added for the label to contain the date the label was applied.

An equipment rating was established to limit the installations in which this requirement would apply. FR55 would have applied at any equipment rating, including those below 1,200 amperes. The addition of the 1200-amp threshold is not new material as it does not increase the application of this requirement, it significantly reduces the number of installations in which it would apply.

Informational Note No. 3 was added to provide guidance on acceptable industry practices for developing arc-flash labels, incident energy levels, arc-flash boundaries, and minimum required levels of personal protective equipment and so forth.

Dates were edited to reflect current editions.
Delete the newly added section below.

(B) Service Equipment.

In addition to the requirements in (A), service equipment shall contain the following information:

1. Nominal system voltage
2. Arc flash boundary
3. At least one of the following:
   - Available incident energy and the corresponding working distance
   - Minimum arc rating of clothing
   - Site-specific level of PPE

Informational Note No. 1: NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-1998, Product Safety Signs and Labels, provides guidelines for the design of safety signs and labels for application to products.

Statement of Problem and Substantiation for Public Comment

In my opinion, this is a maintenance issue and not a minimum design standard. This requirement is already covered in NFPA 70E. I understand the intent of this change, but I am concerned this change will create a hazardous situation. In an industrial setting, where all details are known, this is a good requirement. However, on smaller commercial projects this requirement could create a situation where inaccurate data is given to a maintenance electrician. Having this requirement in NFPA 70 will require electrical engineers to supply this information on the initial design of the project. I have two concerns with that approach.

1. On these small projects, changes are often made in the field that are not submitted back to the engineer for approval. A change as simple as adding an additional power pole to move the transformer bank closer to the service will make all original data inaccurate.

2. Some utility companies are now only giving worse case available fault current data based on an infinite bus. Worst case data is given to resolve the utility of any liability of future upgrades to the power system. While this seems to err on the safe side for available fault current, it will often provide lower than actual incident energy levels due to the predicted quick tripping of protection devices because of the falsely high fault current. Actual fault current levels will often require much more time to clear and thus increase the incident energy levels.

As a professional engineer, the only way I see to comply with this on most small commercial projects will be to list the incident energy level as above 40 cals/cm2 so the equipment cannot be worked on energized.

Related Item

Public Input No. 551-NFPA 70-2014 [Section No. 110.16]

Submitter Information Verification

Submitter Full Name: Andy Sherrill
Organization: Sherrill Electrical
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Aug 03 10:01:18 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: See SR 11. CMP-1 reaffirms the need to retain the concepts of 110.16(B). Based on the comments received, the panel has revised the text to address the concerns noted in these PCs.
Public Comment No. 356-NFPA 70-2015 [Section No. 110.16(B)]

(B) Service Equipment.
In addition to the requirements in (A), for other than dwelling units, service equipment shall contain the following information:

1. Nominal system voltage
2. Arc flash boundary
3. At least one of the following:
   - Available incident energy and the corresponding working distance
   - Minimum arc rating of clothing
   - Site-specific level of PPE

Informational Note No. 1: NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-1998, Product Safety Signs and Labels, provides guidelines for the design of safety signs and labels for application to products.

Statement of Problem and Substantiation for Public Comment

Adding the text ‘for other than dwelling units’ to (B), the reader will be better prepared to implement the requirements.

Related Item
First Revision No. 55-NFPA 70-2015 [Section No. 110.16]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 14:30:04 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-11-NFPA 70-2015
Statement: This Second Revision makes installation-related revisions and clarifications to FR55 as suggested in First Revision Public Input, First Revisions and ballot comments.

The addition of available fault current and clearing time has been added. This, like all revisions in this SR, does not represent new material. FR55 contained a requirement to label incident-energy which is based upon current and time.

Changing from incident energy to available fault current and clearing time simplifies the installation for the installer. In order to get an incident energy value both the available fault current and clearing time are determined and then a calculation is performed. It is simply the requirement to calculate incident energy with known values of current and time that is removed, thereby removing from the installer the requirement to calculate.

The label is permitted to be either field or factory applied.

Clarifying language has also been added to recognize that (B) only applies to “other than dwelling units.”
Language was added for the label to contain the date the label was applied.

An equipment rating was established to limit the installations in which this requirement would apply. FR55 would have applied at any equipment rating, including those below 1,200 amperes. The addition of the 1200-amp threshold is not new material as it does not increase the application of this requirement, it significantly reduces the number of installations in which it would apply.

Informational Note No. 3 was added to provide guidance on acceptable industry practices for developing arc-flash labels, incident energy levels, arc-flash boundaries, and minimum required levels of personal protective equipment and so forth.

Dates were edited to reflect current editions.
(B). Service Equipment.

In addition to the requirements in (A), service equipment shall contain the following information:

1. Nominal system voltage
2. Arc flash boundary
3. At least one of the following:
   4. Available incident energy and the corresponding working distance
   5. Minimum arc rating of clothing
   6. Site-specific level of PPE

Informational Note No. 1: NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-1998, Product Safety Signs and Labels, provides guidelines for the design of safety signs and labels for application to products.

Statement of Problem and Substantiation for Public Comment

IEC’s position is to delete FR 55.

IEC believes in safe work practices and environments for employees and understands the provisions provided in NFPA 70 E are a requirement for employers to follow. The added label requirements in FR 55 are already addressed in 70 E that places the responsibility on the owner including a date to warn workers when the label was created. The proposed revision is not consistent with 70 E and would create confusion for installers and inspectors and may compromise worker safety. IEC is concerned about the liability that may be associated with these added label requirements.

Related Item

First Revision No. 55-NFPA 70-2015 [Section No. 110.16]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 19 12:59:27 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: See SR 11. CMP-1 reaffirms the need to retain the concepts of 110.16(B). Based on the comments received, the panel has revised the text to address the concerns noted in these PCs.
Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]

(B) Service Equipment.
In addition to the requirements in (A), service equipment shall contain the following information:

1. Nominal system voltage
2. Arc flash boundary
3. At least one of the following:
   (c) Available incident energy and the corresponding working distance
   (c) Minimum arc rating of clothing
   (c) Site-specific level of PPE

Informational Note No. 1: NFPA 70E-2015, Standard for Electrical Safety in the Workplace, provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-1998, Product Safety Signs and Labels, provides guidelines for the design of safety signs and labels for application to products.

Statement of Problem and Substantiation for Public Comment

Referenced updated editions of NFPA 70E and ANSI Z535.4.

Related Public Comments for This Document

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<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
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<td>Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
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<td>Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-11-NFPA 70-2015

Statement: This Second Revision makes installation-related revisions and clarifications to FR55 as suggested in First Revision Public Input, First Revisions and ballot comments.

The addition of available fault current and clearing time has been added. This, like all revisions in this SR, does not represent new material. FR55 contained a requirement to label incident-energy which is based upon current and time.

Changing from incident energy to available fault current and clearing time simplifies the installation for the installer. In order to get an incident energy value both the available fault current and clearing time are determined and then a calculation is performed. It is simply the requirement to calculate incident energy with known values of current and time that is removed, thereby removing from the installer the requirement to calculate.

The label is permitted to be either field or factory applied.

Clarifying language has also been added to recognize that (B) only applies to “other than dwelling units.”

Language was added for the label to contain the date the label was applied.

An equipment rating was established to limit the installations in which this requirement would apply. FR55 would have applied at any equipment rating, including those below 1,200 amperes. The addition of the 1200-amp threshold is not new material as it does not increase the application of this requirement, it significantly reduces the number of installations in which it would apply.

Informational Note No. 3 was added to provide guidance on acceptable industry practices for developing arc-flash labels, incident energy levels, arc-flash boundaries, and minimum required levels of personal protective equipment and so forth.

Dates were edited to reflect current editions.
(B) - Service Equipment.
In addition to the requirements in (A), service equipment shall contain the following information:

(1) Nominal system voltage
(2) Arc flash boundary
(3) At least one of the following:
   (4) Available incident energy and the corresponding working distance
   (5) Minimum arc rating of clothing
   (6) Site-specific level of PPE

Informational Note No. 1: NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides guidance, such as determining severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

Informational Note No. 2: ANSI Z535.4-1998, Product Safety Signs and Labels, provides guidelines for the design of safety signs and labels for application to products.

Statement of Problem and Substantiation for Public Comment
NECA stands in opposition to First Revision 55 that expands the label requirements in 110.16. Public Inputs (551, 493, 4789, 4626, 3973, and 1491) should have been resolved. NECA is mindful of the obligations to provide safe work environments for employees and understands requirements contained within both NFPA 70 National Electrical Code and NFPA 70E Standard for Electrical Safety in the Workplace. Section 110.16 of the NEC is titled “Arc Flash Hazard Warning.” The information contained in this section should continue to relate to a generic warning for qualified persons. As resolved by NEC CMP-1 in previous NEC development cycles, the warning should remain general in nature and should not include information about “how to” protect using PPE, because this section is not about “how to protect.” The NEC is an installation Code that provides information and requirements for electrical installations that essentially protect persons and property from hazards arising from “use of electricity.” It should not include workplace safety requirements related to how to protect against electric shock, arc-flash and arc-blast events that could occur when workers are performing energized work, justified or not justified. The label requirements proposed in FD 55 are currently addressed in NFPA 70E, as they should be. The proposed NEC revision would be inconsistent with the requirements in 70E and would introduce confusion for installers and inspectors, and would not be practical or enforceable. Many inspectors would not fully understand the information on such labels and whether the information was accurate, and be expected to approve it. It also creates problems for manufacturers that current provide generic arc-flash hazard-warning labels at the factory, which is current provision in this section. The responsibility for this type of marking detail rests with owners, as indicated in NFPA 70E. With no date and time included in the proposed marking, there are serious concerns about the validity and accuracy of such information after the service equipment is initially marked. Another problem is that there are two clearing times (lines side of service OCPD and load side of service OCPD) upon which the values on such a mark or label should be based, further complicating the proposed marking requirement. NECA is also concerned that a false sense of security that might be created, and that the values of energy provided on such marks would not be accurate and compromise worker and owner safety. NECA believes these proposed requirements are inappropriate in the NEC and should be provided only in NFPA 70E. It is important to realize that according to 70E, the owners have the responsibility to maintain the label information accuracy and validity, which presents a whole variety of problems and concerns, given how much attention owners typically do not provide to equipment maintenance issues, which would include maintaining the accurate information on these labels. NECA continues to emphasize that compliance with NFPA 70E is a requirement, not an option.

Related Item
First Revision No. 55-NFPA 70-2015 [Section No. 110.16]

Submitter Information Verification
Submitter Full Name: Michael Johnston
Organization: National Electrical Contractor
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 13:50:20 EDT 2015
<table>
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Statement of Problem and Substantiation for Public Comment

This proposed revision includes a requirement that the label contain the date of application as correctly pointed out by multiple CMP-1 members in their affirmative comments. Additionally text is added to ensure that the label is permanent and suitable for the environment in which it is applied. Further clarity is provided by adding prescriptive text that the label is based upon the load side of the service overcurrent device.

There has been much discussion as to whether such a requirement is an installation requirement or a work practices issue. This issue was discussed by the NEC Correlating Committee at length after the First Draft meeting and the overwhelming decision was that this requirement belongs in the NEC and not NFPA 70E.

NFPA 70E is not adopted by OSHA, states, cities or municipalities. NFPA 70E is a standard, not a code. Standards are designed to be adopted into other codes or regulations. In the Foreword to NFPA 70E it is clearly stated that 70E is designed to assist OSHA. It is imperative to understand that OSHA does not require this type of label. Only where the equipment owner is proactive and decides to label does this occur. If labeling were an OSHA requirement there would be no need for FR 55. Employers must follow federal/state requirements and legally adopted codes for electrical installations and "none" require labeling. This revision will now require that at a minimum, the service equipment will be labeled.

NFPA 70E is not a requirement. OSHA is the "shall" and NFPA 70E shows the employer "how." This new requirement will be mandatory.

The NEC Correlating Committee reviewed the history of this issue in the NEC and overwhelmingly decided that this requirement is within the purview of the NEC. FR 55 is not new to the NEC process. If the NEC Correlating Committee had determined that this requirement was outside of the scope of the NEC, we would have some serious deleting to do. There are countless installation requirements that exist solely for the safety of persons that will examine, adjust, service, or maintain electrical equipment while energized. These requirements include but are not limited to: current arc flash warning labels, workspace clearances, arc energy reduction requirements, disconnects within sight of equipment and equipment labeling requirements. None of these requirements are necessary for safe installation and operation but all are critically important for the safety of persons that will examine, adjust, service, or maintain electrical equipment while energized.

A precedent is set, this issue has repeatedly been in the NEC revision process without any comment from the NEC Correlating Committee including this revision cycle. See proposal 1-235 in the 2001 ROP. This proposal added a similar requirement to that seen in FR 55. The NEC Correlating Committee agreed that this issue was appropriate and within the scope of the NEC. In fact the Correlating Committee added a note to change the word "residential" to "dwelling!" This is one of many such examples.

Related Item
First Revision No. 55-NFPA 70-2015 [Section No. 110.16]

Submitter Information Verification

Submitter Full Name: James Dollard
Organization: IBEW Local Union 98
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 14:49:27 EDT 2015
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-11-NFPA 70-2015
Statement: This Second Revision makes installation-related revisions and clarifications to FR55 as suggested in First Revision Public Input, First Revisions and ballot comments.

The addition of available fault current and clearing time has been added. This, like all revisions in this SR, does not represent new material. FR55 contained a requirement to label incident-energy which is based upon current and time.

Changing from incident energy to available fault current and clearing time simplifies the installation for the installer. In order to get an incident energy value both the available fault current and clearing time are determined and then a calculation is performed. It is simply the requirement to calculate incident energy with known values of current and time that is removed, thereby removing from the installer the requirement to calculate.

The label is permitted to be either field or factory applied.

Clarifying language has also been added to recognize that (B) only applies to “other than dwelling units.”

Language was added for the label to contain the date the label was applied.

An equipment rating was established to limit the installations in which this requirement would apply. FR55 would have applied at any equipment rating, including those below 1,200 amperes. The addition of the 1200-amp threshold is not new material as it does not increase the application of this requirement, it significantly reduces the number of installations in which it would apply.

Informational Note No. 3 was added to provide guidance on acceptable industry practices for developing arc-flash labels, incident energy levels, arc-flash boundaries, and minimum required levels of personal protective equipment and so forth.

Dates were edited to reflect current editions.
Public Comment No. 1540-NFPA 70-2015 [Section No. 110.21]

110.21 Marking.
   (A) Equipment Markings.
   (1) The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this Code. The marking or label shall be of sufficient durability to withstand the environment involved.
   (2) Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning. Informational Note: Industry standards are available for application of reconditioned and refurbished equipment.

B) Field-Applied Hazard Markings.
   Where caution, warning, or danger signs or labels are required by this Code, the labels shall meet the following requirements:
   (1) The marking shall warn of the hazards using effective words, colors, symbols, or any combination thereof. Informational Note: ANSI Z535.4-2011, Product Safety Signs and Labels, provides guidelines for suitable font sizes, words, colors, symbols, and location requirements for labels.
   (2) The label shall be permanently affixed to the equipment or wiring method and shall not be hand written. Exception to (2): Portions of labels or markings that are variable, or that could be subject to changes, shall be permitted to be hand written and shall be legible.
   (3) The label shall be of sufficient durability to withstand the environment involved. Informational Note: ANSI Z535.4-2011, Product Safety Signs and Labels, provides guidelines for the design and durability of safety signs and labels for application to electrical equipment.

Statement of Problem and Substantiation for Public Comment

The addition of marking requirements for refurbished or remanufactured equipment should not have been accepted. It appears the primary intent of this change is to provide traceability of refurbished or remanufactured equipment resold by 3rd parties and used to replace existing equipment. Providing company name and trademark labels on equipment that is regularly maintained and/or refurbished by the owner/operator as part of a regular equipment maintenance program does not enhance the traceability of the work, nor does it necessarily improve the safety of the installation, which is the purpose of the NEC.

Related Item
First Revision No. 42-NFPA 70-2015 [Section No. 110.21(A)]

Submitter Information Verification

Submitter Full Name: Louis Barrios
Organization: Shell Global Solutions
Affiliation: American Chemistry Council
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:56:48 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: See SR 9. CMP-1 reaffirms its position on FR 42 that incorporation of language the more specifically clarifies that the term equipment refers to all equipment including new or other types.
The manufacturer’s name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this Code. The marking or label shall be of sufficient durability to withstand the environment involved.

Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning. Informational Note: Industry standards are available for application of reconditioned and refurbished equipment. Exception: In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.21(A)(2) are not required.

Field-Applied Hazard Markings

Where caution, warning, or danger signs or labels are required by this Code, the labels shall meet the following requirements:

1. The marking shall warn of the hazards using effective words, colors, symbols, or any combination thereof. Informational Note: ANSI Z535.4-2011, Product Safety Signs and Labels, provides guidelines for suitable font sizes, words, colors, symbols, and location requirements for labels.

2. The label shall be permanently affixed to the equipment or wiring method and shall not be hand written. Exception to (2): Portions of labels or markings that are variable, or that could be subject to changes, shall be permitted to be hand written and shall be legible.

3. The label shall be of sufficient durability to withstand the environment involved. Informational Note: ANSI Z535.4-2011, Product Safety Signs and Labels, provides guidelines for the design and durability of safety signs and labels for application to electrical equipment.

Statement of Problem and Substantiation for Public Comment

Note: the only change proposed is a new exception to 110.21(A)(2). It appears the primary intent of this change is to provide traceability of refurbished or remanufactured equipment resold by 3rd parties and used to replace existing equipment. Industrial facilities regularly maintain and refurbish equipment as part of a regular maintenance cycle for safety and reliability. Providing company name and trademark labels on equipment that is regularly maintained and/or refurbished by the owner/operator as part of a regular equipment maintenance program does not enhance the traceability of the work or improve the safety of the installation.

Related Item
First Revision No. 42-NFPA 70-2015 [Section No. 110.21(A)]

Submitter Information Verification

Submitter Full Name: Louis Barrios
Organization: Shell Global Solutions
Affiliation: American Chemistry Council
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:04:05 EDT 2015

Committee Statement

Committee Rejected but see related SR
SR-9 incorporates suggestions from PCs 582, 707 and 1550.

This provides additional guidance for reconditioned equipment. When a listed product is reconditioned (such as being rebuilt, refurbished or remanufactured) after it leaves a factory where the listing mark was applied, the organization responsible for the testing and inspection (as detailed in NEC Section 90.7) does not know if the product continues to meet the applicable certification requirements unless the reconditioning has been specifically evaluated by an organization properly equipped and qualified for making such determinations. Therefore, the AHJ should not rely solely on the equipment's original listing mark as the basis of approval of the "reconditioned equipment."

Industrial facilities may regularly maintain and refurbish equipment as part of a regular maintenance cycle for safety and reliability. Providing company name and trademark labels on equipment that is regularly maintained and/or refurbished by the owner/operator as part of a regular equipment maintenance program does not enhance the traceability of the work or improve the safety of the installation.

The language is added in the informational note to make it clear that normal service work such as replacing a fuse, circuit breaker or other routine work is generally not considered refurbishing or reconditioning of equipment.
Public Comment No. 582-NFPA 70-2015 [Section No. 110.21(A)(2)]

(2) Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning. Reconditioned equipment shall be identified as “reconditioned” and shall be acceptable only if approved. Approval of the reconditioned equipment shall not be based solely on the equipment’s original listing.

Informational Note: Industry standards are available for application of reconditioned and refurbished equipment.

Products which are listed when originally manufactured may be labeled with the label, symbol, or other identifying mark of the organization that performed the examination of the equipment as it was originally manufactured. One method for approval of reconditioned equipment is for the reconditioned equipment to be examined and relabeled by an organization that conforms to the requirements of Section 90.7.

Statement of Problem and Substantiation for Public Comment

This public comment provides additional guidance needed to evaluate reconditioned equipment. Text is proposed for the new 110.21(A)(2) that would follow the enforcement requirements in 110.2.

The Information Note is revised to remove the reference to unspecified Standards, and to include an explanation that the AHJ can use the same approval process that is customary for “listed and labeled” equipment.

As “reconditioned equipment” is introduced into this Code Section, it is important to note that the listing mark is a manufacturer’s declaration that a product was manufactured in accordance with the applicable listing requirements, and was in compliance with those requirements when it was shipped from the factory. When a listed product is reconditioned (or rebuilt, refurbished or remanufactured) after it leaves a factory where the listing mark was applied, the organization responsible for the testing and inspection (as detailed in NEC Section 90.7) does not know if the product continues to meet the applicable certification requirements unless the reconditioning has been specifically evaluated by an organization properly equipped and qualified for making such determinations. Therefore, the AHJ should not rely solely on the equipment’s original listing mark as the bases of approval of the “reconditioned equipment.”

AHJs are responsible for assessing the acceptability of any reconditioned equipment and may choose to rely on a “Rebuilt,” “Refurbished” or “Remanufactured” listing promulgated by organizations properly equipped and qualified, as described in NEC Section 90.7, as a basis for approval.

Related Item
First Revision No. 42-NFPA 70-2015 [Section No. 110.21(A)]

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 15:14:37 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-9-NFPA 70-2015
Statement: SR 9 incorporates suggestions from PCs 582, 707 and 1550.

This provides additional guidance for reconditioned equipment. When a listed product is reconditioned (such as being rebuilt, refurbished or remanufactured) after it leaves a factory where the listing mark was applied, the organization responsible for the testing and inspection (as detailed in NEC Section 90.7) does not know if the product continues to meet the applicable certification requirements unless the reconditioning has been specifically evaluated by an organization properly equipped and qualified for making such determinations. Therefore, the AHJ should not rely solely on the equipment’s original listing mark as the basis of approval of the “reconditioned equipment.”
Industrial facilities may regularly maintain and refurbish equipment as part of a regular maintenance cycle for safety and reliability. Providing company name and trademark labels on equipment that is regularly maintained and/or refurbished by the owner/operator as part of a regular equipment maintenance program does not enhance the traceability of the work or improve the safety of the installation.

The language is added in the informational note to make it clear that normal service work such as replacing a fuse, circuit breaker or other routine work is generally not considered refurbishing or reconditioning of equipment.
Public Comment No. 707-NFPA 70-2015 [Section No. 110.21(A)(2)]

(2) Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning.

   Informational Note: Industry standards are available for application of reconditioned and refurbished equipment. Normal servicing of equipment that remains within a facility is not considered to be reconditioned or refurbished.

Statement of Problem and Substantiation for Public Comment

A concern was expressed in the Public Input stage that the new language might be misinterpreted to apply to normal service work like replacing a fuse, circuit breaker or other routine work. The suggested language is added to make it clear that this type of work is not considered refurbishing or reconditioning of equipment.

Related Item
First Revision No. 42-NFPA 70-2015 [Section No. 110.21(A)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 17 19:00:11 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-9-NFPA 70-2015
Statement: SR 9 incorporates suggestions from PCs 582, 707 and 1550.

This provides additional guidance for reconditioned equipment. When a listed product is reconditioned (such as being rebuilt, refurbished or remanufactured) after it leaves a factory where the listing mark was applied, the organization responsible for the testing and inspection (as detailed in NEC Section 90.7) does not know if the product continues to meet the applicable certification requirements unless the reconditioning has been specifically evaluated by an organization properly equipped and qualified for making such determinations. Therefore, the AHJ should not rely solely on the equipment’s original listing mark as the basis of approval of the “reconditioned equipment.”

Industrial facilities may regularly maintain and refurbish equipment as part of a regular maintenance cycle for safety and reliability. Providing company name and trademark labels on equipment that is regularly maintained and/or refurbished by the owner/operator as part of a regular equipment maintenance program does not enhance the traceability of the work or improve the safety of the installation.

The language is added in the informational note to make it clear that normal service work such as replacing a fuse, circuit breaker or other routine work is generally not considered refurbishing or reconditioning of equipment.
Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning. Reconditioning of the equipment shall be in accordance with the original equipment manufacturer's listing.

Informational Note: Industry standards are available for application of reconditioned and refurbished equipment.

Statement of Problem and Substantiation for Public Comment

IEC's position is to add the last sentence to 110.21(A)(2) to ensure the equipment has retained the original listing after reconditioning.

Related Item
First Revision No. 42-NFPA 70-2015 [Section No. 110.21(A)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 19 13:11:32 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CMP-1 reaffirms its position on FR 42 that incorporation of language the more specifically clarifies that the term equipment refers to all equipment including new or other types. The authority having jurisdiction has approval responsibilities and this language addresses reconditioned equipment and provides a more generalized requirement that AHJs can use as basis for approval. CMP-1 recognizes that the approval processes and means of issuing approvals vary. This language introduced allows the AHJ to accept any method without restriction to one. See SR 9 for further information.
Public Comment No. 1748-NFPA 70-2015 [Section No. 110.24]

110.24 Available Fault Current.

(A) Field Marking.

Service equipment at other than dwelling units shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault-current calculation was performed and be of sufficient durability to withstand the environment involved. The calculation shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Informational Note: The available fault-current marking(s) addressed in 110.24 is related to required short-circuit current ratings of equipment. NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment.

(B) Modifications.

When modifications to the electrical installation occur that affect the maximum available fault current at the service, the maximum available fault current shall be verified or recalculated as necessary to ensure the service equipment ratings are sufficient for the maximum available fault current at the line terminals of the equipment. The required field marking(s) in 110.24(A) shall be adjusted to reflect the new level of maximum available fault current.

Exception: The field marking requirements in 110.24(A) and 110.24(B) shall not be required in industrial installations where conditions of maintenance and supervision ensure that only qualified persons service the equipment.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that CMP-1 review its action and verify the correct edition date shown for NFPA 70E in the Informational Note.

Related Item

First Revision No. 45-NFPA 70-2015 [Section No. 110.24(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip: Submittal Date: Mon Sep 28 14:46:52 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-10-NFPA 70-2015
Statement: CMP-1 changed the word "and" to "or" to indicate that the calculation should be available to staff that do any of the identified actions. The date for 70E was changed to reflect the current edition.
Public Comment No. 496-NFPA 70-2015 [Section No. 110.24(A)]

(A) Field Marking.

Service equipment at other than dwelling units shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault-current calculation was performed and be of sufficient durability to withstand the environment involved. The calculation shall be documented and made available to those authorized to design, install, inspect, maintain, and/or operate the system.

Informational Note: The available fault-current marking(s) addressed in 110.24 is related to required short-circuit current ratings of equipment. NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment.

Statement of Problem and Substantiation for Public Comment

The word "and" would require that the information be available only to an entity that performs all the functions where "or" will require that the documentation be provided to each of the entities.

Related Item

First Revision No. 45-NFPA 70-2015 [Section No. 110.24(A)]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 02 16:17:33 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-10-NFPA 70-2015
Statement: CMP-1 changed the word "and" to "or" to indicate that the calculation should be available to staff that do any of the identified actions. The date for 70E was changed to reflect the current edition.
Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]

(A) Field Marking.

Service equipment at other than dwelling units shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault-current calculation was performed and be of sufficient durability to withstand the environment involved. The calculation shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Informational Note: The available fault-current marking(s) addressed in 110.24 is related to required short-circuit current ratings of equipment. NFPA 70E-2012 2015, Standard for Electrical Safety in the Workplace, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment.

Statement of Problem and Substantiation for Public Comment

Updated NFPA 70E edition.

Related Public Comments for This Document

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<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
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<td>Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]</td>
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<td>Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 95-NFPA 70-2015 [Section No. 620.1]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack]
Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]
Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]
Public Comment No. 111-NFPA 70-2015 [Section No. 505.2]
Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]
Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]

Related Item
First Revision No. 45-NFPA 70-2015 [Section No. 110.24(A)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Jun 28 15:35:57 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-10-NFPA 70-2015
Statement: CMP-1 changed the word "and" to "or" to indicate that the calculation should be available to staff that do any of the identified actions. The date for 70E was changed to reflect the current edition.
Public Comment No. 708-NFPA 70-2015 [Section No. 110.26(A)(4)]

(4) Limited Access.

Where equipment operating at 1000 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized is required by installation instructions or function to be located in a space with limited access, all of the following shall apply:

(a) Where equipment is installed above a lay-in ceiling, there shall be an opening not smaller than 559 mm × 559 mm (22 in. × 22 in.), or in a crawl space, there shall be an accessible opening not smaller than 559 mm × 762 mm (22 in. × 30 in.).

(b) The width of the working space shall be the width of the equipment enclosure or a minimum of 762 mm (30 in.), whichever is greater.

(c) All enclosure doors or hinged panels shall be capable of opening a minimum of 90 degrees.

(d) The space in front of the enclosure shall comply with the depth requirements of Table 110.26(A)(1). The maximum height of the working space shall be the height necessary to install the equipment in the limited space. A horizontal ceiling structural member or access panel shall be permitted in this space.

Statement of Problem and Substantiation for Public Comment

The language in the first revision does not indicate why such equipment would be in a space with limited access that does not comply with other Code requirements for adequate working space. The added wording is intended to clarify that the equipment is required to be installed in an area with limited access in order to serve the function for which it is intended or to comply with manufacturer's installation instructions.

Related Item

First Revision No. 18-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 17 19:05:58 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-12-NFPA 70-2015
Statement: The language in the first revision does not indicate why such equipment would be in a space with limited access that does not comply with other Code requirements for adequate working space. The added wording is intended to clarify that the equipment is required to be installed in an area with limited access in order to serve the function for which it is intended or to comply with manufacturer's installation instructions.
Public Comment No. 1568-NFPA 70-2015 [Section No. 110.26(B)]

(B) Clear Spaces.

Working space required by this section shall not be used for storage. When normally enclosed live parts are exposed for inspection or servicing, the working space, if in a passageway or general open space, shall be suitably guarded. Permanent and conspicuous signs shall be provided. The sign shall meet the requirements in 110.21(B) and shall read as follows:

NOTICE
ELECTRICAL EQUIPMENT WORKING SPACE AND
EGRESS AREA — NO OBSTRUCTION OR STORAGE ALLOWED

Statement of Problem and Substantiation for Public Comment

FR-17 should not have been accepted. Additional signage has not been shown to solve the stated problem.

Related Item
First Revision No. 17-NFPA 70-2015 [Section No. 110.26(B)]

Submitter Information Verification

Submitter Full Name: Louis Barrios
Organization: Shell Global Solutions
Affiliation: American Chemistry Council
Street Address:
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 14:24:51 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: The requirement in the First Draft for signage to be installed in locations that are dedicated to clear space working areas has not been shown to be an effective means of ensuring compliance with the Section. The code does not prohibit the installation of signage at the building owner’s option. It is essential that the requirement for clear space remain in the Code.
Public Comment No. 768-NFPA 70-2015 [Section No. 110.26(B)]

(B) Clear Spaces.

Working space required by this section shall not be used for storage. When normally enclosed live parts are exposed for inspection or servicing, the working space, if in a passageway or general open space, shall be suitably guarded. Permanent and conspicuous signs shall be provided. The sign shall meet the requirements in 110.21(B) and shall read as follows:

NOTICE

ELECTRICAL EQUIPMENT WORKING SPACE AND EGRESS AREA — NO OBSTRUCTION OR STORAGE ALLOWED

Statement of Problem and Substantiation for Public Comment

IEC's position is to delete FR 17.

The code is clear that the working space shall not be used for storage. IEC does not believe adding another sign requirement will solve this issue.

Related Item

First Revision No. 17-NFPA 70-2015 [Section No. 110.26(B)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 19 13:23:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: The requirement in the First Draft for signage to be installed in locations that are dedicated to clear space working areas has not been shown to be an effective means of ensuring compliance with the Section. The code does not prohibit the installation of signage at the building owner’s option. It is essential that the requirement for clear space remain in the Code.
(2) Large Equipment.
For equipment rated 1200 amperes or more and over 1.8 m (6 ft) wide that contains overcurrent devices, switching devices, or control devices, there shall be one entrance to and egress from the required working space not less than 610 mm (24 in.) wide and 2.0 m (6 1/2 ft) high at each end of the working space.

A single entrance to and egress from the required working space shall be permitted where either of the conditions in 110.26(C) (2)(a) or (C)(2)(b) is met.

(a) Unobstructed Egress. Where the location permits a continuous and unobstructed way of egress travel, a single entrance to the working space shall be permitted.

(b) Extra Working Space. Where the depth of the working space is twice that required by 110.26(A)(1), a single entrance shall be permitted. It shall be located such that the distance from the equipment to the nearest edge of the entrance is not less than the minimum clear distance specified in Table 110.26(A)(1) for equipment operating at that voltage and in that condition.

For new installations (with the exception of vaults), the primary and secondary egress paths from the space may not include a ladder or other obstruction that impedes access to medical attention. For existing installations, the "second" means of egress from the space, may include a ladder as long as there is a safe landing outside the space where the person may be accessed by medical personnel. The primary means of egress from the space shall be unobstructed for existing installations.

Statement of Problem and Substantiation for Public Comment

The code is not clear whether or not a ladder may be used in the egress path. NFPA 101, Section 40 and Section 7 appear to allow a "fire ladder" in the egress components for an industrial occupancy. Fundamentally, if we're requiring listed panic hardware on the doors so an injured person may escape from the hazard, it seems that we would also want the person to have an unobstructed exit path to seek medical attention. This public input is an attempt to clarify that and make it clear that for new installations, that is the intent. This is not intended to require existing installation to make costly retrofits if they have an unobstructed "primary" means of egress. If both entrances involve the use of a ladder, however, this language would require retrofit of existing installations. The panel stated in response to Public Input 2367 that "The panel recognizes that ladders may be required for entering and exiting locations such as vaults". This response does not clarify the code's intent, here, and in my opinion the code should not remain silent on whether a ladder may be used. Fundamentally, if we're requiring "listed panic hardware", we should make it clear whether or not the panel intends one entrance to have stairs, or both entrances to have stairs as opposed to allowing potentially both entrances to have ladders, thus delaying medical attention if required.

Related Item
Public Input No. 2367-NFPA 70-2014 [Section No. 110.26(C)(2)]

Submitter Information Verification

Submitter Full Name: Richard Holub
Organization: The DuPont Company, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:24:17 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: CMP-1 maintains its position with regard to ladders and egress path. Building codes and OSHA regulations address egress paths.
Outdoor. Outdoor installations shall comply with 110.26(E)(2)(a) through (c).

(a) Installation Requirements. Outdoor electrical equipment shall be the following:

(2) Installed

(b) in suitable

(1) in identified enclosures
(2) Protected from accidental contact by unauthorized personnel, or by vehicular traffic
(3) Protected from accidental spillage or leakage from piping systems

(c) Work Space. The working clearance space shall include the zone described in 110.26(A). No architectural appurtenance or other equipment shall be located in this zone.

   Exception to (b): Structural overhangs or roof extensions shall be permitted in this zone.

(d) Dedicated Equipment Space. The space equal to the width and depth of the equipment, and extending from grade to a height of 1.8 m (6 ft) above the equipment, shall be dedicated to the electrical installation. No piping or other equipment foreign to the electrical installation shall be located in this zone.

Statement of Problem and Substantiation for Public Comment

The term suitable is listed in the 2011 NEC Manual of Style as a term which is vague and possibly unenforceable. The term identified in Article 100 as "Recognizable as suitable for the specific purpose, function, use, environment, application, and so forth, where described in a particular Code requirement." By making this proposed change, the requirement eliminates the vague and possibly unenforceable term and replaces it with a term that does not change requirement but is enforceable.

Related Item

First Revision No. 20-NFPA 70-2015 [Section No. 110.26(E)(2)]

Submitter Information Verification

Submitter Full Name: John Simmons
Organization: Florida East Coast JATC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 12:48:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-14-NFPA 70-2015
Statement: The vague and possibly unenforceable term “suitable” is replaced with the defined and enforceable term “identified” to comply with the NEC Style Manual and to add consistency throughout the code. Outdoor use enclosures are tested for exclusion of rain, and are inherently protected against accidental spillage or leakage from piping systems. Exclusion of architectural appurtenances is covered in the Exception.
(2) Outdoor.
Outdoor installations shall comply with 110.26(E)(2)(a) through (c).

   (a) **Installation Requirements.** Outdoor electrical equipment shall be the following:

   1. Installed in suitable enclosures
   2. Protected from accidental contact by unauthorized personnel, or by vehicular traffic
   3. Protected from accidental spillage or leakage from piping systems

   (b) **Work Space.** The working clearance space shall include the zone described in 110.26(A). No architectural
appurtenance or other equipment shall be located in this zone.

      *Exception to (b): Structural overhangs or roof extensions shall be permitted in this zone.*

   (c) **Dedicated Equipment Space.** The space equal to the width and depth of the equipment, and extending from grade to
a height of 1.8 m (6 ft) above the equipment, shall be dedicated to the electrical installation. No piping or other equipment
foreign to the electrical installation shall be located in this zone.

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**Statement of Problem and Substantiation for Public Comment**

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 20.

**Related Item**

First Revision No. 20-NFPA 70-2015 [Section No. 110.26(E)(2)]

**Submitter Information Verification**

**Submitter Full Name:** CC on NEC-AAC
**Organization:** NFPA
**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Mon Sep 28 14:48:22 EDT 2015

**Committee Statement**

**Committee Action:** Rejected but see related SR
**Resolution:** SR-14-NFPA 70-2015
**Statement:** The vague and possibly unenforceable term “suitable” is replaced with the defined and enforceable term “identified” to
comply with the NEC Style Manual and to add consistency throughout the code. Outdoor use enclosures are tested for
exclusion of rain, and are inherently protected against accidental spillage or leakage from piping systems. Exclusion of
architectural appurtenances is covered in the Exception.
Locked Electrical Equipment Rooms or Enclosures.

1. Electrical equipment rooms or enclosures housing electrical apparatus that are controlled by a lock(s) shall be considered accessible to qualified persons.

2. The entrance to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at 601 to 1000 volts, nominal, shall be kept locked unless such entrances are under the observation of a qualified person at all times. Permanent and conspicuous danger signs shall be provided. The danger sign shall meet the requirements in 110.21(B) and shall read as follows:

   DANGER — HIGH VOLTAGE — KEEP OUT

Statement of Problem and Substantiation for Public Comment

FR-21, which creates an intermediate voltage level requirement that covers 601-1000V, should not have been accepted. This requirement does not need to be carried over from 110.34(C). Suitable guarding of LV parts is already required in 110.27 and addressed directly in 110.27(A). Relocating this requirement and creating an intermediate voltage level of 601-1000V is redundant and may create confusion. This intermediate voltage does not exist in global standards, with which the Code is attempting to correlate. The NEC should make a "clean distinction" that LV is \(< =1000V\) and HV is \(>1000V\).

Related Item
First Revision No. 21-NFPA 70-2015 [Section No. 110.26(F)]

Submitter Information Verification

Submitter Full Name: Louis Barrios
Organization: Shell Global Solutions
Affiliation: American Chemistry Council
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:36:11 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: The first revision added unnecessary requirements for systems operating under 1000 volts, nominal. Creating similar requirements to 110.34(C) for an intermediate voltage level of 601-1000V may create confusion.
Public Comment No. 812-NFPA 70-2015 [Section No. 110.26(F)]

(F) Locked Electrical Equipment Rooms or Enclosures.

(1) -
Electrical equipment rooms or enclosures housing electrical apparatus that are controlled by a lock(s) shall be considered accessible to qualified persons.

(2) -
The entrance to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at 601 to 1000 volts, nominal, shall be kept locked unless such entrances are under the observation of a qualified person at all times. Permanent and conspicuous danger signs shall be provided. The danger sign shall meet the requirements in 110.21(B) and shall read as follows:

DANGER — HIGH VOLTAGE — KEEP OUT.

Statement of Problem and Substantiation for Public Comment

Return 110.26(F) to 2014 text. The substantiation provided by CMP-1 to support this revision seeks to create a new "gap voltage" to fix a problem that does not exist. As past chair of the CC appointed HV task group, I fully understand the reason for the 1000 volt threshold. There is a significant need for correlation throughout the NEC at 1000 volts. Creating "gap voltage ranges" as a short term solution will most certainly cause confusion. As pointed out in the negative ballot of Mr. Barrios, the intent of this revision is met in the present text of the NEC.

Related Item
First Revision No. 2-NFPA 70-2015 [Section No. 90.2(B)]
Public Input No. 1514-NFPA 70-2014 [New Section after 110.26(F)]

Submitter Information Verification

Submitter Full Name: James Dollard
Organization: IBEW Local Union 98
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 08:33:18 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: The first revision added unnecessary requirements for systems operating under 1000 volts, nominal. Creating similar requirements to 110.34(C) for an intermediate voltage level of 601-1000V may create confusion.
Public Comment No. 709-NFPA 70-2015 [Section No. 110.27(A)]

(A) Live Parts Guarded Against Accidental Contact.

Except as elsewhere required or permitted by this Code, live parts of electrical equipment operating at 50 to 1000 volts, nominal shall be guarded against accidental contact by approved enclosures or by any of the following means:

1. By location in a room, vault, or similar enclosure that is accessible only to qualified persons.
2. By permanent, substantial partitions or screens arranged so that only qualified persons have access to the space within reach of the live parts. Any openings in such partitions or screens shall be sized and located so that persons are not likely to come into accidental contact with the live parts or to bring conducting objects into contact with them.
3. By insulating covers over exposed conductive parts, removable only by qualified persons having access to the space, such that it is possible to expose only one phase or polarity at a time.
4. By location on a balcony, gallery, or platform elevated and arranged so as to exclude unqualified persons.
5. By elevation above the floor or other working surface as follows:
   - A minimum of 2.5 m (8 ft) for 50 to 300 volts between ungrounded conductors
   - A minimum of 2.6 m (8 ft 6 in) for 301 to 600 volts between ungrounded conductors
   - A minimum of 2.62 m (8 ft 7 in) for 601 to 1000 volts between ungrounded conductors

Statement of Problem and Substantiation for Public Comment

It is unclear how list item (3) achieves equal protection, and the committee statement does not adequately explain the new allowance. (My only revision was to cross out list item 3, but for some reason Terra shows list items 4 and 5 crossed out as well. Hopefully it will show up correctly for the committee.)

Related Item
First Revision No. 48-NFPA 70-2015 [Section No. 110.27(A)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 19:11:09 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-16-NFPA 70-2015
Statement: The requirement in list item (3) is adequately covered by the other parts of this section. Protection of specific equipment is identified by other sections of the code and the applicable product standards. SR 16 removes the item 3 that was added in FR 48.
110.28 Enclosure Types.

Enclosures (other than surrounding fences or walls covered in 110.31) of switchboards, switchgear, panelboards, industrial control panels, motor control centers, meter sockets, enclosed switches, transfer switches, power outlets, circuit breakers, adjustable-speed drive systems, pullout switches, portable power distribution equipment, termination boxes, general-purpose transformers, fire pump controllers, fire pump motors, and motor controllers, rated not over 1000 volts nominal and intended for such locations, shall be marked with an enclosure-type number as shown in Table 110.28.

Table 110.28 shall be used for selecting these enclosures for use in specific locations other than hazardous (classified) locations. The enclosures are not intended to protect against conditions such as condensation, icing, corrosion, or contamination that may occur within the enclosure or enter via the conduit or unsealed openings.

### Table 110.28 Enclosure Selection

<table>
<thead>
<tr>
<th>Provides a Degree of Protection Against the Following Environmental Conditions</th>
<th>For Outdoor Use</th>
<th>For Indoor Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidental contact with the enclosed equipment</td>
<td>3 3R 3S 3X 3RX 3SX 4 4X 6 6P</td>
<td>1 2 4X 5 6 6P 12K 13</td>
</tr>
<tr>
<td>Rain, snow, and sleet</td>
<td>X X X X X X X X</td>
<td>X X X X</td>
</tr>
<tr>
<td>Sleet*</td>
<td>= = X = = X = = =</td>
<td>= = =</td>
</tr>
<tr>
<td>Windblown dust</td>
<td>X = X X = X X X</td>
<td>X X X</td>
</tr>
<tr>
<td>Hosedown</td>
<td>= = = = = = = X X</td>
<td>= = =</td>
</tr>
<tr>
<td>Corrosive agents</td>
<td>= = = X X = = =</td>
<td>= = =</td>
</tr>
<tr>
<td>Temporary submersion</td>
<td>= = = = = = = X X</td>
<td>= = =</td>
</tr>
<tr>
<td>Prolonged submersion</td>
<td>= = = = = = = = =</td>
<td>= = =</td>
</tr>
</tbody>
</table>

*Mechanism shall be operable when ice covered.

Informational Note No. 1: The term *raintight* is typically used in conjunction with Enclosure Types 3, 3S, 3SX, 3X, 4, 4X, 6, and 6P. The term *rainproof* is typically used in conjunction with Enclosure Types 3R and 3RX. The term *watertight* is typically used in conjunction with Enclosure Types 4, 4X, 6, and 6P. The term *driptight* is typically used in conjunction with Enclosure Types 2, 5, 12, 12K, and 13. The term *dusttight* is typically used in conjunction with Enclosure Types 3, 3S, 3SX, 3X, 5, 12, 12K, and 13.

Informational Note No. 2: Ingress protection (IP) ratings may be found in ANSI/NEMA IEC 60529, *Degrees of Protection Provided by Enclosures*. IP ratings are not a substitute for Enclosure Type ratings.

### Statement of Problem and Substantiation for Public Comment

Referenced current SDO in informational note 2.

### Related Public Comments for This Document

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<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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</table>
Public Comment No. 39-NFPA 70-2015 [Section No. 110.31]
Public Comment No. 41-NFPA 70-2015 [Section No. 399.10]
Public Comment No. 42-NFPA 70-2015 [Section No. Table]
Public Comment No. 43-NFPA 70-2015 [Section No. B.310.15(B)(2)]
Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]
Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]
Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]
Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]
Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]
Public Comment No. 53-NFPA 70-2015 [Section No. 840.44(B)]
Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]
Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]
Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]
Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]
Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]
Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]
Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]
Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]
Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]
Public Comment No. 93-NFPA 70-2015 [Section No. 210.12(A)]
Public Comment No. 95-NFPA 70-2015 [Section No. 620.1]
Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack.]
Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]
Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]
Public Comment No. 111-NFPA 70-2015 [Section No. 505.2]
Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]
Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]

Related Item
First Revision No. 50-NFPA 70-2015 [Section No. 110.28]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 29 22:25:11 EDT 2015
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<td><strong>Committee Action:</strong></td>
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<tr>
<td><strong>Resolution:</strong></td>
</tr>
<tr>
<td><strong>Statement:</strong></td>
</tr>
</tbody>
</table>
110.31 Enclosure for Electrical Installations.

Electrical installations in a vault, room, or closet or in an area surrounded by a wall, screen, or fence, access to which is controlled by a lock(s) or other approved means, shall be considered to be accessible to qualified persons only. The type of enclosure used in a given case shall be designed and constructed according to the nature and degree of the hazard(s) associated with the installation.

For installations other than equipment as described in 110.31(D), a wall, screen, or fence shall be used to enclose an outdoor electrical installation to deter access by persons who are not qualified. A fence shall not be less than 2.1 m (7 ft) in height or a combination of 1.8 m (6 ft) or more of fence fabric and a 300 mm (1 ft) or more extension utilizing three or more strands of barbed wire or equivalent. The distance from the fence to live parts shall be not less than given in Table 110.31.

Table 110.31 Minimum Distance from Fence to Live Parts

<table>
<thead>
<tr>
<th>Nominal Voltage</th>
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<tbody>
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<td></td>
<td>m</td>
</tr>
<tr>
<td>1001–13,799</td>
<td>3.05</td>
</tr>
<tr>
<td>13,800–230,000</td>
<td>4.57</td>
</tr>
<tr>
<td>Over 230,000</td>
<td>5.49</td>
</tr>
</tbody>
</table>

Note: For clearances of conductors for specific system voltages and typical BIL ratings, see ANSI, see IEEE, C2-2007 2012, National Electrical Safety Code.

Informational Note: See Article 450 for construction requirements for transformer vaults.

(A) Electrical Vaults.

Where an electrical vault is required or specified for conductors and equipment 110.31(A)(1) to (A)(5) shall apply.

(1) Walls and Roof.

The walls and roof shall be constructed of materials that have adequate structural strength for the conditions, with a minimum fire rating of 3 hours. For the purpose of this section, studs and wallboard construction shall not be permitted.

(2) Floors.

The floors of vaults in contact with the earth shall be of concrete that is not less than 102 mm (4 in.) thick, but where the vault is constructed with a vacant space or other stories below it, the floor shall have adequate structural strength for the load imposed on it and a minimum fire resistance of 3 hours.

(3) Doors.

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

Exceptions to (1), (2), and (3): Where the vault is protected with automatic sprinkler, water spray, carbon dioxide, or halon, construction with a 1-hour rating shall be permitted.

(4) Locks.

Doors shall be equipped with locks, and doors shall be kept locked, with access allowed only to qualified persons. Personnel doors shall swing out and be equipped with panic bars, pressure plates, or other devices that are normally latched but that open under simple pressure.

(5) Transformers.

Where a transformer is installed in a vault as required by Article 450, the vault shall be constructed in accordance with the requirements of Part III of Article 450.


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

(B) Indoor Installations.

(1) In Places Accessible to Unqualified Persons.

Indoor electrical installations that are accessible to unqualified persons shall be made with metal-enclosed equipment. Switchgear, transformers, pull boxes, connection boxes, and other similar associated equipment shall be marked with appropriate caution signs. Openings in ventilated dry-type transformers or similar openings in other equipment shall be designed so that foreign objects inserted through these openings are deflected from energized parts.
In Places Accessible to Qualified Persons Only.

Indoor electrical installations considered accessible only to qualified persons in accordance with this section shall comply with 110.34, 110.36, and 490.24.

(C) Outdoor Installations.

(1) In Places Accessible to Unqualified Persons.

Outdoor electrical installations that are open to unqualified persons shall comply with Parts I, II, and III of Article 225.

(2) In Places Accessible to Qualified Persons Only.

Outdoor electrical installations that have exposed live parts shall be accessible to qualified persons only in accordance with the first paragraph of this section and shall comply with 110.34, 110.36, and 490.24.

(D) Enclosed Equipment Accessible to Unqualified Persons.

Ventilating or similar openings in equipment shall be designed such that foreign objects inserted through these openings are deflected from energized parts. Where exposed to physical damage from vehicular traffic, suitable guards shall be provided. Equipment located outdoors and accessible to unqualified persons shall be designed such that exposed nuts or bolts cannot be readily removed, permitting access to live parts. Where equipment is accessible to unqualified persons and the bottom of the enclosure is less than 2.5 m (8 ft) above the floor or grade level, the enclosure door or hinged cover shall be kept locked. Doors and covers of enclosures used solely as pull boxes, splice boxes, or junction boxes shall be locked, bolted, or screwed on. Underground box covers that weigh over 45.4 kg (100 lb) shall meet this requirement.

Statement of Problem and Substantiation for Public Comment

Referenced current SDO names, standard names, and editions.

Related Public Comments for This Document

<table>
<thead>
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Related Item

First Revision No. 32-NFPA 70-2015 [Section No. 110.31 [Excluding any Sub-Sections]]

Submitter Information Verification
Committee Statement

Committee Action: Rejected but see related SR
Statement: The references to ANSI/ASTM E119 standard and NFPA 80-2016 in the Informational Note were updated. See SR 19 for change made to footnote to table in 110.31 submitted in PC 39.
Electrical installations in a vault, room, or closet or in an area surrounded by a wall, screen, or fence, access to which is controlled by a lock(s) or other approved means, shall be considered to be accessible to qualified persons only. The type of enclosure used in a given case shall be designed and constructed according to the nature and degree of the hazard(s) associated with the installation.

For installations other than equipment as described in 110.31(D), a wall, screen, or fence shall be used to enclose an outdoor electrical installation to deter access by persons who are not qualified. A fence shall not be less than 2.1 m (7 ft) in height or a combination of 1.8 m (6 ft) or more of chain-link fence fabric and a 300 mm (1 ft) or more extension utilizing three or more strands of barbed wire or equivalent. The distance from the fence to live parts shall be not less than given in Table 110.31.

Table 110.31 Minimum Distance from Fence to Live Parts

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</tr>
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Note: For clearances of conductors for specific system voltages and typical BIL ratings, see ANSI C2-2007, National Electrical Safety Code.

Informational Note: See Article 450 for construction requirements for transformer vaults.

Statement of Problem and Substantiation for Public Comment

We have developers stating that 4" x 4" knotted agricultural fabric is all that is necessary to comply with this section on solar PV installations. We have had too many incidences of people using this fabric like a ladder, but no reference to require chain-link fabric.

Related Item

Public Input No. 1192-NFPA 70-2014 [Section No. 110.31 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: ALLAN STPETER
Organization: VT PSD
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 15 10:44:29 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The recommended language is too restrictive. There are many different types of fence fabric that are suitable for enclosing outdoor electrical installations.


Public Comment No. 800-NFPA 70-2015 [Section No. 110.31(A)(5)]

(5) Transformers.
Where a transformer is installed in a vault as required by Article 450, the vault shall be constructed in accordance with the requirements of Part III of Article 450.


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

Statement of Problem and Substantiation for Public Comment

Standard date update

Related Public Comments for This Document

<table>
<thead>
<tr>
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<td>Public Comment No. 801-NFPA 70-2015 [Section No. 300.11(B)(1)]</td>
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<td>Public Comment No. 803-NFPA 70-2015 [Section No. 450.21(B)]</td>
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<td>Public Comment No. 804-NFPA 70-2015 [Section No. 450.42]</td>
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Related Item
Public Input No. 1728-NFPA 70-2014 [Section No. 110.31(A)(5)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Sun Sep 20 19:35:47 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: The references to ANSI/ASTM E119 standard and NFPA 80-2016 in the Informational Note were updated. See SR 19 for change made to footnote to table in 110.31 submitted in PC 39.
(D) Enclosed Equipment Accessible to Unqualified Persons.

Ventilating or similar openings in equipment shall be designed such that foreign objects inserted through these openings are deflected from energized parts. Where exposed to physical damage from vehicular traffic, suitable guards shall be provided. Equipment located outdoors and accessible to unqualified persons, the general public, shall be designed such that exposed nuts or bolts cannot be readily removed, permitting access to live parts. Where equipment is accessible to unqualified persons, the general public, and the bottom of the enclosure is less than 2.5 m (8 ft) above the floor or grade level, the enclosure door or hinged cover shall be kept locked. Doors and covers of enclosures used solely as pull boxes, splice boxes, or junction boxes shall be locked, bolted, or screwed on. Underground box covers that weigh over 45.4 kg (100 lb) shall meet this requirement.

Statement of Problem and Substantiation for Public Comment

In industrial locations, and other non-public spaces there may be electrical equipment that are accessible by unqualified persons, but not accessible to the general public. The terms general public and unqualified persons are not synonymous. Please consider keeping the term "general public" in this section.

Related Item
First Revision No. 33-NFPA 70-2015 [Section No. 110.31(D)]

Submitter Information Verification

Submitter Full Name: TIMOTHY CROUSHORE
Organization: FIRSTENERGY
Affiliation: FirstEnergy
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jul 27 09:09:16 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed text does not enhance clarity or usability.
Public Comment No. 710-NFPA 70-2015 [Section No. 110.31(D)]

(D) Enclosed Equipment Accessible to Unqualified Persons.

Ventilating or similar openings in equipment shall be designed such that foreign objects inserted through these openings are deflected from energized parts. Where exposed to physical damage from vehicular traffic, suitable guards shall be provided. Equipment located outdoors and accessible to unqualified persons shall be designed such that exposed nuts or bolts cannot be readily removed, permitting access to live parts. Where equipment is accessible to unqualified persons and the bottom of the enclosure is less than 2.5 m (8 ft) above the floor or grade level, the enclosure door or hinged cover shall be kept locked. Doors and covers of enclosures used solely as pull boxes, splice boxes, or junction boxes shall be locked, bolted, or screwed on. Underground box covers that weigh over 45.4 kg (100 lb) shall meet this requirement.

Statement of Problem and Substantiation for Public Comment

In the last sentence of (D), the word "shall" is unnecessary. The covers meet the intent of the previous requirement by virtue of their weight, and code users are being informed that this is true. If "shall" remains in the language, it could be erroneously construed to mean that the covers must be locked, bolted or screwed on even if they do weigh over 100 pounds.

Related Item

First Revision No. 33-NFPA 70-2015 [Section No. 110.31(D)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 17 19:15:25 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-20-NFPA 70-2015
Statement: In the last sentence of (D), the word "shall" is unnecessary. The covers meet the intent of the previous requirement by virtue of their weight, and code users are being informed that this is true. If "shall" remains in the language, it could be erroneously construed to mean that the covers must be locked, bolted or screwed on even if they do weigh over 100 pounds.
Public Comment No. 711-NFPA 70-2015 [Section No. 110.34(E)]

(E) Elevation of Unguarded Live Parts.

Unguarded live parts above working space shall be maintained at elevations not less than required by Table 110.34(E).

Table 110.34(E) Elevation of Unguarded Live Parts Above Working Space

<table>
<thead>
<tr>
<th>Nominal Voltage Between Phases</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001–7500 V</td>
<td>2.7 m, 9 ft</td>
</tr>
<tr>
<td>7501–35,000 V</td>
<td>2.9 m, 9 ft 6 in.</td>
</tr>
<tr>
<td>Over 35 kV</td>
<td>2.9 m + 9.5 mm/kV</td>
</tr>
<tr>
<td></td>
<td>above 35</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

In the "Over 35 kV" row, I added a "+" sign between the values to return it to the original text: "2.9 m + 9.5 mm/kV" and "9 ft 6 in. + 0.37 in./kV"

I believe the deletion of the "+" sign was done incorrectly in the FR. (For some reason, Terra would not show the addition of the "+" sign in the revision screen, so I hope the suggested change is clear.)

Related Item
First Revision No. 34-NFPA 70-2015 [Section No. 110.34(E)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 19:20:22 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-21-NFPA 70-2015
Statement: These plus signs in the "Over 35kV" row were inadvertently omitted in the FR. The table was revised to clarify the elevation over 35kV.
110.41 Inspections and Tests.

(A) Pre-energization and Operating Tests.
Where required elsewhere in this Code, the complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be tested when first installed on-site.

(B) Test Report.
A test report covering the results of the tests required in 110.41(A) shall be available to the authority having jurisdiction prior to energization and made available to those authorized to install, operate, test, and maintain the system.

Statement of Problem and Substantiation for Public Comment

FR-36 should not have been accepted. The proposed new section 110.41 is broad, overly restrictive and falls outside the scope of 90.1(A). There are many elements of a "complete electrical system design" that are not relevant to the practical safeguarding of persons and property from hazards arising from the use of electricity. The proposed text is also unenforceable. Is it the responsibility of the AHJ to review and approve "the complete electrical system design"? The new section also requires the "complete electrical system design" to be tested "when first installed on-site". There are many tests conducted on electrical installations that are not relevant to practical safeguarding of persons and property. Also, testing installations "when first installed" may not be practical, or verify the safety of the installation, especially in the case of large projects that may take several years to install and energize. This new section has the potential of going well beyond the practical safeguarding of persons and property from hazards arising from the use of electricity, and therefore should be deleted.

Related Item
First Revision No. 36-NFPA 70-2015 [New Section after 110.40]

Submitter Information Verification

Submitter Full Name: Louis Barrios
Organization: Shell Global Solutions
Affiliation: American Chemistry Council
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:42:23 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CMP-1 reaffirms the action and statement for FR 36.
### 110.73 Equipment Work Space.

Where electrical equipment with live parts that is likely to require examination, adjustment, servicing, or maintenance while energized is installed in a manhole, vault, or other enclosure designed for personnel access, the work space and associated requirements in 110.26 shall be met for installations operating at 1000 volts or less. Where the installation is over 1000 volts, the work space and associated requirements in 110.34 shall be met. A manhole access cover that weighs over 45 kg (100 lb) shall meet be considered as meeting the requirements of 110.34(C).

### Statement of Problem and Substantiation for Public Comment

As revised, the manhole cover would also need a lock and sign as required in 110.34 (C). The original intent needs to be restored that a manhole access cover weighing over 100 lbs meets the requirement in 110.34(C). Please re-instate the original wording of section 110.73 Equipment Work Space.

### Related Item

First Revision No. 30-NFPA 70-2015 [Section No. 110.73]

### Submitter Information Verification

- **Submitter Full Name:** TIMOTHY CROUSHORE
- **Organization:** FIRSTENERGY
- **Affiliation:** FirstEnergy
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Mon Jul 27 09:30:14 EDT 2015

### Committee Statement

- **Committee Action:** Rejected but see related SR
- **Resolution:** SR-22-NFPA 70-2015
- **Statement:**

> A simple declarative sentence structure is preferred. See 3.3.1 of the NEC Style Manual. The word "shall" is unnecessary. Covers that weigh over 45.4 kg (100 lb) meet the intent of the requirement by virtue of their weight.

> 45 kg is changed to 45.4 kg for consistency with 110.31[D].
110.73 Equipment Work Space.

Where electrical equipment with live parts that is likely to require examination, adjustment, servicing, or maintenance while energized is installed in a manhole, vault, or other enclosure designed for personnel access, the work space and associated requirements in 110.26 shall be met for installations operating at 1000 volts or less. Where the installation is over 1000 volts, the work space and associated requirements in 110.34 shall be met. A manhole access cover that weighs over 45 kg (100 lb) 

shall meet. meets the requirements of 110.34(C).

Statement of Problem and Substantiation for Public Comment

In the last sentence, the word "shall" is unnecessary. The covers meet the intent of the previous requirement by virtue of their weight, and code users are being informed that this is true. If "shall" remains in the language, it could be erroneously construed to mean that the covers must be locked, bolted or screwed on even if they do weigh over 100 pounds.

Related Item
First Revision No. 30-NFPA 70-2015 [Section No. 110.73]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 19:27:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-22-NFPA 70-2015
Statement: A simple declarative sentence structure is preferred. See 3.3.1 of the NEC Style Manual. The word "shall" is unnecessary. Covers that weigh over 45.4 kg (100 lb) meet the intent of the requirement by virtue of their weight.

45 kg is changed to 45.4 kg for consistency with 110.31[D].
Public Comment No. 1177-NFPA 70-2015 [New Section after 210.1]

TITLE OF NEW CONTENT
210.2 Definitions
Unfinished Basements. Portions or areas of a basement not intended as habitable rooms or spaces

Statement of Problem and Substantiation for Public Comment

Including unfinished basements in 210.8(B) has identified sufficient substantiation to define the term "unfinished basement" for the purposes of the 210. This can be accomplished by locating the definition in 210.2 vacated during the First Draft actions. By removing the text "storage areas, work areas, and the like" from 210.8(A)(5) in the First Draft the reference to open areas in basements was lost. This presents enforcement challenges for the inspector. For example; how would a habitable space within a basement that has not been finished as a "room" be treated? The words "or spaces" was added to the end of the proposed definition for clarity and uniform understanding. Companion comments have been submitted to delete the text in 210.8(A) & (B).

Related Item
First Revision No. 346-NFPA 70-2015 [Section No. 210.8(A)]
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification
Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSP
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 09:52:09 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Changes made to 210.8(A) and (B) regarding unfinished basements makes the proposed definition unnecessary.
Public Comment No. 1176-NFPA 70-2015 [ Section No. 210.1 ]

210.1 Scope.
This article provides the general requirements for branch circuits.

Note since there is no 210.2 in terraview add the following definition.

210.2 Definitions
Laundry Area. Any space within 1.8 m (6 ft) of the nearest edge of a washing machine or dryer.

Statement of Problem and Substantiation for Public Comment

CMP 2 rejected PI No. 3458, which sought to create a definition of a laundry area, stating “Sufficient information or substantiation has not been provided for the panel to conclude that all laundry areas are limited to only six feet from the edge of the laundry equipment. Based on all the various design layouts that the panel discussed it would not be possible to determine where the laundry area begins and ends.” The last sentence of the Panel’s statement is exactly why defining the term is necessary. Currently there is no way for an electrical inspector to provide uniform enforcement of the boundaries for GFCI requirements for receptacle outlets in laundry areas. For example; if there was a studio apartment with a washing machine in one corner of the common area would GFCI protection be required for all the 125 volt, 15 and 20 ampere receptacles? What if a basement has been finished as one large open room but there is a washing machine or dryer in the room, do all the 125 volt, 15 and 20 ampere receptacles in the room require GFCI protection? The substantiation that brought the GFCI requirements for laundry areas in the 2014 NEC was directly related to appliance failures not receptacle outlets in adjacent areas. IAEI panel members did not vote against the addition of the requirement as there was merit to requiring GFCI protection for receptacle outlets adjacent to a washer or dryer which introduce grounded surfaces to the environment. With those thoughts in mind, the 1.8 m (6 ft) measurement makes perfect sense and it should be in any direction. Any receptacle outlets located beyond the traditional reach measurement of 1.8 m (6 ft) should be judged by the specific environment they are located in as contact with the appliance is not likely. If the GFCI protection requirements are really for the appliance and not the environment the receptacle outlet is located in they do not belong in 210.8 and should be moved to 422.5 in the next cycle. Section 210.2 was vacated at the First Draft stage so it was chosen as the location for the new definition. The term “laundry area” is used in other locations in 210 and therefore should be defined for the purpose of the article.

Related Item
Public Input No. 3458-NFPA 70-2014 [New Definition after Definition: Labeled.]

Submitter Information Verification

Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSPECTORS
Street Address: City:
State:
Zip:
Submittal Date: Thu Sep 24 09:42:40 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The laundry area does not need to be defined by a specific linear measurement from an appliance that will not be present during the inspection.
### 210.3 Other Articles for Specific-Purpose Branch Circuits.

Table 210.3 lists branch circuit requirements for specific equipment and applications that amend or supplement the requirements of this article.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Article</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-conditioning and refrigerating equipment</td>
<td>440.6, 440.31, 440.32</td>
<td></td>
</tr>
<tr>
<td>Audio signal processing, amplification, and reproduction equipment</td>
<td>640.8</td>
<td></td>
</tr>
<tr>
<td>Busways</td>
<td>368.17</td>
<td></td>
</tr>
<tr>
<td>Circuits and equipment operating at less than 50 volts</td>
<td>720</td>
<td></td>
</tr>
<tr>
<td>Central heating equipment other than fixed electric space-heating equipment</td>
<td>422.12</td>
<td></td>
</tr>
<tr>
<td>Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits</td>
<td>725</td>
<td></td>
</tr>
<tr>
<td>Cranes and hoists</td>
<td>610.42</td>
<td></td>
</tr>
<tr>
<td><strong>Direct Current Microgrid</strong></td>
<td><strong>712</strong></td>
<td><strong>712.25, 712.40, 712.70</strong></td>
</tr>
<tr>
<td>Electric signs and outline lighting</td>
<td>600.6</td>
<td></td>
</tr>
<tr>
<td>Electric welders</td>
<td>630</td>
<td></td>
</tr>
<tr>
<td>Electrified truck parking space</td>
<td>626</td>
<td></td>
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<tr>
<td>Elevators, dumbwaiters, escalators, moving walks, wheelchair lifts, and stairway chair lifts</td>
<td>620.61</td>
<td></td>
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<tr>
<td>Fire alarm systems</td>
<td>760</td>
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<tr>
<td>Fixed electric heating equipment for pipelines and vessels</td>
<td>427.4</td>
<td></td>
</tr>
<tr>
<td>Fixed electric space-heating equipment</td>
<td>424.3</td>
<td></td>
</tr>
<tr>
<td>Fixed outdoor electrical deicing and snow-melting equipment</td>
<td>426.4</td>
<td></td>
</tr>
<tr>
<td>Information technology equipment</td>
<td>645.5</td>
<td></td>
</tr>
<tr>
<td>Infrared lamp industrial heating equipment</td>
<td>422.48, 424.3</td>
<td></td>
</tr>
<tr>
<td>Induction and dielectric heating equipment</td>
<td>665</td>
<td></td>
</tr>
<tr>
<td>Marininas and boatyards</td>
<td>555.19</td>
<td></td>
</tr>
<tr>
<td>Mobile homes, manufactured homes, and mobile home parks</td>
<td>550</td>
<td></td>
</tr>
<tr>
<td>Motion picture and television studios and similar locations</td>
<td>530</td>
<td></td>
</tr>
<tr>
<td>Motors, motor circuits, and controllers</td>
<td>430</td>
<td></td>
</tr>
<tr>
<td>Pipe organs</td>
<td>650.7</td>
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<tr>
<td>Recreational vehicles and recreational vehicle parks</td>
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</tr>
<tr>
<td>X-ray equipment</td>
<td>660.2, 517.73</td>
<td></td>
</tr>
</tbody>
</table>

### Statement of Problem and Substantiation for Public Comment

Robert Bosch LLC proposes to add a reference in the table to the new article 712 addressing Direct Current (DC) Microgrids. There are specific branch circuit requirements for DC Microgrids in article 712 that amend or supplements the requirements of this article.

Robert Bosch LLC is actively involved in DC Microgrid pilot installations with the Department of Defense, the California Energy Commission, as well as with building-scale demonstration projects in North Carolina and Michigan. Through this experience, it has become clear that code clarifications are necessary with respect to branch circuits for DC Microgrids and Article 712 is being included to address those issues as well as other issues related to DC use within buildings.

**Related Item**

First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

### Submitter Information Verification

**Submitter Full Name:** Andrew Yip  
**Organization:** Robert Bosch LLC  
**Street Address:**
### Committee Statement

<table>
<thead>
<tr>
<th>Committee Action</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected</td>
<td>Section 90.3 already provides the guidance that specific equipment and applications in Chapters 5, 6 and 7 can amend or supplement the branch circuit requirements in Article 210, so the sections referencing branch circuit requirements in those chapters have been removed. See SR-303 which deletes specific references.</td>
</tr>
</tbody>
</table>
Public Comment No. 1431-NFPA 70-2015 [Section No. 210.3]

210.3 Other Articles for Specific-Purpose Branch Circuits.

Table 210.3 lists branch circuit requirements, references, for specific equipment and applications not located in Chapters 5, 6, and 7 that amend or supplement the requirements of this article.

Table 210.3 Specific-Purpose Branch Circuits

<table>
<thead>
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</tr>
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<td>Motors, motor circuits, and controllers</td>
<td>430</td>
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<td>Pipe organs 650.7</td>
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</tbody>
</table>

Additional Proposed Changes

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<th>File Name</th>
<th>Description</th>
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<tr>
<td>210.3_Comment-MH.docx</td>
<td>This file is provided in case the changes being recommended are not clear in Terra View.</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

Section 210.3 was revised to clarify the application of the table. Other than for listing specific purpose requirements in Chapters 2, 3 & 4, Table 210.3 is not necessary nor is it all inclusive as it exists. Section 90.3 already provides the guidance that specific equipment and applications in Chapters 5, 6 & 7 can amend or supplement the branch circuit requirements in 210 so the sections referencing branch circuit requirements in those Chapters can be removed.

Tables are helpful and benefit readers when they remain all inclusive. However, it would be a challenging task to provide readers with a continually updated list of all the sections that include branch circuit requirements that amend or supplement those in 210 so only the references that do not amend or supplement those in Article 210 via 90.3 were kept.

Related Item
First Revision No. 7524-NFPA 70-2015 [Section No. 210.2]

Submitter Information Verification

Submitter Full Name: Mark Hilbert
Committee Statement

Committee Action: Accepted
Resolution: SR-303-NFPA 70-2015
Statement: Section 210.3 is revised to clarify the application of the table. Other than for listing specific purpose requirements in Chapters 2, 3 & 4, Table 210.3 is not necessary nor is it all inclusive as it exists. Section 90.3 already provides the guidance that specific equipment and applications in Chapters 5, 6 & 7 can amend or supplement the branch circuit requirements in Article 210, so the sections referencing branch circuit requirements in those chapters can be removed.
210.3 Other Articles for Specific-Purpose Branch Circuits.

Table 210.3 lists branch circuit requirements for specific equipment and applications that amend or supplement the requirements of this article.

Table 210.3 Specific-Purpose Branch Circuits

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</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that FR 357 be referred to Code-Making Panel 12 for action in Article 625.

Related Item
First Revision No. 357-NFPA 70-2015 [Section No. 210.3]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 14:57:16 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>The comment from the Correlating Committee should have been directed to FR 353, which deleted 210.17. CMP 12 addressed the deletion through the creation of FR 3371, which relocated the requirement to 625.40.</td>
</tr>
</tbody>
</table>
Public Comment No. 1234-NFPA 70-2015 [ New Section after 210.5(C)(1) ]

(c) For 277/480 volt systems, the wire colors shall be brown, orange and yellow. For 120/208 volt systems, the wire colors shall be black, red and blue.

Statement of Problem and Substantiation for Public Comment

This is used elsewhere in the NEC. This also adds consistency to the installation. The CMP pointed out it was not in mandatory language, so this has been changed to reflect mandatory language.

Related Item
Public Input No. 2896-NFPA 70-2014 [Section No. 210.5(C)(1)]

Submitter Information Verification

Submitter Full Name: Jim Muir
Organization: Building Safety Division, Clark County, WA
Affiliation: NFPA's Building Code Development Committee (BCDC)
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 14:51:40 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Unique color codes may be used in different geographic areas or within different industrial facilities. The current language provides the flexibility to accommodate these unique applications.
(1) Branch Circuits Supplied from More Than One Nominal Voltage System.

Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 210.5(C)(1)(a) and (b).

(a) Means of Identification. The means of identification shall be permitted to be by separate color coding, marking tape, tagging, or other approved means.

(b) Posting of Identification Means. The method utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment. The label shall be of sufficient durability to withstand the environment involved and shall not be handwritten.

Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it is permissible to mark only the new system voltage. Existing unidentified systems shall not be required to be identified at each termination, connection, and splice point in compliance with 210.5(C)(1)(a) and (b). Labeling is required at each voltage system distribution equipment to identify that only one voltage system has been marked for a new system(s). The new system label(s) shall include the words "Other unidentified systems exist on the premises."

Statement of Problem and Substantiation for Public Comment

The First Draft language is not clear and therefore presents installation and enforcement challenges. The proposed text will clarify the existing unidentified installations must have been made prior to the adoption of the 2005 NEC, when 210.5(C) first appeared, to be excluded from new system identifications and where that identification is required. Providing the specific minimum specific wording will preserve the intent of the change while promoting consistency in installations and inspections.

Related Item
First Revision No. 302-NFPA 70-2015 [Section No. 210.5(C)(1)]

Submitter Information Verification

Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSP
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 15:59:50 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-304-NFPA 70-2015
Statement: The revised text clarifies that the existing unidentified installations must have been made prior to the adoption of the 2005 NEC, when 210.5(C) first appeared, to be excluded from new system identifications and where that identification is required.
Public Comment No. 1653-NFPA 70-2015 [Sections 210.5(C)(1), 210.5(C)(2)]

Sections 210.5(C)(1), 210.5(C)(2)

(1) Branch Circuits Supplied from More Than One Nominal Voltage System.

Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase or line and system at all termination, connection, and splice points in compliance with 210.5(C)(1)(a) and (b).

(a) Means of Identification. The means of identification shall be permitted to be by separate color coding, marking tape, tagging, or other approved means.

(b) Posting of Identification Means. The method utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment. The label shall be of sufficient durability to withstand the environment involved and shall not be handwritten.

Exception: In existing installations where a voltage system(s) already exists and a different voltage system is being added, it is permissible to mark only the new system voltage at each termination, connection, and splice point in compliance with 210.5(C)(1)(a) and (b). Labeling is required at each voltage system distribution equipment to identify that only one voltage system has been marked.

(2) Branch Circuits Supplied from Direct-Current Systems.

Where a branch circuit is supplied from a dc system operating at more than 60 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 210.5(C)(2)(a) and (b). The identification methods utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.

(a) Positive Polarity, Sizes 6 AWG or Smaller. Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(1) A continuous red outer finish

(2) A continuous red stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or black

(3) Imprinted plus signs (+)

(b) Negative Polarity, Sizes 6 AWG or Smaller. Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(1) A continuous black outer finish

(2) A continuous black stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or red

(3) Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

Statement of Problem and Substantiation for Public Comment

The Code requires continuous identification of ungrounded dc conductors via markings every 24”. This puts undue financial burden on retrofit installations.

The EMerge Alliance proposes to allow the re-use of existing conductors in retrofit situations through suitable marking means as accepted elsewhere in the Code.

We do not believe there will be any adverse safety risk caused by this change.

The previously accepted exception to 210.5(C)1 in FR 302 above should apply to 210.5(C)2, with suitable contextual wording changes.
Related Item
First Revision No. 302-NFPA 70-2015 [Section No. 210.5(C)(1)]
First Revision No. 303-NFPA 70-2015 [Section No. 210.5(C)(2)]

Submitter Information Verification
Submitter Full Name: BEN HARTMAN
Organization: NEXTEK POWER SYSTEMS
Affiliation: EMerge Alliance
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 15:53:05 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-305-NFPA 70-2015
Statement: An additional list item is added to the identification means of positive and negative polarity conductors. This addition supports the re-use of branch conductors for dc applications.
210.5(C)(2) was a new requirement in the 2014 NEC. It was a positive step forward in requiring clear identification of dc wiring and its polarity. Looking forward, a large part of the application of dc microgrids (see Article 712) and the LED retrofit business will involve dc power distribution through existing branch circuits. The 2014 Code did not consider this re-use case for marking, and essentially requires new cable to be pulled when a modern permanent marking method such as printed heat shrink sleeves would be quite adequate. This change is proposed in order to support this emerging, environmentally important LED retrofit industry. It allows marking by up to date, permanent means (e.g. heat shrink sleeve), and re-use of branch conductors for dc lighting and dc microgrid applications.

Note Terraview is wrongly changing numbering - in both cases this becomes a part (4). It also takes the (+) sign out from between the parens in the first addition.

Regarding the safety of re-use of 277 Vac branch circuits for dc applications, building wire is typically rated for 600V ac and dc. The nominal voltage to ground of most dc microgrids is 190 Vdc (380 V center-resistively grounded). This imparts significantly less stress on insulation than 277 Vac which impresses \(277 \times \sqrt{2} = 390\) Vpeak to ground. Ungrounded dc microgrid systems are also required to have ground fault protection by both articles 250 and 712.

**Related Item**

Submitter No. 4607-NFPA 70-2014 [Section No. 210.5(C)(2)]

**Submitter Information Verification**

Submitter Full Name: Robert Wills
<table>
<thead>
<tr>
<th><strong>Committee Statement</strong></th>
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<tr>
<td><strong>Committee Action:</strong></td>
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<tr>
<td><strong>Resolution:</strong></td>
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<tr>
<td><strong>Statement:</strong></td>
</tr>
</tbody>
</table>
(2) Branch Circuits Supplied from Direct-Current Systems.

Where a branch circuit is supplied from a dc system operating at more than 60 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 210.5(C)(2)(a) and (b). The identification methods utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.

(a) Positive Polarity, Sizes 6 AWG or Smaller. Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(2) A continuous red outer finish

(3) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black

(4) Imprinted plus signs (+)

±

(1) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

(2) In retrofit work, a permanent sleeve or tube marked /POSITIVE/POS at all splices and terminations shall be permitted

(e) Negative Polarity, Sizes 6 AWG or Smaller. Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(1) A continuous black outer finish

(2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red

(3) Imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

(4) In retrofit work, a permanent sleeve or tube marked -/NEGATIVE/NEG at all splices and terminations shall be permitted

Statement of Problem and Substantiation for Public Comment

There is increasing interest in retrofitting DC microgrids into buildings for improved energy efficiency, reliability, and self-generation of power from e.g. solar. The proposed change will provide a safe, permanent means of marking DC circuits without pulling new wire.

Related Item

Submitter Information Verification

Submitter Full Name: Ben Polito
Organization: Pika Energy Inc
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 12:10:48 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-305-NFPA 70-2015
| **Statement:** | An additional list item is added to the identification means of positive and negative polarity conductors. This addition supports the re-use of branch conductors for dc applications. |
Where a branch circuit is supplied from a dc system operating at more than 60 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means for existing wiring circuits in buildings which are being converted to a dc system; for new construction buildings where new wiring circuits are being installed each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 210.5(C)(2)(a) and (b). The identification methods utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.

(a) Positive Polarity, Sizes 6 AWG or Smaller. Where the positive polarity of a dc system does not serve as the connection point for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(2) A continuous red outer finish

(3) A continuous red stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or black

(4) Imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

(e) Negative Polarity, Sizes 6 AWG or Smaller. Where the negative polarity of a dc system does not serve as the connection point for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(1) A continuous black outer finish

(2) A continuous black stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or red

(3) Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

Statement of Problem and Substantiation for Public Comment

Robert Bosch LLC (Bosch) proposes an amendment to Article 210.5(C)(2). This amendment clarifies how existing wiring circuits in buildings being converted to a dc system will be identified.

The reason for this amendment is that existing ungrounded conductors of 6 AWG or smaller in buildings being converted to a dc system can also be safely reused and identified per the same requirements as ungrounded conductors of 4 AWG or larger without any safety or reliability concerns. It is reasonable for the present requirements for 6 AWG or smaller in Article 210.5(C)(2)(a) and (b) to apply to new building construction, however for existing buildings it would in essence require perfectly usable existing wiring to be removed/disposed of and new wiring to be installed. This adds extra unnecessary waste/cost with the potential to create a less reliable and safe wiring environment through the extensive rework necessary, for zero benefit as the existing wiring does not need replacement and can be properly identified. The retrofit of specific existing wiring circuits to operate on a dc system, such as lighting circuits in commercial buildings, rather than having to install new wiring represents a tremendous improvement in utilization of renewable energy, overall system reliability, and resiliency to power outages with long-term cost effective savings and no impact to safety and reliability. Conversion to DC circuits also offers the opportunity to utilize high-resistance midpoint grounding schemes, which substantially reduces the chances of electric shock, since both current-carrying conductors have a high-resistance path to ground in this configuration.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tr>
<td>Public Comment No. 839-NFPA 70-2015 [Section No. 712.25(B)]</td>
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<tr>
<td>Public Comment No. 841-NFPA 70-2015 [Section No. 712.40(B)]</td>
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<tr>
<td>Public Comment No. 1372-NFPA 70-2015 [Section No. 215.12(C)(2)]</td>
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<tr>
<td>Public Input No. 4607-NFPA 70-2014 [Section No. 210.5(C)(2)]</td>
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<tr>
<td>First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]</td>
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## Submitter Information Verification

<table>
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<tr>
<th>Submitter Full Name:</th>
<th>Andrew Yip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization:</td>
<td>Robert Bosch LLC</td>
</tr>
<tr>
<td>Street Address:</td>
<td></td>
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<tr>
<td>City:</td>
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<td>Submittal Date:</td>
<td>Thu Sep 17 20:53:09 EDT 2015</td>
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## Committee Statement

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<th>Rejected but see related SR</th>
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<tbody>
<tr>
<td>Resolution:</td>
<td>SR-305-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement:</td>
<td>An additional list item is added to the identification means of positive and negative polarity conductors. This addition supports the re-use of branch conductors for dc applications.</td>
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</tbody>
</table>
210.7 Multiple Branch Circuits.

Where two or more branch circuits supply devices or equipment on the same yoke or mounting strap, a means to simultaneously disconnect the ungrounded conductors supplying those devices or equipment shall be provided at the point at which the branch circuits originate.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 319.

Related Item
First Revision No. 319-NFPA 70-2015 [Section No. 210.7]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City: 
State: 
Zip: 
Submittal Date: Mon Sep 28 14:49:55 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: This revision removes the redundant reference to "devices and equipment."
210.7 Multiple Branch Circuits.
Where two or more branch circuits supply devices or equipment on the same yoke or mounting strap, a means to simultaneously disconnect the ungrounded supply conductors supplying those devices or equipment shall be provided at the point at which the branch circuits originate.

Statement of Problem and Substantiation for Public Comment
The opening part of the paragraph already identifies the requirement is to simultaneously disconnect the ungrounded conductors for devices or equipment. The proposed editorial revision removes the redundant reference to "devices and equipment."

Related Item
First Revision No. 319-NFPA 70-2015 [Section No. 210.7]

Submitter Information Verification
Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSP
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 16:39:12 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Statement: This revision removes the redundant reference to "devices and equipment."
210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.

Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) and 210.8(B). The ground-fault circuit interrupter shall be installed in a readily accessible location.

Informational Note No. 1: See 215.9 for ground-fault circuit-interrupter protection for personnel on feeders.

Informational Note No. 2: See 422.5(A) for GFCI requirements for appliances.

For the purposes of this section, when determining distance from receptacles the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window.

(A) Dwelling Units.

All 125- and 250-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A) (1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

(1) Bathrooms

(2) Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

Exception to (3): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

(4) Crawl spaces — at or below grade level

(5) Unfinished basements — for purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms

Exception to (5): A receptacle supplying only a permanently installed fire alarm or burglar alarm system shall not be required to have ground-fault circuit-interrupter protection.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Receptacles installed under the exception to 210.8(A) (5) shall not be considered as meeting the requirements of 210.52(G).

(6) Kitchens — where the receptacles are installed to serve the countertop surfaces

(7) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

(8) Boathouses

(9) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(10) Laundry areas

(B) Other Than Dwelling Units.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(1) Class A Ground-Fault Circuit-Interrupter Protection (GFCI).

(a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall have GFCI protection for personnel.

(b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

(2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).

(a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.
(3) Locations.

(a) Bathrooms  (b) Kitchens  (c) Rooftops

(d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated
to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance
with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure
that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2)
shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is
interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would
introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health
care facilities other than those covered under 210.8(B) (1), GFCI protection shall not be required.

(f) Indoor wet locations  (g) Locker rooms with associated showering facilities

(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms

(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of
the basement not intended as habitable rooms.

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Statement of Problem and Substantiation for Public Comment

The Correlating Committee additionally directs that FR 4247 be sent to Code-Making Panel 2 for additional action with regard to the use
of “general” and “critical care areas” in 210.8.

Related Item

First Revision No. 4247-NFPA 70-2015 [Definition: Patient Care Space.]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 09:44:35 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-322-NFPA 70-2015
Statement: The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because
of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the
requirement to these circuits.

An editorial change was made by deleting “locations” section and the sections renumbered as it was necessary due to
the deletion of the items (1) and (2) of this section.

The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.

The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is
unnecessary.
210.8  Ground-Fault Circuit-Interrupter Protection for Personnel.

Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) and 210.8(B). The ground-fault circuit interrupter shall be installed in a readily accessible location.

Informational Note No. 1: See 215.9 for ground-fault circuit-interrupter protection for personnel on feeders.

Informational Note No. 2: See 422.5(A) for GFCI requirements for appliances.

For the purposes of this section, when determining distance from receptacles the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window.

(A)  Dwelling Units.

All 125- and 250-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A)(1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

1) Bathrooms

2) Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

3) Outdoors

   Exception to (3): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22 as applicable.

4) Crawl spaces — at or below grade level

5) Unfinished basements — for purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms

   Exception to (5): A receptacle supplying only a permanently installed fire alarm or burglar alarm system shall not be required to have ground-fault circuit-interrupter protection.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Receptacles installed under the exception to 210.8(A)(5) shall not be considered as meeting the requirements of 210.52(G).

6) Kitchens — where the receptacles are installed to serve the countertop surfaces

7) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

8) Boathouses

9) Bathubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

10) Laundry areas

(B)  Other Than Dwelling Units.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.


   a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall have GFCI protection for personnel,

   b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).

   a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

   b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.
(3) Locations.

(a) Bathrooms  
(b) Kitchens  
(c) Rooftops  

(d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B) (1), GFCI protection shall not be required.

(f) Indoor wet locations  
(g) Locker rooms with associated showering facilities  

(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms  

(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.  

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

(k) **[C] Boat Hoists.** GFCI protection shall be provided for outlets not exceeding 240 volts that supply boat hoists installed in dwelling unit locations.

### Statement of Problem and Substantiation for Public Comment

The 2014 NEC addresses the hazard associate with boat hoists beginning with the outlet serving the boat hoist up to 240V. Protection is not limited to just protecting the “appliance.” There can be cord and plug connected boat hoists. A hazard may exist when inserting or removing the plug from the receptacle, therefore the protection needs to be in the branch circuit. Since the protection needs to remain in the branch circuit the requirement in the NEC must remain in 210.8. 210.8(C) should not be moved to Article 422.

**Related Item**

First Revision No. 348-NFPA 70-2015 [Section No. 210.8(C)]

### Submitter Information Verification

Submitter Full Name: Ed Larsen  
Organization: Schneider Electric USA  
Affiliation: Schneider Electric USA  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Mon Sep 21 14:33:24 EDT 2015

### Committee Statement

Committee Action: Rejected but see related SR

Resolution: Moving this requirement to Article 422 (providing the option for appliances equipped with GFCI protection to meet this requirement) would reduce the existing protection afforded by the NEC

Statement: GFCI protection for boat hoists and dishwashers needs to remain in the branch circuit or outlet. Section 422.5 First Revisions allow the option of providing GFCI protection for boat hoists and dishwashers in the attachment plug, the supply cord or installed within the appliance. There is no UL standard that requires GFCI protection integral with appliances or their cords. For new construction, GFCI protection afforded in the outlet or in the circuit breaker is the best solution for safety as this solution pays no regard to whether or not GFCI protection is provided for in the cord of the appliance.
210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.

Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) and 210.8(B). The ground-fault circuit interrupter shall be installed in a readily accessible location.

Informational Note No. 1: See 215.9 for ground-fault circuit-interrupter protection for personnel on feeders.

Informational Note No. 2: See 422.5(A) for GFCI requirements for appliances.

For the purposes of this section, when determining distance from receptacles the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or cabinet opening or window.

(A) Dwelling Units.

All 125- and 250-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A)(1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

1. Bathrooms
2. Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use
3. Outdoors
   Exception to (3): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.
4. Crawls spaces — at or below grade level
5. Unfinished basements — for purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms
   Exception to (5): A receptacle supplying only a permanently installed fire alarm or burglar alarm system shall not be required to have ground-fault circuit-interrupter protection.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Receptacles installed under the exception to 210.8(A)(5) shall not be considered as meeting the requirements of 210.52(G).

6. Kitchens — where the receptacles are installed to serve the countertop surfaces
7. Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink
8. Boathouses
9. Bathubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall
10. Laundry areas

(B) Other Than Dwelling Units.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

   (a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall have GFCI protection for personnel,
   (b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

2. Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).
   (a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.
   (b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.
Locations.

(a) Bathrooms  (b) Kitchens  (c) Rooftops
(d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B) (1), GFCI protection shall not be required.

(f) Indoor wet locations  (g) Locker rooms with associated showering facilities

(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms

(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

Statement of Problem and Substantiation for Public Comment

The term “cabinet opening” was added to the new second paragraph to clarify measurements are not made through cabinet openings. This clarification is in response to several questions as to whether cabinet openings were included during the IAEI Section meeting presentations.

Related Item
First Revision No. 333-NFPA 70-2015 [Section No. 210.8 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSPECTORS
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 16:55:46 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed words “cased opening, cabinet opening or similar opening” do not add clarity and add confusion due to the great number of possible interpretations of openings.
Public Comment No. 544-NFPA 70-2015 [Section No. 210.8 [Excluding any Sub-Sections]]

Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) and 210.8(B). The ground-fault circuit interrupter shall be installed in a readily accessible location.

Informational Note No. 1: See 215.9 for ground-fault circuit-interrupter protection for personnel on feeders.

Informational Note No. 2: See 422.5(A) for GFCI requirements for appliances.

For the purposes of this section, when determining distance from receptacles the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, window, cased opening, or similar openings.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

there are other openings used in the field such as a "cased" and "shadowbox" openings. If these openings are not included, the measurement could extent into other rooms, of course if this is the panels intent this language should not be included.

Related Item

Public Input No. 2991-NFPA 70-2014 [Section No. 210.8(A)]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Fri Sep 04 10:49:42 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed words "cased opening, cabinet opening or similar opening" do not add clarity and add confusion due to the great number of possible interpretations of openings.
TITLE OF NEW CONTENT 210.8 (A) exception
Type your content here ...
exception: receptacles install under the provisions of 406.15 shall not require GFCI protection

Statement of Problem and Substantiation for Public Comment

we normally see this type of installation in under counter lights. the requirement in 406.15 list a non standard configuration type receptacles. Relief should be given to the type of receptacle

Related Item
Public Input No. 2803-NFPA 70-2014 [Section No. 210.8(A)]
Public Input No. 1436-NFPA 70-2014 [New Section after 210.8]
Public Input No. 4387-NFPA 70-2014 [Section No. 210.8 [Excluding any Sub-Sections]]
Public Input No. 2897-NFPA 70-2014 [Section No. 210.8(A)]

Submitter Information Verification
Submitter Full Name: ALFIO TORRISI
Organization: master
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 11 16:19:51 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: If a receptacle is installed in a location that requires GFCI protection, then any load plugged in to it should be provided with GFCI protection. Furthermore, 406.15 was deleted during the first revision.
Public Comment No. 1060-NFPA 70-2015 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125- and 250-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A) (1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

(1) Bathrooms
(2) Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use
(3) Outdoors

Exception to (3): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

(4) Crawl spaces — at or below grade level
(5) Unfinished basements — for purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms

Exception to (5): A receptacle supplying only a permanently installed fire alarm or burglar alarm system shall not be required to have ground-fault circuit-interrupter protection.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Receptacles installed under the exception to 210.8(A) (5) shall not be considered as meeting the requirements of 210.52(G).

(6) Kitchens — where the receptacles are installed to serve the countertop surfaces
(7) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink
(8) Boathouses
(9) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall
(10) Laundry areas

Statement of Problem and Substantiation for Public Comment

This comment would seek to return the parent text of 210.8(A) to the original text at 210.8(A) of the 2014 NEC. Where is the substantiation for including 250-volt receptacles in required GFCI protection? No one is more supportive and committed to GFCI protection than the submitter of this comment, but I don't see the required substantiation for this increase. In the Public Input that spurred this proposed change (PI 516), the submitter made a statement about 250 volt air compressors, chop saws, table saws etc. that are widely used in residential areas that see potential hazards from ground faults. This is a statement, not substantiated evidence of these alleged ground faults. Speaking as an experienced woodworker, the 250 volt air compressors chop saws, and table saws that I encounter (especially at dwelling units) are also rated at 30-amperes or greater. If these tools addressed in the public input are rated at 250-volts, they typically would not be covered by these GFCI requirements as they are typically plugged into a 30-ampere rated receptacle (not requiring GFCI protection). Even as currently proposed by FR 346, 210.8(A) would only apply to 15- and 20-ampere rated receptacles. The proposed change would increase the voltage rating, not the ampere rating of the receptacle.

A quick fix to this would be for CMP-2 to simply raise both the voltage rating (to 250 volts) and the ampere rating (to 30 ampere) for the receptacle involved, but once again I ask, where is the substantiation? If the ampere rating were to be increased for GFCI protection, this would encompass such things as the clothes dryer receptacle. Where is the substantiation for a 250-volt, 30-ampere rated clothes dryer to be GFCI protected?

If this section remains as proposed, it will be very difficult for an AHJ to explain why a 250-volt, 20-ampere rated receptacle does not require GFCI protection and a 250-volt, 30-ampere rated receptacle does not require GFCI protection.

Related Item
Public Input No. 516-NFPA 70-2014 [Section No. 210.8(A)]
First Revision No. 346-NFPA 70-2015 [Section No. 210.8(A)]

Submitter Information Verification
Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-316-NFPA 70-2015
Statement:
The requirement for 250 volt ground fault protection was deleted because there was insufficient substantiation to support expanding the requirement to these circuits.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.

The text regarding sinks has been revised to clarify how the measurement is made.
**Public Comment No. 1236-NFPA 70-2015 [ Section No. 210.8(A) ]**

(A) Dwelling Units.

All 125- and 250-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A) (1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

(1) Bathrooms

(2) Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

Exception to (3): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

(4) Crawl spaces — at or below grade level

(5) Unfinished basements — for purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms

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Exception to

Exceptions to (5):

1. A receptacle supplying only a permanently installed fire alarm or burglar alarm system shall not be required to have ground-fault circuit-interrupter protection.

2. Ground-fault circuit-interrupter protection shall not be required for a single receptacle providing power for sump or sewage pumps where an accessible ground-fault circuit-interrupter protected receptacle is located within 900 mm (3 ft) of the non-GFCI protected receptacle.

   Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Receptacles installed under the exception to 210.8(A) (5) shall not be considered as meeting the requirements of 210.52(G).

(6) Kitchens — where the receptacles are installed to serve the countertop surfaces

(7) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

(8) Boathouses

(9) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(10) Laundry areas

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**Statement of Problem and Substantiation for Public Comment**

This adds a second exception to item (5). The CMP indicated that no technical substantiation was provided. It is common sense that if a wet condition operates the GFCI and shunts the power to a sump pump, the sump pump will not do its job to remove the water. This will provide a reliable power source for an emergency sump operation while still providing GFI protected convenience outlet for the occupant.

Here is an example of the problem. This is an excerpt from the Louisiana State Uniform Construction Code Councils’ sub committee reviewing the 2014 NEC for possible adoption. This excerpt is from their March 3, 2015 public hearing:

"Committee member Mr. John Stephens from Stephens Contracting Company Inc. testified his company receives numerous calls, concerning nuisance trips, on private sewage treatment plants with sump pumps. They keep sending men out at a cost of $85 per trip to reset the GFCI circuit and they can never determine the cause. Committee member Mr. Ronnie Joundot with Joundot Electric testified his company had also experienced numerous calls concerning nuisance trips on these same type of installations. Discussion followed with several individuals from both the inspection and private sector testifying they had experienced the same issues in the past. The discussion lasted for approximately 1 hour before the issue was tabled for a later meeting to allow the committee to proceed with other sections of the code." The issue was tabled and the review committee sent it forward with the request for the entire LSUCCC to consider some type of amendment addressing the GFCI issues on private sewage treatment plants, refrigerators and dishwashers.

Consideration should be given to amending the NEC to add this exception.
### Related Item

Public Input No. 2897-NFPA 70-2014 [Section No. 210.8(A)]

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### Submitter Information Verification

- **Submitter Full Name:** Jim Muir
- **Organization:** Building Safety Division, Clark County, WA
- **Affiliation:** NFPA's Building Code Development Committee (BCDC)
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Thu Sep 24 14:56:34 EDT 2015

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### Committee Statement

- **Committee Action:** Rejected
- **Resolution:** Sufficient substantiation has not been provided to support this change. Listed sump and sewage pumps are compatible with listed GFCI devices.
Public Comment No. 545-NFPA 70-2015 [Section No. 210.8(A)]

(A) Dwelling Units.

All 125- and through 250-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A) (1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

(1) Bathrooms

(2) Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

Exception to (3): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

(4) Crawl spaces — at or below grade level

(5) Unfinished basements — for purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms

Exception to (5): A receptacle supplying only a permanently installed fire alarm or burglar alarm system shall not be required to have ground-fault circuit-interrupter protection.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Receptacles installed under the exception to 210.8(A) (5) shall not be considered as meeting the requirements of 210.52(G).

(6) Kitchens — where the receptacles are installed to serve the countertop surfaces

(7) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

(8) Boathouses

(9) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(10) Laundry areas

Statement of Problem and Substantiation for Public Comment

Contrary to the panel statement this section was amended by other PI's to include 250v circuits, however it neglected to act on the ampacity of the circuit as addressed in PI 2803. The notion that a 25 ampere circuit is less dangerous than a 20 ampere circuit have been dismissed, pool pump motors are a good example of this. When deciding to require 250v GFCI protection for the pool pumps the panel recognized ampere capacity whether 20 amps or 25 amps had no bearing. Please reconsider the ampacity limitation as a 220v 20 amp compressor next to a sink is no different than a 220v 25 amp compressor. The panel recognized this hazard in the 2017 NEC section 210.8(B). I would hope the same safety concerns are given to homeowner. As far as the voltage is concerned the Panel should consider larger home that have 208/120 three phase services and amend the language to 120 through 250volts.

Related Item

Public Input No. 2803-NFPA 70-2014 [Section No. 210.8(A)]
First Revision No. 346-NFPA 70-2015 [Section No. 210.8(A)]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 11:30:49 EDT 2015

Committee Statement
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<td>SR-316-NFPA 70-2015</td>
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<tr>
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<td>The text regarding sinks has been revised to clarify how the measurement is made.</td>
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Public Comment No. 598-NFPA 70-2015 [Section No. 210.8(A)]

(A) Dwelling Units.
All 125- and 250-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A) (1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

(1) Bathrooms
(2) Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use
(3) Outdoors
   Exception to (3): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.
(4) Crawl spaces — at or below grade level
(5) Unfinished basements — for purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms
   Exception to (5): A receptacle supplying only a permanently installed fire alarm or burglar alarm system shall not be required to have ground-fault circuit-interrupter protection.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Receptacles installed under the exception to 210.8(A) (5) shall not be considered as meeting the requirements of 210.52(G).
(6) Kitchens — where the receptacles are installed to serve the countertop surfaces
(7) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside top inside edge of the sink bowl
(8) Boathouses
(9) Bathubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall
(10) Laundry areas

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

This is a three dimensional product INSIDE, OUTSIDE TOP AND BOTTOM, it should be clear the measurement is taken from the top of the sink. Some stone sinks and free standing sinks are completely exposed and in the case of a drop in sink the outside edge could mean the bottom. If the top inside reference it would be clearer, the measurement starts on the top of the sink along the inside edge of the bowl.

Related Item
Public Input No. 2991-NFPA 70-2014 [Section No. 210.8(A)]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address: 
City:
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-316-NFPA 70-2015
Statement: The requirement for 250 volt ground fault protection was deleted because there was insufficient substantiation to support expanding the requirement to these circuits.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.

The text regarding sinks has been revised to clarify how the measurement is made.
(A) Dwelling Units.

All 125- and 250-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A) (1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

(1) Bathrooms

(2) Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

Exception to (3): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

(4) Crawl spaces — at or below grade level

(5) Unfinished basements — for purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms

Exception to (5): A receptacle supplying only a permanently installed fire alarm or burglar alarm system shall not be required to have ground-fault circuit-interrupter protection.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Receptacles installed under the exception to 210.8(A) (5) shall not be considered as meeting the requirements of 210.52(G).

(6) Kitchens — where the receptacles are installed to serve the countertop surfaces

(7) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

(8) Boathouses

(9) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(10) Laundry areas

Statement of Problem and Substantiation for Public Comment

IEC's position is to delete the requirement for 250 volt GFCI protection in 210.8(A) - (FR 346)

The submitter of PI 516 was concerned about portable power tools and identified tools such as air compressors, chop saws, and tablesaws. For residential applications these tools are typically 120 volt and already covered by current Code requirements. If 250 volt tools are utilized in a dwelling unit then the GFCI protection should be located in the article covering the specific equipment.

There is no significant substantiation to expand GFCI protection to 250-volt, single phase, 15- and 20-ampere receptacles in dwelling units.

Related Item

First Revision No. 346-NFPA 70-2015 [Section No. 210.8(A)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 12 17:31:16 EDT 2015

Committee Statement
| Committee Action: | Rejected but see related SR |
| Resolution: | SR-316-NFPA 70-2015 |
| Statement: | The requirement for 250 volt ground fault protection was deleted because there was insufficient substantiation to support expanding the requirement to these circuits. |
| | The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary. |
| | The text regarding sinks has been revised to clarify how the measurement is made. |
All 125-volt and 250-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A) (1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

(1) Bathrooms

(2) Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

Exception to (3): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

(4) Crawl spaces — at or below grade level

(5) Unfinished basements — for purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms

Exception to (5): A receptacle supplying only a permanently installed fire alarm or burglar alarm system shall not be required to have ground-fault circuit-interrupter protection.

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Receptacles installed under the exception to 210.8(A) (5) shall not be considered as meeting the requirements of 210.52(G).

(6) Kitchens — where the receptacles are installed to serve the countertop surfaces

(7) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

(8) Boathouses

(9) Bathtubs or shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

(10) Laundry areas

Statement of Problem and Substantiation for Public Comment

The text defining unfinished basements in 210.8(A)(5) was relocated to a new 210.2 for consistency within 210 and the NEC in general. Removing the text "storage areas, work areas, and the like" from 210.8(A)(5) and expanding the GFCI requirements in 210.8(B) to include unfinished basements identifies sufficient substantiation to define the term for the purposes of the article. This can be accomplished by locating the definition in the now available 210.2. A companion comment has been submitted to include the definition in a new 210.2.

The words "or spaces" will be added to the new definition in 210.2 for clarification. As worded in 201.8(A)(5) in First Draft, the reference to open areas in basements has been lost. This will present enforcement challenges for example; how would a habitable space within a basement that has not been finished as a "room" be treated? If the defining the term in a new 210.2 is not accepted the words "or spaces" should be added to 210.8(A)(5) so it reads; …. habitable rooms or spaces.

Related Item

First Revision No. 346-NFPA 70-2015 [Section No. 210.8(A)]

Submitter Information Verification

Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSPECTORS
Street Address: 2300 10th St. N
City: Alexandria
State: VA
Zip: 22314
Submittal Date: Mon Sep 21 16:58:04 EDT 2015
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Public Comment No. 1436-NFPA 70-2015 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(3) Locations.

- Bathrooms
- Kitchens
- Rooftops

   Outdoors: Exception No. 1 to (c) and (d)

   (1) Class A Ground-Fault Circuit-Interrupter Protection (GFCI).

      (a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall have GFCI protection for personnel.

      (b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

   (2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).

      (a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

      (b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

- Bathrooms
- Kitchens
- Rooftops
- Outdoors

Exception No. 1 to (3): Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 2 to (3) and (4): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No.

2 to (d)

4]: In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(5) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e)

5]: In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e)

5]: For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B)(1), GFCI protection shall not be required.

(6) Indoor wet locations

(7) Locker rooms with associated showering facilities

(8) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms

- Crawls spaces— GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.

- Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.
IEC's position is to Delete FR 347

The code does not prohibit use of these devices and there was not enough technical substantiation to expand on GFCI protection beyond 125-volt, single phase, 15- and 20-ampere receptacles in "other than dwelling units." FR-347 is too broad. SPGCFI protection needs to be equipment specific and located in the applicable article.

Related Item
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 11:17:18 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: It is not the panel's intent to return this section back to the 2014 language. Specifics have not been identified to warrant deleting 210.8(B)(1)
Public Comment No. 1751-NFPA 70-2015 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(1) Class A Ground-Fault Circuit-Interrupter Protection (GFCI).

(a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall have GFCI protection for personnel.

(b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

(2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).

(a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(3) Locations.

(a) Bathrooms

(b) Kitchens

(c) Rooftops

(d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B)(1), GFCI protection shall not be required.

(f) Indoor wet locations

(g) Locker rooms with associated showering facilities

(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms

(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on First Revision #347, 210.8(B), in regard to clarity and numbering/order.

Related Item
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: National Fire Protection Association Report
City: http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
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Public Comment No. 35-NFPA 70-2015 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(1) Class A Ground-Fault Circuit-Interrupter Protection (GFCI).

(a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall have GFCI protection for personnel.

(b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

(2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).

(a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(3) Locations.

(a) Bathrooms (b) Kitchens (c) Rooftops (d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B)(1), GFCI protection shall not be required.

(f) Indoor wet locations (g) Locker rooms with associated showering facilities

(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms

(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

Statement of Problem and Substantiation for Public Comment

Revert to 2014 text and try again. FR 347 fails in several ways, 2 of which are: 1. Removing Exception (1) to (3) is a mistake in that now we must have a readily-accessible GFCI breaker in the panel supplying the rooftop receptacle, which if tripped while in use, necessitates a trip down from the roof, rather than simply pressing a reset button on the receptacle at hand; 2. Insufficient guidance is provided to enable the code user to select the appropriate SPGFCI Class. The vote on this FR was close and negative comments should have been heeded. This FR is not ready for prime time.

Related Item
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification
Committee Statement

Committee Action: Rejected

Resolution: It is not the panel's intent to return this section back to the 2014 language. Specifics have not been identified to warrant deleting 210.8(B)(1)
Public Comment No. 599-NFPA 70-2015 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(1) Class A Ground-Fault Circuit-Interrupter Protection (GFCI).

(a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall have GFCI protection for personnel,

(b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

(2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).

(a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(3) Locations.

(a) Bathrooms

(b) Kitchens

(c) Rooftops

(d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside, top inside edge of the sink.

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B)(1), GFCI protection shall not be required.

(f) Indoor wet locations

(g) Locker rooms with associated showering facilities

(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms

(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

Additional Proposed Changes

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<td>sink3.jpg</td>
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Statement of Problem and Substantiation for Public Comment

locations 1 -8 is a typo should say 210.8 (B)(3), the measurement from the sink is a companion of PC 598

Related Item

First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]
Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-322-NFPA 70-2015

Statement:
The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits.

An editorial change was made by deleting "locations" section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section.

The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.

The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.
Public Comment No. 616-NFPA 70-2015 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B) through (B) shall have ground-fault circuit-interrupter (GFCI) or special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

   (a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall have GFCI protection for personnel.
   (b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).
   (a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.
   (b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

3) Locations.
   (a) Bathrooms
   (b) Kitchens
   (c) Rooftops
   (d) Outdoors

   Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

   Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

   (e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

   Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

   Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B) (1), GFCI protection shall not be required.

   (f) Indoor wet locations
   (g) Locker rooms with associated showering facilities
   (h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms
   (i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.
   (j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.
Committee Statement

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<th>Rejected but see related SR</th>
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<td>SR-322-NFPA 70-2015</td>
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<tr>
<td>Statement:</td>
<td>The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits. An editorial change was made by deleting &quot;locations&quot; section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section. The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible. The text regarding sinks has been revised to clarify how the measurement is made. Patient care categories were added to correlate with Article 517 and NFPA 99. The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.</td>
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</table>
Public Comment No. 642-NFPA 70-2015 [ Section No. 210.8(B) ]

(B) Other Than Dwelling Units.

All single-phase receptacles rated
All 125-volt, single-phase, 15- and 20-ampere, receptacles installed in the locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(1) Class A Ground-Fault Circuit-Interrupter Protection (GFCI).
operating at 150 volts to ground or less
-50 amperes or less, shall have GFCI protection for personnel. All three-phase receptacles rated 150 volts to ground or less, 100 and rated at 60 amperes or less

shall have
GFCI protection for personnel.

(2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).

(a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(3) Locations.
Class A Ground Fault Circuit Interrupter (GFCI) protection for personnel.

(1) Class A GFCI required locations

(a) Bathrooms (b) Kitchens (c) Rooftops

(d) Outdoors

Exception No Exception No. 1 to (c): Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 2 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B) (1), GFCI protection shall not be required.

(f) Indoor wet locations (g) Locker rooms with associated showering facilities

(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms

(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

Informational Note No.1: Three-phase GFCI protection is available for voltages up to and including 150 volts to ground. The Assured Equipment Grounding Conductor Program is sometimes used to provide personnel protection where GFCIs are not otherwise required (see 590.6(B)(2)).

Informational Note No. 2: Special Purpose Ground Fault Circuit Interrupters (SPGFCIs) are available to provide ground fault protection for receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors. These devices are available in both single-phase and three-phase versions, and typically have adjustable ground fault trip settings.
Statement of Problem and Substantiation for Public Comment

The added GFCI requirements for single-phase and three-phase lower voltages and also higher voltages were not substantiated by any technical data. Special Purpose GFCIs have not been proven to add any layer of safety above and beyond an "Assured Equipment Grounding Conductor Program". Introducing them to the electrical public by way of an informational note rather than a mandated requirement allows electrical professionals the opportunity to prove their worth as a valid safety device. This revision removes the requirement for SPGFCIs and also three-phase lower voltage GFCI devices, and adds them as an option in the form of informational notes.

The improper numbering of the first revision has been corrected (210.8(B)(1) through (8), which does not exist). This has been replaced by proper numbering of the locations where Class A GFCIs are required ((1)(a) through (j)).

An exception was added back from the 2014 NEC allowing receptacles on rooftops to not be readily accessible other than from the rooftop. This exception was new text in 2014 and should remain. It only makes sense to clarify what is meant by ready access on a rooftop.

Related Item
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: Robert Huddleston
Organization: Eastman Chemical Company
Affiliation: American Chemistry Council
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 15:01:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-321-NFPA 70-2015 The proposed Informational notes were not included as the special purpose GFCI requirements were deleted. Increasing from 50 to 60 amperes was not accepted because there was no substantiation to do so.
Statement: Receptacles of the higher voltage and current ratings in the locations identified in 210.8(B) present the similar shock hazards as those of lower voltage and current ratings. The numbering in

the introductory paragraph was changed to correlate with the revisions to the section. Item (1)(a) and (1)(b) were incorporated into the opening paragraph.
Public Comment No. 819-NFPA 70-2015 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8) shall be permitted to have ground-fault circuit-interrupter protection for personnel.

(1) Class A Ground-Fault Circuit-Interrupter Protection (GFCI) shall be used when 210.8(B)(1)(a) or (b) apply.

(a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall be permitted to have GFCI protection for personnel.

(b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

(2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI) shall be used when 210.8(B)(2)(a) or (b) apply.

(a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall be permitted to have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall be permitted to have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(3) Locations.

(a) Bathrooms
(b) Kitchens
(c) Rooftops
(d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B)(1), GFCI protection shall not be required.

(f) Indoor wet locations
(g) Locker rooms with associated showering facilities
(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms
(i) Crawls spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.
(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

Statement of Problem and Substantiation for Public Comment

The first draft of 201.8 (B) is need of a clean-up.

Related Item

Public Input No. 2192-NFPA 70-2014 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: Edwin Kramer
Organization:
Street Address:
Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-321-NFPA 70-2015 The proposed Informational notes were not included as the special purpose GFCI requirements were deleted. Increasing from 50 to 60 amperes was not accepted because there was no substantiation to do so.

Statement: Receptacles of the higher voltage and current ratings in the locations identified in 210.8(B) present the similar shock hazards as those of lower voltage and current ratings. The numbering in the introductory paragraph was changed to correlate with the revisions to the section. Item (1)(a) and (1)(b) were incorporated into the opening paragraph.
Public Comment No. 853-NFPA 70-2015 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(1) Class A Ground-Fault Circuit-Interrupter Protection (GFCI).

(a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall have GFCI protection for personnel.

(b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

(2) Classes C, D or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).

(a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(3) Locations.

(a) Bathrooms (b) Kitchens (c) Rooftops

(d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B) (1), GFCI protection shall not be required.

(f) Indoor wet locations (g) Locker rooms with associated showering facilities

(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms

(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

Statement of Problem and Substantiation for Public Comment

The words “125-volt, single-phase, 15- and 20-ampere” need to be deleted because the requirement now includes three-phase receptacles and receptacles rated up to 100 A.

FR 347 adds a requirement for the use of Classes C, D or E Special Purpose Ground-Fault Circuit Interrupters (SPGFCI) in specified locations where the voltage is more that 150 volts to ground. These devices are listed to UL 943C. According to UL 943C, in applications where the voltage to ground exceeds 150 volts but does not exceed 300 volts, a Class C SPGFCI is to be used. In applications where the voltage to ground exceeds 300 volts, a Class D SPGFCI may be used if an oversized equipment grounding conductor is installed. If an oversized equipment grounding conductor is not installed, a Class E SPGFCI must be used. No mention of these requirements is made in the proposed Code text, thus there is the possibility of these devices being misapplied, endangering persons who should be protected from shock. The text in (B)(2) should be deleted.
Related Item
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: Ed Larsen
Organization: Schneider Electric USA
Affiliation: Schneider Electric USA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 14:05:59 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-322-NFPA 70-2015
Statement: The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits.

An editorial change was made by deleting “locations” section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section.

The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.

The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.
Public Comment No. 988-NFPA 70-2015 [Section No. 210.8(B)]

(B) Other Than Dwelling Units.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (B 10) shall have ground-fault circuit interrupter protection for personnel.

(1) Class A Ground-Fault Circuit-Interrupter Protection (GFCI).

(a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall have GFCI protection for personnel.

(b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

(2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).

(a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit interrupter (SPGFCI) protection for personnel.

(b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit interrupter (SPGFCI) protection for personnel.

(3) Locations.

- Bathrooms
- Kitchens
- Rooftops
- Outdoors: Exception No. 1 to (c) and (d)

(2) Bathrooms
(3) Rooftops
(4) Outdoors

Exception No. 1 to (3): Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Exception No. 2 to (d)

4): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2), shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(5) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e)

5): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under, 210.8(B)(1), GFCI protection shall not be required.

(6) Indoor wet locations
(7) Locker rooms with associated showering facilities
(8) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms
(9) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.
(10) Unfinished basements —

For the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.
Statement of Problem and Substantiation for Public Comment

This comment essentially returns the numbering structure of 210.8(B) to that of 2014 NEC and removes the text expanding the requirements to include single and three phase receptacles up to 600 volts and 100 amperes. There were several issues with wording of 210.8(B) in the First Draft (FR No. 347). For example; the text in the First Draft opening paragraph only references single phase, 125 volt, 15 and 20 ampere receptacles when the requirements were expanded to include receptacles to up to 600 volts, 100 amperes and three phase types, the exception numbering is not consistent and Exception No. 1 to (3), regarding rooftop GFCI receptacle devices, was removed by FR 347 but remains in the First Draft. Removing the expanded requirements solves other wording issues.

The substantiation provided for expanding the current Class A GFCI ampacity, voltage and phase requirements and to mandate special-purpose ground-fault protection circuit-interrupter, Class C, D or E (SPGFCI), protection for higher voltages as general branch circuit requirements was extremely insufficient. At these expanded levels the receptacle outlets will likely be used for specific purpose portable or other cord and plug connected equipment. Specific-purpose ground-fault protection requirements should be located in the applicable article for the equipment or the conditions such as 422 or 590 as opposed to a general branch circuit requirement in 210. Locating special purpose requirements in the appropriate article is consistent with the First Draft actions to move appliance GFCI requirements from 210 to 422.

The text defining unfinished basements in 210.8(B)(3)(j) in the First Draft was relocated to a new 210.2 for consistency within 210. Including unfinished basements in 210.8(B) and expanding the AFCI requirements in 210.12 has identified sufficient substantiation to define the term for the purposes of the article. This can be accomplished by locating the definition in the now available 210.2. A companion comment has been submitted to include the definition in a new 210.2.

Related Item
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSP
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 19:51:31 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-322-NFPA 70-2015
Statement: The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits.

An editorial change was made by deleting "locations" section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section.

The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.

The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.
All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the Class A ground-fault circuit-interrupter protection for personnel and Classes C, D, or E special purpose ground-fault circuit-interrupter protection for personnel shall be provided in locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

Statement of Problem and Substantiation for Public Comment

When the body of the section was extensively revised the lead-in sentence was not adjusted to go with the revisions. There are no longer locations 210.8(B)(1) through (8).

Related Public Comments for This Document

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Submitter Information Verification

Submitter Full Name: Kenneth Vannice
Organization: [Not Specified]
Affiliation: USITT Engineering Commission
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 00:50:50 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-322-NFPA 70-2015
Statement: The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits.

An editorial change was made by deleting “locations” section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section.

The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.

The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.
Public Comment No. 357-NFPA 70-2015 [Section No. 210.8(B) [Excluding any Sub-Sections]]

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8), shall have ground-fault circuit-interrupter protection for personnel.

Statement of Problem and Substantiation for Public Comment

Reference should be (B)(3), not (B)(1) through (8).

Related Item
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 14:37:52 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-322-NFPA 70-2015
Statement: The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits.

An editorial change was made by deleting “locations” section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section.

The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.

The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.
All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (B)(2) installed in locations specified in 210.8(B)(3) shall have ground-fault circuit-interrupter protection for personnel.

Statement of Problem and Substantiation for Public Comment

210.8(B) has been expanded to include receptacles beyond 125-volt, single phase, 15- and 20-ampere. The proposed changes are meant to clarify which receptacles are to have ground-fault circuit-interrupter protection.

Related Item

First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: EDWARD RODRIGUEZ
Organization: IEC TEXAS GULF COAST
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 30 15:34:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-322-NFPA 70-2015
Statement: The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits.

An editorial change was made by deleting “locations” section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section.

The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.

The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.
Public Comment No. 425-NFPA 70-2015 [Sections 210.8(B)(1), 210.8(B)(2)]

Sections 210.8(B)(1), 210.8(B)(2)
(1) Class A Ground-Fault Circuit-Interrupter Protection (GFCI).
   (a) All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less, shall have GFCI protection for personnel.
   (b) All three-phase receptacles rated 150 volts to ground or less, 100 amperes or less, shall have GFCI protection for personnel.

(2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).
   (a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.
   (b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

Statement of Problem and Substantiation for Public Comment

BOMA, International is requesting the committee reverse its action on mandating the use of Special Purpose GFCI's in all occupancies, where there use will have no impact in improving the safety of occupants where there is no evidence that the hazard currently exists. According to the US Bureau of Labor Statistics, a majority of the shocks (outside of residential occupancies) occur from individuals coming into contact with overhead power lines (44%) followed by workers who come into contact with wiring, transformers and other electrical components (27%) as part of their daily work routine. These statistics were reported in the ESFI report available at http://www.esfi.org/resource/electrical-safety-then-and-now-281. Currently, the code does not prohibit their use to protect personal in industrial settings and the proponent should continue to promote better engineering practices to encourage their use. BOMA agrees that improvements for electrical safety and reducing electrical shocks should be the goal, but as it was so appropriately stated in the negative comment from Mr. McGovern. “Sufficient substantiation has not been provided to expand GFCI protection beyond 125 volt receptacles in the areas specified other than the fact that new products have been developed for sale in the market place.”

Related Item
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: STEVEN ORLOWSKI
Organization: BOMA, International
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 21 11:05:00 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-322-NFPA 70-2015
Statement: The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits.

An editorial change was made by deleting “locations” section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section.

The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.

The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.
The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.
Public Comment No. 1069-NFPA 70-2015 [Section No. 210.8(B)(2)]

(2) Classes C, D, or E Special-Purpose Ground-Fault Circuit-Interrupter Protection (SPGFCI).

(a) All single-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

(b) All three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, shall have special-purpose ground-fault circuit-interrupter (SPGFCI) protection for personnel.

Statement of Problem and Substantiation for Public Comment

The PI for "210.8(B)(2) Classes C, D, or E Special-Purpose Ground Fault Circuit-Interrupter Protection (SPGFCI)" should be DELETED.

While Class C, D, and E GFCI devices may increase safety for workers, it would be premature to mandate their usage at this time until sufficient field experience shows that they will reduce fatalities, and will not cause nuisance tripping in industrial type settings, in addition to all the 'Other Than Dwelling Units' locations that would be impacted. There is presently nothing that would prohibit installing these devices in facilities today.

Related Item
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: Christopher Walker
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 15:15:31 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-322-NFPA 70-2015
Statement: The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits.

An editorial change was made by deleting "locations" section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section.

The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.

The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.
Public Comment No. 1023-NFPA 70-2015 [Section No. 210.8(B)(3)]

(3) Locations.

(a) Bathrooms (b) Kitchens (c) Rooftops
(d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

Exception No. 3 to (d): For receptacles in outdoor locations in Articles 520, 525 and 530 occupancies GFCI and SPGFCI protection shall be permitted but not required.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B) (1), GFCI protection shall not be required.

(f) Indoor wet locations (g) Locker rooms with associated showering facilities

(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms

(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

Statement of Problem and Substantiation for Public Comment

In many cases GFCI and SPGFCI protection is not reliably functional in these supervised occupancies with the equipment involved. In a previous cycle a similar proposal was made. UL determined that the equipment had not been evaluated for this use and would have to be considered on a case by case basis. There are applications where this equipment can be applied and applications where it doesn’t function properly. This is partially due to very long runs of sets of single-conductor cables, phase-cut single-phase dimming controls on three-phase circuits, arc lamp ballasts with high harmonic content, and portable generators bonded only to their frame. The proposed Exception allows the use of this equipment where it can be applied and does not require its use where it does not function properly. The last time a similar proposal was made proposals in Articles 520, 525 and 530 were made to negate the requirements. When the proposal was withdrawn the counter proposals in Article 520 and 530 were withdrawn and the requirements in Section 525.23 were revised to coordinate with the requirements of 210. If Exception 3 is not granted, Section 525.23 will need to be revised to re-coordinate with 210 and similar sections re-inserted into Article 520 and 530.

Entertainment electrical equipment is mostly portable moving from show to show. Each time it is moved it becomes a new installation involving a new electrical permit and a new inspection. Large stocks of rental electrical equipment that is compliant one day is un-rentable the next day if the requirements change. The requirements for GFCI’s, as stated in the NEC, appear to be frequency neutral. Consequently it applies to all the ungrounded DC systems found in Article 530. The UL standard for GFCI’s indicates that they are for use on AC circuits.

Related Public Comments for This Document

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<td>The related comment must be processed before the comment is valid.</td>
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Related Item

First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: Kenneth Vannice
Organization: [ Not Specified ]
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Public Comment No. 1173-NFPA 70-2015 [Section No. 210.8(B)(3)]

(3) Locations.

(a) Bathrooms  
(b) Kitchens  
(c) Rooftops  
(d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care (Category 2) or critical care areas (Category 1) spaces of health care facilities other than those covered under 210.8(B) (1), GFCI protection shall not be required.

(f) Indoor wet locations  
(g) Locker rooms with associated showering facilities  
(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms  
(i) Crawls spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

Additional Proposed Changes

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<td>Klein01_Hart01_HEA-FUN_Agenda_item_NEC2017_CN155_FR4247_FR347.pdf</td>
<td>Request and details to NFPA HEA-FUN Committee for use of parenthetic transition of NFPA 99-extracted terms</td>
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<td>reply_Klein01_Hart01_HEA-FUN_Agenda_item_NEC2017_CN155_FR4247_FR347.pdf</td>
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<td>99_HEA-FUN_A2017_FDMinutes-8-15_annotated.pdf</td>
<td>Minutes of NFPA 99 HEA-FUN Committee: Item 7 consideration and acceptance of extract transition approach in NFPA 70</td>
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Statement of Problem and Substantiation for Public Comment

This Public Comment is responsive to NEC® Correlating Committee Note CN155 regarding 2017 NEC® First Revision FR4247 for Article 517 [and First Revision FR347 for Section 210.8(B)].

In accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, HAS CONSENTED to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®.


Please see the attached PDF file for details and for the requested action.

Related Public Comments for This Document

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<td>Public Comment No. 1175-NFPA 70-2015 [Definition: Patient Care Space.]</td>
<td>revised terms in 517.2 Definitions used in 210.8(B)(3)(e) Exception</td>
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</table>
Public Comment No. 1175-NFPA 70-2015 [Definition: Patient Care Space]

Related Item
Correlating Committee Note No. 155-NFPA 70-2015 [Definition: Patient Care Space]
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]
Public Input No. 3239-NFPA 70-2014 [Section No. 210.8(B)]
First Revision No. 4217-NFPA 70-2015 [Section No. 520.48]
Public Input No. 2838-NFPA 70-2014 [Definition: Patient Care Space]
Public Input No. 4488-NFPA 70-2014 [Definition: Patient Care Space]

Submitter Information Verification
Submitter Full Name: Brian Rock
Organization: Hubbell Incorporated
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 07:22:11 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-322-NFPA 70-2015
Statement: The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits.

An editorial change was made by deleting “locations” section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section.

The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.

The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.
### (3) Locations.

(a) Bathrooms
(b) Kitchens
(c) rooftops

(d) Outdoors

*Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.*

*Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.*

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

*Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.*

*Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B) (1), GFCI protection shall not be required.*

(f) Indoor wet locations
(g) Locker rooms with associated showering facilities

(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms

(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

(C) Boat Hoists.

GFCI protection shall be provided for outlets not exceeding 240 volts that supply boat hoists installed in dwelling unit locations.

(D) Kitchen Dishwasher Branch Circuit.

GFCI protection shall be provided for outlets that supply dishwashers installed in dwelling unit locations.

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### Statement of Problem and Substantiation for Public Comment

IEC’s position is to reject FR-348 and FR-349.

GFCI protection for boat hoists and dishwashers needs to remain in the branch circuit or outlet. The proposed text in FR-4801 (422.5) allows the option of providing GFCI protection for boat hoists and dishwashers in the attachment plug, the supply cord or installed within the appliance. There is no UL standard that requires GFCI protection integral with appliances or their cords. Moving this requirement to Article 422, providing the option for appliances equipped with GFCI protection to meet this requirement, would reduce the existing protection afforded by the NEC. For new construction, GFCI protection afforded in the outlet or in the circuit breaker is the best solution for safety as this solution pays no regards to whether or not GFCI protection is provided for in the cord of the appliance.

**Related Item**

- First Revision No. 348-NFPA 70-2015 [Section No. 210.8(C)]
- First Revision No. 349-NFPA 70-2015 [Section No. 210.8(D)]

### Submitter Information Verification

**Submitter Full Name:** JOHN MASARICK

**Organization:** Independent Electrical Contractors, Inc.

**Affiliation:** Independent Electrical Contractors, Inc.

**Street Address:**

**City:**

**State:**

**Zip:**

**Submittal Date:** Fri Sep 25 12:36:02 EDT 2015
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(3) Locations.
(a) Bathrooms  (b) Kitchens  (c) Rooftops
(d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B) (1), GFCI protection shall not be required.

(f) Indoor wet locations  (g) Locker rooms with associated showering facilities
(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms
(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.
(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

Exception No. 3 to (d): Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

Statement of Problem and Substantiation for Public Comment

This exception was added in the 2014 NEC to add clarity (see ROP 2-52). The exception should remain for clarification purposes.

Related Item
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification
Submitter Full Name: Michael Weaver
Organization: M&W Electric
Affiliation: NECA
Street Address: City: State: Zip:
Submittal Date: Fri Sep 25 13:34:39 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-322-NFPA 70-2015
Statement: The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits.

An editorial change was made by deleting “locations” section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section.
The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.

The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.
Public Comment No. 358-NFPA 70-2015 [Section No. 210.8(B)(3)]

(3) Locations.

(a) Bathrooms  (b) Kitchens  (c) Rooftops  
(d) Outdoors

Exception No. 1 to (c) and (d): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.

Exception No. 2 to (d): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.

(e) Sinks — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink

Exception No. 1 to (e): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

Exception No. 2 to (e): For receptacles located in patient bed locations of general care or critical care areas of health care facilities other than those covered under 210.8(B) (1), GFCI protection shall not be required.

(f) Indoor wet locations  (g) Locker rooms with associated showering facilities

(h) Garages, service bays, and similar areas other than vehicle exhibition halls and showrooms

(i) Crawl spaces — GFCI protection shall be provided for lighting outlets in crawl spaces at or below grade level.

(j) Unfinished basements — for the purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms.

Statement of Problem and Substantiation for Public Comment

Delete the text so that the rule is a rule and not a definition.

Related Item

First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 14:43:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-322-NFPA 70-2015
Statement: The requirement for the Class C, D or E special purpose ground fault circuit Interrupter protection was deleted because of a concern for the improper application of this solution as well as insufficient substantiation to support expanding the requirement to these circuits.

An editorial change was made by deleting “locations” section and the sections renumbered as it was necessary due to the deletion of the items (1) and (2) of this section.

The rooftop exception was re-instated to clarify when the receptacle needs to be readily accessible.
The text regarding sinks has been revised to clarify how the measurement is made.

Patient care categories were added to correlate with Article 517 and NFPA 99.

The text regarding unfinished basements has been revised such that a definition for unfinished basements is unnecessary.
Public Comment No. 267-NFPA 70-2015 [Section No. 210.11(C)(4)]

(4) Garage Branch Circuits.
In addition to the number of branch circuits required by other parts of this section, at least one 20-ampere branch circuit shall be provided to supply receptacle outlet(s) in attached garages and in detached garages with electric power.

Statement of Problem and Substantiation for Public Comment

The first draft wording requires that electric power be provided to a detached garage at a dwelling unit. The decision to provide electric power to a detached garage is a design issue and not a code issue. Electric power to a detached garage is not required by the 2014 NEC. There is nothing in the substantiation for the PI that suggests a need for this new requirement to provide electric power to a detached garage.

Related Item
Public Input No. 1010-NFPA 70-2014 [New Section after 210.11(C)]

Submitter Information Verification
Submitter Full Name: DON GANIERE
Organization:  [Not Specified]
Street Address:  [Not Specified]
City:  [Not Specified]
State:  [Not Specified]
Zip:  [Not Specified]
Submittal Date:  Sat Jul 18 13:43:04 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The First Revision wording does not require that electric power be provided to a detached garage at a dwelling unit.
Public Comment No. 952-NFPA 70-2015 [Section No. 210.11(C)(4)]

(4) Garage Branch Circuits.
In addition to the number of branch circuits required by other parts of this section, at least one 20-ampere branch circuit shall be provided to supply garage receptacle outlet(s) required by 210.52(G)(1) and other outlets and devices in that particular garage. Such circuit(s) shall have no other outlets.
Exception: This branch circuit shall be permitted to supply a receptacle outlet(s) located immediately adjacent on the outside of the garage.

Statement of Problem and Substantiation for Public Comment

As originally proposed by PI 1010, this proposed language is similar in structure to the existing text at 210.11(C). This proposed text (added by this comment) is also being proposed at 210.52(G)(1). Section 210.52 is requirements for dwelling unit receptacle outlets. A more appropriate location for this text that deals with the branch circuit supplying these receptacle outlets is 210.11(C), which deals with required branch circuits for dwelling units.

This proposed text and the proposed exception will allow the garage lighting outlet(s) and related switches, along with an outdoor receptacle outlet(s) located on the outside of the garage to also be supplied from the garage branch circuit without the installer having to install a separate branch circuit to supply these lighting outlets and outside receptacle outlet as currently required by the 2014 NEC text at 210.52(G)(1).

Related Item
Public Input No. 1010-NFPA 70-2014 [New Section after 210.11(C)]
First Revision No. 330-NFPA 70-2015 [Section No. 210.11(C)(3)]

Submitter Information Verification
Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 14:51:29 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-324-NFPA 70-2015
Statement: Changes were made to clarify that readily accessible outdoor receptacle outlets are to be permitted on the garage branch circuit. These additional outlets provide convenience receptacles similar to those used in the garage.
210.12 Arc-Fault Circuit-Interrupter Protection.

Arc-fault circuit-interrupter protection shall be provided as required in 210.12(A), (B), and (C). The arc-fault circuit interrupter shall be installed in a readily accessible location.

(A) Dwelling Dormitory Units.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling units in dormitory units shall be protected by any of the means described in 210.12(A)(1) through (6):

(1) A listed combination-type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

(2) A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:

(4) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.

(5) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

(6) The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

(7) A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch-circuit overcurrent protective device where all of the following conditions are met:

(8) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.

(9) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

(10) The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

(11) If RMC, IMC, EMT, Type MC, or steel-armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters, and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(12) Where a listed conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Exception: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or metal wireways or auxiliary gutters or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

Informational Note No. 1: For information on combination-type and branch/feeder-type arc-fault circuit interrupters, see UL 1699-2011, Standard for Arc-Fault Circuit Interrupters. For information on outlet branch-circuit type arc-fault circuit interrupters, see UL Subject 1699A, Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on system combination AFCIs, see UL Subject 1699C, Outline of Investigation for System Combination Arc-Fault Circuit Interrupters.

Informational Note No. 2: See 29.6.3(5) of NFPA 72-2013, National Fire Alarm and Signaling Code, for information related to secondary power-supply requirements for smoke alarms installed in dwelling units.

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.
Dormitory Units.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and devices installed in dormitory unit bedrooms, living rooms, hallways, closets, bathrooms, and similar rooms shall be protected by a listed arc-fault circuit interrupter meeting the requirements of 210.12(A)(1) through (6) as appropriate.

Branch Circuit Extensions or Modifications — Dwelling Units and Dormitory Units.

In any of the areas specified in 210.12(A) or 210.12(C), where branch-circuit wiring is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

1. A listed combination-type AFCI located at the origin of the branch circuit
2. A listed outlet branch-circuit type-AFCI located at the first receptacle outlet of the existing branch circuit

Exception: AFCI protection shall not be required where the extension of the existing conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices.

Guest Rooms and Guest Suites.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and devices installed in guest rooms and guest suites of hotels and motels shall be protected by a listed arc-fault circuit interrupter meeting the requirements of 210.12(A)(1) through (6) as appropriate.

Statement of Problem and Substantiation for Public Comment

The current afci breakers on the market are prone to tripping for reasons not related to arcs or anything remotely dangerous. On every electrical contractor forum in every supply house and talking to countless EC's there are talks of contractors having to "chase ghosts", breakers tripping at random and not on demand (cant replicate trip). Many of these contractors, me included have spent countless dollars trying to find what is causing these trips. The findings of these Licensed Electrical Contractors in the field dealing with these breakers every day are that they ghost trip at random due to things such as ie: LED bulbs, electronic equipment of all kinds including but not limited to dvd players, TV's, computers etc, electronic noise, line side connections (power company conns) dimmers, electronic switching devices, vacuums, hair dryers, power tools, fluorescent light ballasts and even ham radios in the neighborhood. Nothing is wrong with any of this equipment it is just interfering with the electronics of the afcis. I have personally also had homeowners refrigerators tripping afci when it cycled into energy saving mode causing hundreds of dollars of spoiled food each time. I agree that the idea of afci technology is relevant but the current variation on the market is defective costing electrical contractors countless dollars trying to troubleshoot a circuit where there is nothing wrong. These devices should not be required in dwellings until such a time that these nuisance ghost trip issues can be resolved. By not doing so you are costing the very people (electrical contractors) who support and for who this code is written enough money to put us out of business. Contractors cannot bear this cost. Why do we have to bear the responsibility, cost and loss of respect and customers due to something which is obviously a manufacturer defect. If you doubt what I say please use your database of electrical contractors and do a poll of how many of these nuisance trips each are having, this is a serious enough issue. There are polls out there already which show over 80% of trade professional respondents who want to eliminate 210-12 altogether(mikeholt.com) I have yet to hear from a contractor who has not wasted thousands of dollars chasing these non existent afci ghosts. PLEASE TAKE THIS ISSUE SERIOUSLY, as I know the manufactures will deny any problems. Just because a product is mass produced does not mean that it has to be forced to market and definitely not forced into code until that product is 100% effective and free of nuisance issues which have proven to cost contractors countless dollars. It will also set off a firestorm when millions of homeowners lose there refrigerator and freezer contents because of a defective breaker. By leaving dormitories and guest rooms manufacturers still have places which are not permanent residences to BETA test and work out these issues. Another option is removing 210-12 altogether until afci technology is 100%. I personally think afci technology should be removed from premises wiring and integrated into all manufactured plug in or hard wired EQUIPMENT. This would eliminate all false circuit trips and would be a simple to troubleshoot problem as only faulty equipment would trip, not entire circuit.

Related Item

Public Input No. 4218-NFPA 70-2014 [Section No. 210.12]

Submitter Information Verification

Submitter Full Name: mike kline
Organization: Kline Electric inc
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 18 20:35:11 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The need for arc fault protection in dwelling units is well substantiated. No mention was made in the substantiation of contractors contacting AFCI manufacturers for assistance which is an important step in the problem resolution process.
Public Comment No. 439-NFPA 70-2015 [ Section No. 210.12(A) ]

(A) Dwelling Units.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling units shall be protected by any of the means described in 210.12(A)(1) through (6):

1. A listed combination-type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

2. A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

3. A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:
   4. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.
   5. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
   6. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

7. A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch-circuit overcurrent protective device where all of the following conditions are met:
   8. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.
   9. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
   10. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.
   11. The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination–type AFCI and shall be listed as such.

12. If RMC, IMC, EMT, Type MC, or steel-armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters, and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

13. Where a listed conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

**Exception:** Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or metal wireways or auxiliary gutters or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

Informational Note No. 1: For information on combination-type and branch/feeder-type arc-fault circuit interrupters, see UL 1699-2011, Standard for Arc-Fault Circuit Interrupters. For information on outlet branch-circuit type arc-fault circuit interrupters, see UL Subject 1699A, Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on system combination AFCIs, see UL Subject 1699C, Outline of Investigation for System Combination Arc-Fault Circuit Interrupters.

Informational Note No. 2: See 29.6.3(5) of NFPA 72-2013, National Fire Alarm and Signaling Code, for information related to secondary power-supply requirements for smoke alarms installed in dwelling units.

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Comment

The Committee Statement of FR329 which supported the elimination of 210.12 (A) (4) used excerpts from the UL research report titled “Effectiveness of Circuit Breakers in Mitigating Parallel Arcing Faults in the HomeRun”. It should be noted that this was updated by a later report titled “Evaluation of Run Length and Available Current on Breaker Ability to Mitigate Parallel Arcing Faults – Part II: Effect of run Length with 500A Available at the Panelboard”. The following statement is extracted from its summary on pages 3-4.

“The initial study on this topic attempted to evaluate the magnetic trip level of residential 15- and 20-amp circuit breakers to determine whether a generalized magnetic trip distribution could be found. The initial set of circuit breakers, which were sampled from four North...
American manufacturers and included circuit breakers of different designs for each manufacturer, suggested that 99% of all circuit breakers would magnetically trip at or below 300A for 15A breakers and 350A for 20A breakers. However, follow-up testing one year later negated this findings, with circuit breakers of the same model number but of a different batch had significantly different magnetic trip levels, varying by 50A or more for some manufacturers, yet varying for others. These results showed that magnetic trip levels could conceivably be controlled, but were not in all cases. The revised data showed that panelboard current and run length would need to be set assuming magnetic trip thresholds as high as 400-450A would be needed, which makes arc mitigating using magnetic trip levels not specifically calibrated for this application impractical as well as potentially unreliable. Therefore, the results of Part I of this work showed that circuit breakers with magnetic trip levels calibrated for the purpose of mitigating parallel arcing faults would be necessary."

This updated UL report clearly indicates that further investigation confirms that ordinary residential breakers used for arc mitigation are “impractical” and “potentially unreliable” from an arc fault protection perspective.

Additionally, many members of CMP 2 have witnessed testing which demonstrates that ordinary thermal magnetic circuit breakers will NOT provide arcing protection. This clearly refutes the misleading conclusions which some have drawn from previously submitted reports.

There is no technical reason to reduce the level of safety provided by the other five options by deleting the requirement for a listed system combination AFCI in option 4. Standard thermal magnetic circuit breakers are not designed, tested or listed to detect and interrupt low level arcing faults. The American Circuit Breaker Manufacturers Association (whose members consist of Eaton, General Electric, Schneider Electric and Siemens) does not support the claims that the magnetic trip characteristics will protect the home run circuit from parallel arcing faults.

The American Circuit Breaker Manufacturers Association (ACBMA) recommends that NFPA breakout the proposed deletion of 210.12(A)(4)(d) as a ballotable detail.

Related Item
First Revision No. 329-NFPA 70-2015 [Section No. 210.12(A)]

Submitter Information Verification
Submitter Full Name: KENNETH REMPE
Organization: Siemens Industry, Inc.
Affiliation: American Circuit Breaker Manufacturers Association (ACBMA)
Street Address: 
City: 
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Zip: 
Submittal Date: Wed Aug 26 11:25:26 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: During the First Draft stage 210.12(A)(4)(d) was removed since no product standard exists for a system combination AFCI. There is no listed system combination AFCI. Restating several reasons for continuing the action of removing 210.12(A)(4)(d): 1 - Acceptable alternative products meeting the listing requirements for an outlet branch-circuit AFCI (receptacle) and meeting the installation requirements of 210.12(A)(4) a, b and c continues to be encouraged. Listed OBC AFCIs are available in the marketplace that would meet the Code as written in the First Revision. 2 - As mentioned in the panel statement for the First Revision, the UL report “Influence of Damage and Degradation on Breakdown Voltage of NM Cables” clearly explains that parallel arcing on the “home run” portion of the branch circuit is unlikely to ignite the cable insulation or nearby combustibles under the conditions by which the samples were tested. Further, this report also categorizes the time that a parallel arc exists (in the home run) which is too short to ignite combustibles due to insufficient energy transfer. Additionally, the report informs that this short time duration is far shorter than the maximum time (8 half cycles) a listed AFCI is required to interrupt an parallel arcing fault which infrers that a listed AFCI at the service panel is not required to interrupt arcs of this short duration (1.4 of a cycle). Parallel arcing does not continue for the allowable maximum of 8 half cycles. 3 - The Panel is aware that this is a reduction in parallel arc protection in the “home run” and considers the trade off in protection, for the sake of making alternative protection devices available in the marketplace acceptable. As with other Code-required products, acceptable alternatives promote competition and new product development.
Dwelling Units.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling units shall be protected by any of the means described in 210.12(A)(1) through (6):

1. A listed combination-type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

2. A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

3. A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:

   4. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.

   5. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

   6. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

7. A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch-circuit overcurrent protective device where all of the following conditions are met:

   8. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.

   9. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

   10. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

11. If RMC, IMC, EMT, Type MC, or steel-armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters, and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

12. Where a listed conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Exception:

Where AFCI protection shall not be required for an individual branch circuit to supplying a fire alarm system, installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or metal wireways or auxiliary gutters or steel-sheathed a metallic raceway, metallic auxiliary gutter, steel-armored cable, Type AC, MC or Type MC, AC systems, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted metallic boxes, conduit bodies, and enclosures.

Informational Note No. 1: For information on combination-type and branch/feeder-type arc-fault circuit interrupters, see UL 1699-2011, Standard for Arc-Fault Circuit Interrupters. For information on outlet branch-circuit type arc-fault circuit interrupters, see UL Subject 1699A, Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on system combination AFCIs, see UL Subject 1699C, Outline of Investigation for System Combination Arc-Fault Circuit Interrupters.

Informational Note No. 2: See 29.6.3(5) of NFPA 72-2013, National Fire Alarm and Signaling Code, for information related to secondary power-supply requirements for smoke alarms installed in dwelling units.

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.
The only thing not allowed is LTFMC and FMC both are made with steel and have the same strength as the armored cable and should be allowed. It would be valuable to have some flexibility in the field for an outdoor or indoor installations. You would only need to reference a metallic raceway and eliminate the laundry list. Metal outlet boxes and junction boxes is to narrow of an allowance, a more general statement covering most installation would be Metal boxes, conduit fittings and enclosures. The current language is confusing, “permitted to be omitted” and appears at the end of the paragraph. Say what this is for (no AFCI) and the give the requirements (Steel everything).

**Related Item**
- First Revision No. 329-NFPA 70-2015 [Section No. 210.12(A)]
- Public Input No. 3596-NFPA 70-2014 [Section No. 210.12(A)]

**Submitter Information Verification**

- **Submitter Full Name:** ALFIO TORRISI
- **Organization:** Master
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Mon Sep 14 19:31:48 EDT 2015

**Committee Statement**

- **Committee Action:** Rejected but held
- **Resolution:** This is new material that has not been subject to public comment but has merit.
Public Comment No. 822-NFPA 70-2015 [Section No. 210.12(A)]

(A) Dwelling Units.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling units shall be protected by any of the means described in 210.12(A)(1) through (6):

1. A listed combination-type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

2. A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

3. A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:
   4. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.
   5. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
   6. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

7. A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch-circuit overcurrent protective device where all of the following conditions are met:
   8. The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.
   9. The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
  10. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.
  11. The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements for a system combination-type AFCI and shall be listed as such.

1. If RMC, IMC, EMT, Type MC, or steel-armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters, and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

2. Where a listed conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Exception: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or metal wireways or auxiliary gutters or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

Informational Note No. 1: For information on combination-type and branch/feeder-type arc-fault circuit interrupters, see UL 1699-2011, Standard for Arc-Fault Circuit Interrupters. For information on outlet branch-circuit type arc-fault circuit interrupters, see UL Subject 1699-A, Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on system combination AFCIs, see UL Subject 1699-C, Outline of Investigation for System Combination Arc-Fault Circuit Interrupters.

Informational Note No. 2: See 29.6.3(5) of NFPA 72-2013, National Fire Alarm and Signaling Code, for information related to secondary power-supply requirements for smoke alarms installed in dwelling units.

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

Revision only adds new item (4)(d). Remaining text is existing.
There is no technical reason to reduce the level of safety afforded by the listed solutions in the other five installation options by deleting the requirement for a listed system combination AFCI in option 4. There is a need to verify that the circuit breaker and OBC AFCI can together provide arc fault protection for the entire branch circuit. NEMA proposed the existing text in 210.12(A)(4) as part of ROC-2-44 in the 2014 revision cycle. Standard thermal-magnetic circuit breakers are not designed, tested or listed to detect and interrupt low level arcing faults. There is no NEMA circuit breaker manufacturer that supports these claims being made about their products.

Related Item
First Revision No. 329-NFPA 70-2015 [Section No. 210.12(A)]

Submitter Information Verification
Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
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City:
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Submittal Date: Mon Sep 21 09:45:44 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: During the First Draft stage 210.12(A)(4)(d) was removed since no product standard exists for a system combination AFCI. There is no listed system combination AFCI. Restating several reasons for continuing the action of removing 210.12(A)(4)(d); 1 - Acceptable alternative products meeting the listing requirements for an outlet branch-circuit AFCI (receptacle) and meeting the installation requirements of 210.12(A)(4) a, b and c continues to be encouraged. Listed OBC AFCIs are available in the marketplace that would meet the Code as written in the First Revision. 2 - As mentioned in the panel statement for the First Revision, the UL report “Influence of Damage and Degradation on Breakdown Voltage of NM Cables” clearly explains that parallel arcing on the “home run” portion of the branch circuit is unlikely to ignite the cable insulation or nearby combustibles under the conditions by which the samples were tested. Further, this report also categorizes the time that a parallel arc exists (in the home run) which is too short to ignite combustibles due to insufficient energy transfer. Additionally, the report informs that this short time duration is far shorter than the maximum time (8 half cycles) a listed AFCI is required to interrupt an parallel arcing fault which infers that a listed AFCI at the service panel is not required to interrupt arcs of this short duration (1.4 of a cycle). Parallel arcing does not continue for the allowable maximum of 8 half cycles. 3 - The Panel is aware that this is a reduction in parallel arc protection in the “home run” and considers the trade off in protection, for the sake of making alternative protection devices available in the marketplace acceptable. As with other Code-required products, acceptable alternatives promote competition and new product development.
Public Comment No. 855-NFPA 70-2015 [Section No. 210.12(A)]

(A) Dwelling Units.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling units shall be protected by any of the means described in 210.12(A)(1) through (6):

1. A listed combination-type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

2. A listed branch-feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

3. A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:
   - The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.
   - The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
   - The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

4. A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch-circuit overcurrent protective device where all of the following conditions are met:
   - The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.
   - The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.
   - The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

5. The combination of the branch-circuit overcurrent device and outlet branch-circuit AFCI shall be identified as meeting the requirements of NFPA 70 at the time the installation is made.

Exception: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, Type MC, or steel-armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters, and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Where a listed conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Informational Note No. 1: For information on combination-type and branch-feeder-type arc-fault circuit interrupters, see UL 1699, Standard for Arc-Fault Circuit Interrupters. For information on outlet branch-circuit type arc-fault circuit interrupters, see UL Subject 1699A, Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on system combination AFCIs, see UL Subject 1699C, Outline of Investigation for System Combination Arc-Fault Circuit Interrupters.

Informational Note No. 2: See 39.6.3(5) of NFPA 72-2013, National Fire Alarm and Signaling Code, for information related to secondary power-supply requirements for smoke alarms installed in dwelling units.

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Comment

The deletion of 210.12(A)(4)(d) is not acceptable due to the reduction in safety created by eliminating the listing requirement. The listing requirement for demonstrating arc fault protection of the entire branch circuit and the cords connected to it is currently found in all four permitted protection methods. In order to remove a listing requirement from any of the four protection methods and not reduce or compromise safety, you must be convinced the protection method will operate within the UL 1699 parameters without any verification.

The acceptance of this FR ignores the Panel’s acceptance of Comment 2-52 that was introduced by UL and others during the development of the 2014 NEC. The Panel statement cites the UL research report titled, “Effectiveness of Circuit Breakers in Mitigating
Parallel Arcing Faults in the Home Run" as providing significant statistical assurance that the "home run" portion of the branch circuit will be protected from parallel arcing faults by standard circuit breakers. This report was revised three months after it was issued, as documented in UL Comment 2-52, and then followed up by two additional reports based on further research. The second report, "Evaluation of Run Length and Available Current on Breaker Ability to Mitigate Parallel Arcing Faults - Part I: Effect of Panelboard Current for 50 Foot Run Lengths" refutes critical findings in the first report, which includes the following:

a) "Evaluation of the magnetic trip level of circuit breakers…show that breaker magnetic trip levels are not sufficiently reliable and consistent to allow for a generalized assumption of an upper bound, as was proposed before", and

b) "…more controlled verification of the magnetic trip level of a circuit breaker intended for mitigating parallel arcing faults may be needed", and

c) "…the magnetic trip level of circuit breakers is not as well controlled as was previously found in a previous study.", and

d) "Circuit breakers with magnetic trip levels 200A or greater failed to mitigate a large fraction of the arcing events in eight half-cycles."

All of the UL research reports on this topic must be considered, unfortunately the only one cited in the PI and the Panel statement was the initial unrevised UL report. It is important for the public record to reflect accurate information for Panel consideration and comment. The Panel statement also cites the UL research report titled “Influence of Damage and Degradation on Breakdown Voltage of NM Cables”, however, the conclusion cited in the Committee statement focuses on only two important but very narrow damage events; voltage surges and hammer damage. There are many other ways and documented occurrences about how NM cable can be damaged.

Since the submission of UL Comment 2-52 test data has been presented to the UL 1699 Standards Technical Panel showing that standard thermal-magnetic circuit breakers cannot pass the UL 1699 performance requirements relating to branch circuit arc fault protection, leaving a protection gap for the home run of the branch circuit. No data has been presented to justify removing the listing requirement in 210.12(A)(4). Standard thermal-magnetic circuit breakers are not designed and tested to detect and interrupt low level arcing faults. No manufacturer claims that they can, which is why AFCI protection was identified as a need to provide such protection.

Related Item
First Revision No. 329-NFPA 70-2015 [Section No. 210.12(A)]

Submitter Information Verification
Submitter Full Name: Ed Larsen
Organization: Schneider Electric USA
Affiliation: Schneider Electric USA
Street Address: 
City: 
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Zip: 
Submittal Date: Mon Sep 21 14:22:21 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: During the First Draft stage 210.12(A)(4)(d) was removed since no product standard exists for a system combination AFCI. There is no listed system combination AFCI. Restating several reasons for continuing the action of removing 210.12(A)(4)(d): 1 - Acceptable alternative products meeting the listing requirements for an outlet branch-circuit AFCI (receptacle) and meeting the installation requirements of 210.12(A)(4) a, b and c continues to be encouraged. Listed OBC AFCIs are available in the marketplace that would meet the Code as written in the First Revision. 2 - As mentioned in the panel statement for the First Revision, the UL report “Influence of Damage and Degradation on Breakdown Voltage of NM Cables” clearly explains that parallel arcing on the "home run" portion of the branch circuit is unlikely to ignite the cable insulation or nearby combustibles under the conditions by which the samples were tested. Further, this report also categorizes the time that a parallel arc exists (in the home run) which is too short to ignite combustibles due to insufficient energy transfer. Additionally, the report informs that this short time duration is far shorter than the maximum time (8 half cycles) a listed AFCI is required to interrupt an parallel arcing fault which infers that a listed AFCI at the service panel is not required to interrupt arcs of this short duration (1.4 of a cycle). Parallel arcing does not continue for the allowable maximum of 8 half cycles. 3 - The Panel is aware that this is a reduction in parallel arc protection in the "home run" and considers the trade off in protection, for the sake of making alternative protection devices available in the marketplace acceptable. As with other Code-required products, acceptable alternatives promote competition and new product development.
Public Comment No. 93-NFPA 70-2015 [Section No. 210.12(A)]

(A) Dwelling Units.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling units shall be protected by any of the means described in 210.12(A)(1) through (6):

(1) A listed combination-type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit

(2) A listed branch/feeder-type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:

(4) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.

(5) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

(6) The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

(7) A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch-circuit overcurrent protective device where all of the following conditions are met:

(8) The branch-circuit wiring shall be continuous from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.

(9) The maximum length of the branch-circuit wiring from the branch-circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG conductor or 21.3 m (70 ft) for a 12 AWG conductor.

(10) The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit.

(11) If RMC, IMC, EMT, Type MC, or steel-armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters, and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

(12) Where a listed conduit or tubing or Type MC cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a listed outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Exception: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or metal wireways or auxiliary gutters or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

Informational Note No. 1: For information on combination-type and branch/feeder-type arc-fault circuit interrupters, see UL 1699-2011, Standard for Arc-Fault Circuit Interrupters. For information on outlet branch-circuit type arc-fault circuit interrupters, see UL Subject 1699A Outline, Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on system combination AFCIs, see UL Subject 1699C, Outline of Investigation for System Combination Arc-Fault Circuit Interrupters.

Informational Note No. 2: See 29.6.3(S) of NFPA 72-2013, National Fire Alarm and Signaling Code, for information related to secondary power-supply requirements for smoke alarms installed in dwelling units.

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

Statement of Problem and Substantiation for Public Comment

In informational note 1 corrected reference to UL 1699A Outline, removed reference to UL Subject 1699C which is now part of UL 1699A Outline.

In informational note 2 updated reference to NFPA 72 to 2016.

Related Public Comments for This Document

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<td>Public Comment No. 39-NFPA 70-2015 [Section No. 110.31]</td>
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Public Comment No. 41-NFPA 70-2015 [Section No. 399.10]
Public Comment No. 42-NFPA 70-2015 [Section No. Table]
Public Comment No. 43-NFPA 70-2015 [Section No. B.310.15(B)(2)]
Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]
Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]
Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]
Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]
Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]
Public Comment No. 53-NFPA 70-2015 [Section No. 840.44(B)]
Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]
Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]
Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]
Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]
Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]
Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]
Public Comment No. 85-NFPA 70-2015 [Section No. 110.28]
Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]
Public Comment No. 112-NFPA 70-2015 [Definition: Equipment Rack.]
Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]
Related Item
First Revision No. 329-NFPA 70-2015 [Section No. 210.12(A)]

Submitter Information Verification
Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jun 29 23:57:15 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected but see related SR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>SR-319-NFPA 70-2015 The addition of the word “Outline” would be redundant.</td>
</tr>
<tr>
<td>Statement:</td>
<td>The standards have been updated to the current edition. UL 1699C has been deleted since the document has been withdrawn.</td>
</tr>
</tbody>
</table>
Public Comment No. 36-NFPA 70-2015 [Section No. 210.12(B)]

(B) Dormitory Units.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and devices installed in dormitory units, bedrooms, living rooms, hallways, closets, bathrooms and similar rooms, shall be protected by a listed arc-fault circuit interrupter meeting the requirements of 210.12(A)(1) through (6) as appropriate.

Statement of Problem and Substantiation for Public Comment

Whereas the need for AFCI protection has been satisfactorily demonstrated, expanding its application throughout the dormitory unit is consistent with the companion change proposed in 210.12(A).

Related Item

First Revision No. 351-NFPA 70-2015 [Section No. 210.12(C)]

Submitter Information Verification

Submitter Full Name: J GRANT HAMMETT
Organization: COLORADO STATE ELECTRICAL BOARD
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 24 14:27:59 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-320-NFPA 70-2015
Statement: "As appropriate" is a vague and unenforceable term. It has been deleted in accordance with NEC Style Manual Section 3.2.1. As previously worded, the arc-fault circuit-interrupter could be required to meet all of the requirements of 210.12(A)(1) through 210.12(A)(6). Revised wording matches how 210.12(A) expresses the same.
Public Comment No. 676-NFPA 70-2015 [Section No. 210.12(B)]

(B) Dormitory Units.
All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and devices installed in dormitory unit bedrooms, living rooms, hallways, closets, bathrooms, kitchens, and similar rooms shall be protected by a listed arc-fault circuit interrupter meeting the requirements of 210.12(A)(1) through (6) as appropriate.

Statement of Problem and Substantiation for Public Comment
We recently experienced a costly fire event in a college dormitory kitchen walk-in refrigerator. A section of heat tracing cable starting arcing but did not trip the circuit breaker. The fault escalated into sparks and fire igniting stored items. A dry sprinkler fused and discharged inside the walk-in refrigerator. The incident caused a significant damage to a central college dormitory, closing the facility.
I believe an AFCI may have prevented the incident. Code section 210.12 (A) Dwelling Units includes kitchen circuits. Code section 210.12 (C) should include kitchens as well.

Related Item
First Revision No. 351-NFPA 70-2015 [Section No. 210.12(C)]

Submitter Information Verification
Submitter Full Name: Paul Dunphy
Organization: Harvard University
Affiliation: Campus Services, Engineering and Utilities
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 16 14:14:52 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: A dormitory unit with a kitchen in the dormitory is a dwelling unit, and AFCI protection is already addressed in 210.12 (A). The location selected for this language in dormitory units would not address the situation which the submitter highlighted. Section 210.12(B) is not the appropriate location for this language (the addition of kitchens) to address the concerns of the submitter.
Public Comment No. 815-NFPA 70-2015 [ Section No. 210.12(B) ]

(B) Dormitory Units.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and devices installed in dormitory unit bedrooms, living rooms, hallways, closets, bathrooms, and similar rooms shall be protected by a listed arc-fault circuit interrupter meeting the requirements of any of the means described in 210.12(A)(1) through (6), as appropriate.

Statement of Problem and Substantiation for Public Comment

“As appropriate” is a vague and unenforceable term. Delete in accordance with NEC® Style Manual 3.2.1. As worded, the arc-fault circuit-interrupter could be required to meet ALL of the requirements of 210.12(A)(1) through 210.12(A)(6). Revise wording to match how 210.12(A) expresses the same. All means in 210.12(A)(1) through 210.12(A)(6) are already specified as being listed; redundant to repeat here.

Related Item
First Revision No. 351-NFPA 70-2015 [Section No. 210.12(C)]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 09:18:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-320-NFPA 70-2015
Statement: “As appropriate” is a vague and unenforceable term. It has been deleted in accordance with NEC Style Manual Section 3.2.1. As previously worded, the arc-fault circuit-interrupter could be required to meet all of the requirements of 210.12(A)(1) through 210.12(A)(6). Revised wording matches how 210.12(A) expresses the same.
(C) Branch Circuit Extensions or Modifications — Dwelling Units and Dormitory Units.

In any of the areas specified in 210.12(A) or 210.12(C), where branch-circuit wiring is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

1. A listed combination-type AFCI located at the origin of the branch circuit
2. A listed outlet branch-circuit type-AFCI located at the first receptacle outlet of the existing branch circuit

Exception: AFCI protection shall not be required where the extension of the existing conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that section 210.12(D) be rewritten with respect to "as appropriate" to comply with the NEC Style Manual.

Related Item
First Revision No. 350-NFPA 70-2015 [Section No. 210.12(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 14:52:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-320-NFPA 70-2015
Statement: "As appropriate" is a vague and unenforceable term. It has been deleted in accordance with NEC Style Manual Section 3.2.1. As previously worded, the arc-fault circuit-interrupter could be required to meet all of the requirements of 210.12(A)(1) through 210.12(A)(6). Revised wording matches how 210.12(A) expresses the same.
Branch Circuit Extensions or Modifications — Dwelling Units and Dormitory Units.

In any of the areas specified in 210.12(A) or 210.12(C), where branch-circuit wiring is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

1. A listed combination-type AFCI located at the origin of the branch circuit
2. A listed outlet branch-circuit type-AFCI located at the first receptacle outlet of the existing branch circuit

Exception: AFCI protection shall not be required where the extension of the existing conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices.

Statement of Problem and Substantiation for Public Comment

This section should be moved down to the bottom and the reference dwelling unit and dormitory units should be removed. This way the section will now apply to A- Dwelling's, B -dormitory's and C- guest suites. a companion PC will be submitted to change 210.12 (D) to (C)

Related Item
Public Input No. 3009-NFPA 70-2014 [Section No. 210.12(B)]
First Revision No. 350-NFPA 70-2015 [Section No. 210.12(B)]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: master
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 16 18:22:09 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-328-NFPA 70-2015
Statement: The section has been reorganized to improve the flow. In the Branch Circuit Extensions and Modifications subsections the text has been revised to reflect the reorganization and to correct a circular reference.

“As appropriate” is a vague and unenforceable term. It has been deleted in accordance with NEC Style Manual Section 3.2.1. As previously worded, the arc-fault circuit-interrupter could be required to meet all of the requirements of 210.12(A)(1) through 210.12(A)(6). Revised wording matches how 210.12(A) expresses the same.
### Public Comment No. 816-NFPA 70-2015 [Section No. 210.12(C)]

(C) Branch Circuit Extensions or Modifications — Dwelling Units and Dormitory Units.

In any of the areas specified in 210.12(A) or 210.12(C), where branch-circuit wiring is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

1. A listed combination-type AFCI located at the origin of the branch circuit
2. A listed outlet branch-circuit type-AFCI located at the first receptacle outlet of the existing branch circuit

**Exception:** AFCI protection shall not be required where the extension of the existing conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices.

### Statement of Problem and Substantiation for Public Comment

Correlation issue. First Revisions FR 350 and FR 351 revised the subdivision of 210.12, redesignating 210.12(B) as 210.12(C) and 210.12(C) as 210.12(B). The addition in FR 350 in redesignated 210.12(C) of "or 210.12(C)" results in a circular reference to itself.

**Related Item**
First Revision No. 350-NFPA 70-2015 [Section No. 210.12(B)]

### Submitter Information Verification

**Submitter Full Name:** VINCE BACLAWSKI  
**Organization:** NEMA

### Committee Statement

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-328-NFPA 70-2015  
**Statement:** The section has been reorganized to improve the flow. In the Branch Circuit Extensions and Modifications subsections the text has been revised to reflect the reorganization and to correct a circular reference.

"As appropriate" is a vague and unenforceable term. It has been deleted in accordance with NEC Style Manual Section 3.2.1. As previously worded, the arc-fault circuit-interrupter could be required to meet all of the requirements of 210.12(A)(1) through 210.12(A)(6). Revised wording matches how 210.12(A) expresses the same.
Public Comment No. 1573-NFPA 70-2015 [Section No. 210.12(D)]

(D) Guest Rooms and Guest Suites.
All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and devices installed in guest rooms and guest suites of hotels and motels shall be protected by a listed arc-fault circuit interrupter meeting the requirements of 210.12(A)(1) through (6) as appropriate.

delete section

Statement of Problem and Substantiation for Public Comment
There was no technical data or sufficient substantiation indicating problems or hazards relating directly to guest rooms to add this section to the code. Hotel and motel rooms are wired and managed differently than dwelling units and should not be subject to the same requirements without data to support it.

Related Item
First Revision No. 352-NFPA 70-2015 [New Section after 210.12(C)]

Submitter Information Verification
Submitter Full Name: Michael Weaver
Organization: M&W Electric
Affiliation: NECA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:34:58 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: There is no substantiation provided that the management of wiring systems in guest suites and guest rooms can mitigate arcing faults. Sufficient substantiation had been provided to support the First Revision language.
Public Comment No. 683-NFPA 70-2015 [Section No. 210.12(D)]

(D C) Guest Rooms and Guest Suites.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and devices installed in guest rooms and guest suites of hotels and motels shall be protected by a listed arc-fault circuit interrupter meeting the requirements of 210.12(A)(1) through (6) as appropriate.

Statement of Problem and Substantiation for Public Comment

see companion PC 682. this change would make the modification allowance apply to all sections

Related Item

First Revision No. 350-NFPA 70-2015 [Section No. 210.12(B)]
First Revision No. 352-NFPA 70-2015 [New Section after 210.12(C)]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 16 18:34:24 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-328-NFPA 70-2015
Statement: The section has been reorganized to improve the flow. In the Branch Circuit Extensions and Modifications subsections the text has been revised to reflect the reorganization and to correct a circular reference.

“As appropriate” is a vague and unenforceable term. It has been deleted in accordance with NEC Style Manual Section 3.2.1. As previously worded, the arc-fault circuit-interrupter could be required to meet all of the requirements of 210.12(A)(1) through 210.12(A)(6). Revised wording matches how 210.12(A) expresses the same.
Guest Rooms and Guest Suites.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and devices installed in guest rooms and guest suites of hotels and motels shall be protected by a listed arc-fault circuit interrupter meeting the requirements of any of the means described in 210.12(A)(1) through (6), as appropriate.

Statement of Problem and Substantiation for Public Comment

NEMA supports the First Revision going forward but essential revisions are necessary to avoid misinterpretation and enforceability issues.

“As appropriate” is a vague and unenforceable term. Delete in accordance with NEC® Style Manual 3.2.1.

As worded, the arc-fault circuit-interrupter could be required to meet ALL of the requirements of 210.12(A)(1) through 210.12(A)(6).

Revise wording to match how 210.12(A) expresses the same. All means in 210.12(A)(1) through 210.12(A)(6) are already specified as being listed; redundant to repeat here.

Related Item
First Revision No. 352-NFPA 70-2015 [New Section after 210.12(C)]

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-328-NFPA 70-2015
Statement: The section has been reorganized to improve the flow. In the Branch Circuit Extensions and Modifications subsections the text has been revised to reflect the reorganization and to correct a circular reference.

“As appropriate” is a vague and unenforceable term. It has been deleted in accordance with NEC Style Manual Section 3.2.1. As previously worded, the arc-fault circuit-interrupter could be required to meet all of the requirements of 210.12(A)(1) through 210.12(A)(6). Revised wording matches how 210.12(A) expresses the same.
210.17. Guest Rooms and Guest Suites.

Guest rooms and guest suites that are provided with permanent provisions for cooking shall have branch circuits installed to meet the rules for dwelling units.

Statement of Problem and Substantiation for Public Comment

This is already in section 210.60 and should be removed

Related Item
First Revision No. 357-NFPA 70-2015 [Section No. 210.3]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 16 18:44:07 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This is not already covered in 210.60. Section 210.17 is in Part I of Article 210 which pertains to general provisions. Section 210.60 is in Part III which pertains to required outlets.
210.19 Conductor — Minimum Ampacity and Size.

(A) Branch Circuits Not More Than 600 Volts.

Informational Note No. 1: See 310.15 for ampacity ratings of conductors.

Informational Note No. 2: See Part II of Article 430 for minimum rating of motor branch-circuit conductors.

Informational Note No. 3: See 310.15(A)(3) for temperature limitation of conductors.

Informational Note No. 4: Conductors for branch circuits as defined in Article 100, sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent, provide reasonable efficiency of operation. See Informational Note No. 2 of 215.2(A)(1) for voltage drop on feeder conductors.

(1) General.

Branch-circuit conductors shall have an ampacity not less than the maximum load to be served. Conductors shall be sized to carry not less than the larger of 210.19(A)(1)(a) or (b).

(a) Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum branch-circuit conductor size shall have an allowable ampacity not less than the noncontinuous load plus 125 percent of the continuous load.

(b) The minimum branch-circuit conductor size shall have an allowable ampacity not less than the maximum load to be served after the application of any adjustment or correction factors.

Exception: If the assembly, including the overcurrent devices protecting the branch circuit(s), is listed for operation at 100 percent of its rating, the allowable ampacity of the branch-circuit conductors shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load.

(2) Branch Circuits with More Than One Receptacle.

Conductors of branch circuits supplying more than one receptacle for cord-and-plug-connected portable loads shall have an ampacity of not less than the rating of the branch circuit.

(3) Household Ranges and Cooking Appliances.

Branch-circuit conductors supplying household ranges, wall-mounted ovens, counter-mounted cooking units, and other household cooking appliances shall have an ampacity not less than the rating of the branch circuit and not less than the maximum load to be served. For ranges of 8 3/4 kW or more rating, the minimum branch-circuit rating shall be 40 amperes.

Exception No. 1: Conductors tapped from a 50-ampere branch circuit supplying electric ranges, wall-mounted electric ovens, and counter-mounted electric cooking units shall have an ampacity of not less than 20 amperes and shall be sufficient for the load to be served. These tap conductors include any conductors that are a part of the leads supplied with the appliance that are smaller than the branch-circuit conductors. The taps shall not be longer than necessary for servicing the appliance.

Exception No. 2: The neutral conductor of a 3-wire branch circuit supplying a household electric range, a wall-mounted oven, or a counter-mounted cooking unit shall be permitted to be smaller than the ungrounded conductors where the maximum demand of a range of 8 3/4-kW or more rating has been calculated according to Column C of Table 220.55, but such conductor shall have an ampacity of not less than 70 percent of the branch-circuit rating and shall not be smaller than 10 AWG.

(4) Other Loads.

Branch-circuit conductors that supply loads other than those specified in 210.3 and other than cooking appliances as covered in 210.19(A)(3) shall have an ampacity sufficient for the loads served and shall not be smaller than 14 AWG.

Exception No. 1: Tap conductors shall have an ampacity sufficient for the load served. In addition, they shall have an ampacity of not less than 15 for circuits rated less than 40 amperes and not less than 20 for circuits rated at 40 or 50 amperes and only where these tap conductors supply any of the following loads:

(a) Individual lampholders or luminaires with taps extending not longer than 450 mm (18 in.) beyond any portion of the lampholder or luminaire

(b) A luminaire having tap conductors as provided in 410.117

(c) Individual outlets, other than receptacle outlets, with taps not over 450 mm (18 in.) long

(d) Infrared lamp industrial heating appliances

(e) Nonheating leads of deicing and snow-melting cables and mats

Exception No. 2: Fixture wires and flexible cords shall be permitted to be smaller than 14 AWG as permitted by 240.5.

(B) Branch Circuits Over 600 Volts.
The ampacity of conductors shall be in accordance with 310.15 and 310.60, as applicable. Branch-circuit conductors over 600 volts shall be sized in accordance with 210.19(B)(1) or (B)(2).

(1) General.

The ampacity of branch-circuit conductors shall not be less than 125 percent of the designed potential load of utilization equipment that will be operated simultaneously.

(2) Supervised Installations.

For supervised installations, branch-circuit conductor sizing shall be permitted to be determined by qualified persons under engineering supervision. Supervised installations are defined as those portions of a facility where both of the following conditions are met:

(1) Conditions of design and installation are provided under engineering supervision.

(2) Qualified persons with documented training and experience in over 600-volt systems provide maintenance, monitoring, and servicing of the system.

Statement of Problem and Substantiation for Public Comment

I agree with the Panel's statement for PI 1268, that two separate comparisons are required to size the conductor properly. I still maintain that the current text is confusing. I would first ask the Panel if there is a difference between ampacity, which is defined in Article 100, and allowable ampacity which is not. I have asked numerous users of the Code to read the current text of 210.19(A) and describe the difference between allowable ampacity and ampacity. The majority respond that an ampacity is read from a table in 310.15 such as Table 310.15(B)(16), and an allowable ampacity results from considering conditions of use and applying adjustment and correction factors. Although this is incorrect and actually backwards, the language in the text of 210.19(A)(1)(b) of "an allowable ampacity not less than the maximum load to be served after the application of any adjustment or correction factors." leads users of the Code to believe an allowable ampacity results from considering conditions of use. Again, this is incorrect. If ampacity is defined in Article 100 as considering the conditions of use, and an allowable ampacity is from an allowable ampacity table in 310.15 such as Table 310.15(B)(16), how can there be an allowable ampacity after conditions of use? After conditions of use and adjustment and correction factors have been applied, is not the result an ampacity, not an allowable ampacity? The current charging text of 210.19(A)(1) requires the conductor to have an ampacity not less than the maximum load to be served. How is the intent of that statement any different than the intent of 210.19(A)(1)(b)? I have proposed removing text in the charging language of 210.19(A)(1), only as it seems to be redundant with 210.19(A)(1)(b), it would be fine if it remained. In 210.19(A)(1)(b), I have removed the word allowable as the current text is technically incorrect and inconsistent with the definition of ampacity and allowable ampacity tables of 310.15 and it is causing confusion. If the panel disagrees, then I ask for the Panel to clarify the two separate comparisons by defining the difference between ampacity and allowable ampacity as used in this section since both terms are used.

Related Public Comments for This Document

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<thead>
<tr>
<th>Related Comment</th>
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<td>Public Comment No. 393-NFPA 70-2015 [Section No. 215.2(A)(1)]</td>
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<tr>
<td>Public Comment No. 1555-NFPA 70-2015 [Section No. 230.42(A)]</td>
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</tbody>
</table>

Related Item

Public Input No. 1268-NFPA 70-2014 [Section No. 210.19(A)(1)]

Submitter Information Verification

Submitter Full Name: DERRICK ATKINS
Organization: Minneapolis Electrical JATC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 17:56:42 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The charging sentence establishes the fundamental requirement for sizing a conductor to serve the load and needs to remain. Removing the word "allowable" will create further confusion and inconsistency. The ampacity must be calculated in accordance with 310.15. Also see Informational Note in 310.15(B) for an explanation of allowable ampacity.
Public Comment No. 54-NFPA 70-2015 [Section No. 210.52(A)(2)]

(2) Wall Space.

As used in this section, a wall space shall include the following:

1. Any space 600 mm (2 ft) or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, and fixed cabinets that do not have countertops or work surfaces.
2. The space occupied by fixed panels in walls, excluding sliding panels.
3. The space afforded by fixed room dividers, such as freestanding bar-type counters or railings.

Statement of Problem and Substantiation for Public Comment

To correlate with 210.52(C)(5). First Revision FR 308 to 210.52(C)(5) raised the issue of installation of receptacles in work surfaces by revising the Information Note to additionally include work surfaces. The Committee Statement for First Revision FR324 nonetheless makes it clear that the intent is not to address kitchen countertops alone.

Consequently, 210.52(C)(5), 210.52(A)(2), 210.52(A)(4), and 210.52(C) need to include requirements for receptacles outlets in work surfaces.

Related Item
First Revision No. 324-NFPA 70-2015 [Section No. 210.52(A)(2)]
First Revision No. 308-NFPA 70-2015 [Section No. 210.52(C)(5)]

Submitter Information Verification

Submitter Full Name: BRIAN ROCK
Organization: HUBBELL INCORPORATED
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jun 25 10:51:51 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: The addition of "similar work surfaces" was made to provide clarity and inclusion of these types of surfaces that may also be found in the areas identified in 210.52(A) in addition to countertops, as being counted as wall space.
(2) Wall Space.

As used in this section, a wall space shall include the following:

1. Any space 600 mm (2 ft) or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, and fixed cabinets that do not have countertops and fireplaces.

2. The space occupied by fixed panels in walls, excluding sliding panels.

3. The space afforded by fixed room dividers, such as freestanding bar-type counters or railings.

Statement of Problem and Substantiation for Public Comment

All the CMP 2 discussion that resulted in the term "fixed cabinets" being added in 2011 was directly related to the receptacle outlets provided for the wall spaces above the countertops in kitchens, pantries, breakfast rooms and dining rooms. This was not to say the receptacle outlet could not be used for an appliance that was not located on the countertop, say a vacuum cleaner, but that the receptacle outlet would not qualify as the required receptacle outlet for an adjacent wall space. There is no doubt the 2011 action created the unintended consequence of eliminating the requirement for a receptacle outlet in rooms such as libraries which had fixed cabinets around the entire floor line of the room.

CMP 2 attempted to address the situation in the First Draft by adding the words "without countertops" to 210.52(A)(2)(1) which does not correct the unintended consequences of 2011 and will add additional confusion. What qualifies as a "countertop" in a library or a den?

Section 210.52(A)(4) already restricts receptacle outlets above countertops in kitchens, pantries, breakfast rooms and dining rooms from qualifying for adjacent wall spaces so the 2011 action was unnecessary. Removing "and fixed cabinets without countertops" from 210.52(A)(2)(1) will address the unintended consequences of the 2011 action without compromising the intent of the First Draft revision.

Related Item

First Revision No. 324-NFPA 70-2015 [Section No. 210.52(A)(2)]

Submitter Information Verification

Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSP
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 12:41:04 EDT 2015

Committee Statement

Committee Action: Rejected

Resolution: The proposed change would return the language of 210.52(A)(2) to its original language of NEC 2011 as this would create the same problem was addressed when 210.52(A)(4) was added in that same cycle. The addition of 210.52(A)(4) was substantiated as follows: "Required countertop receptacles cannot be used to comply with wall space requirements, an example is a 3 ft wall space between the end of a counter and a door, that wall space needs a receptacle and cannot use a countertop receptacle to comply." The changes in 210.52(A)(2) were to address that with the addition of 210.52(A)(4) a change would be required to 210.52(A)(2) which identifies wall space as any space that meets a dimension and is unbroken along the floor line by doors and similar openings. The submitted noted that “... without this added text the “unbroken floor line” would include the floor line in front of the kitchen cabinets.” Additional outlet receptacles are not required in front of kitchen cabinets or other similar work surfaces that already have requirements as per other areas of the NEC. Hence the change was made in 210.52(A)(2) to include countertops.
Public Comment No. 55-NFPA 70-2015 [Section No. 210.52(A)(4)]

(4) Countertop Receptacles and Work Surface Receptacle Outlets.

Receptacles installed for countertop countertops and work surfaces as specified in 210.52(C) shall not be considered as the receptacles, receptacle outlets, required by 210.52(A).

Statement of Problem and Substantiation for Public Comment

To avoid confusion and misinterpretations, and improve readability of the Code.

First Revision FR 308 to 210.52(C)(5) raised the issue of installation of receptacles in work surfaces by revising the Information Note to additionally include work surfaces. The Committee Statement for First Revision FR324 nonetheless makes it clear that the intent is not to address kitchen countertops alone.

Consequently, 210.52(C)(5), 210.52(A)(2), 210.52(A)(4), and 210.52(C) need to include requirements for receptacles outlets in work surfaces.

Related Item
First Revision No. 308-NFPA 70-2015 [Section No. 210.52(C)(5)]
First Revision No. 324-NFPA 70-2015 [Section No. 210.52(A)(2)]

Submitter Information Verification
Submitter Full Name: BRIAN ROCK
Organization: HUBBELL INCORPORATED
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 11:13:39 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Statement: The addition of "similar work surfaces" was made to provide clarity and inclusion of these types of surfaces that may also be found in the areas identified in 210.52(A) in addition to countertops, as being counted as wall space.
Receptacle Outlets Served.

In the kitchen, pantry, breakfast room, dining room, or similar area of a dwelling unit, the two or more 20-ampere small-appliance branch circuits required by 210.11(C)(1) shall serve all wall and floor receptacle outlets covered by 210.52(A), all countertop outlets covered by 210.52(C), and receptacle outlets for refrigeration equipment.

Exception No. 1: In addition to the required receptacles specified by 210.52, switched receptacles supplied from a general-purpose branch circuit as defined in 210.70(A)(1), Exception No. 1, shall be permitted.

Exception No. 2: The receptacle outlet for refrigeration equipment shall be permitted to be supplied from an individual branch circuit rated 15 amperes or greater.

Exception No. 3: A single receptacle dedicated to a specific appliance supplied by an individual branch circuit.

Statement of Problem and Substantiation for Public Comment

Apparently the Panel failed in the substantiation to notice their response was contradicted by Exception No. 3 in this same Section. The Exception for refrigerators was added to allow the 15-ampere outlet and not to be bound by the small appliance circuit receptacle rule. Certain appliances are installed on dedicated circuits by cord and plug connections in the kitchen area regularly. The refrigerator Exception is the only permitted non-small appliance circuit supplied now for other appliances. There is no link stating that the individual branch circuit may be permitted as an Exception, as they have indicated.

Related Item

Public Input No. 3807-NFPA 70-2014 [Section No. 210.52(B)(1)]

Submitter Information Verification

Submitter Full Name: Ron Chilton
Organization: North Carolina Code Clearing Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 10:01:19 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-308-NFPA 70-2015
Statement: This change made to Exception No. 2 recognizes that an individual branch circuit supplied specifically for any single appliance is allowed to be a 15-ampere receptacle outlet.
(C) Countertops and Work Surfaces.

In kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units, receptacle outlets for countertop and work surface spaces shall be installed in accordance with 210.52(C)(1) through (C)(5).

(1) Wall Countertop and Work Surface Spaces.

A receptacle outlet shall be installed at each wall countertop and work surface space that is 300 mm (12 in.) or wider. Receptacle outlets shall be installed so that no point along the wall line is more than 600 mm (24 in.) measured horizontally from a receptacle outlet in that space.

Exception: Receptacle outlets shall not be required on a wall directly behind a range, counter-mounted cooking unit, or sink in the installation described in Figure 210.52(C)(1).

Figure 210.52(C)(1) Determination of Area Behind a Range, or Counter-Mounted Cooking Unit or Sink.

(2) Island Countertop Spaces.

At least one receptacle shall be installed at each island countertop space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater.

(3) Peninsular Countertop Spaces.

At least one receptacle outlet shall be installed at each peninsular countertop long dimension space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater. A peninsular countertop is measured from the connected perpendicular wall.

A receptacle in a wall countertop space shall be permitted to serve as the receptacle for a peninsular countertop space where the spaces are contiguous and the receptacle is located within 1.8 m (6 ft) of the outside edge of the peninsular countertop.
(4) Separate Spaces.
Countertop spaces separated by rangetops, refrigerators, or sinks shall be considered as separate countertop spaces in applying the requirements of 210.52(C)(1). If a range, counter-mounted cooking unit, or sink is installed in an island or peninsular countertop and the depth of the countertop behind the range, counter-mounted cooking unit, or sink is less than 300 mm (12 in.), the range, counter-mounted cooking unit, or sink shall be considered to divide the countertop space into two separate countertop spaces. Each separate countertop space shall comply with the applicable requirements in 210.52(C).

(5) Receptacle Outlet Location.
Receptacle outlets shall be located on or above, but not more than 500 mm (20 in.) above, the countertop. Receptacle outlet assemblies listed for use in countertops shall be permitted to be installed in countertops. Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception, or appliances occupying dedicated space shall not be considered as these required outlets.

Informational Note: See 406.5(E) for requirements for installation of receptacles in countertops and 406.5(F) for requirements for installation in work surfaces.

Exception to (5): To comply with the conditions specified in (1) or (2), receptacle outlets shall be permitted to be mounted not more than 300 mm (12 in.) below the countertop. Receptacles mounted below a countertop in accordance with this exception shall not be located where the countertop extends more than 150 mm (6 in.) beyond its support base.

(1) Construction for the physically impaired
(2) On island and peninsular countertops where the countertop is flat across its entire surface (no backsplashes, dividers, etc.) and there are no means to mount a receptacle within 500 mm (20 in.) above the countertop, such as an overhead cabinet

Statement of Problem and Substantiation for Public Comment
To avoid confusion and misinterpretations, and improve readability of the Code.

First Revision FR 308 to 210.52(C)(5) raised the issue of installation of receptacles in work surfaces by revising the Information Note to additionally include work surfaces. The Committee Statement for First Revision FR324 nonetheless makes it clear that the intent is not to address kitchen countertops alone.

Consequently, 210.52(C)(5), 210.52(A)(2), 210.52(A)(4), and 210.52(C) need to include requirements for receptacles outlets in work surfaces.

Related Item
First Revision No. 308-NFPA 70-2015 [Section No. 210.52(C)(5)]
First Revision No. 324-NFPA 70-2015 [Section No. 210.52(A)(2)]

Submitter Information Verification
Submitter Full Name: BRIAN ROCK
Organization: HUBBELL INCORPORATED
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 11:44:54 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-309-NFPA 70-2015 Additional TC Statement for PC#58: The removal of language as part of 210.52(C)(5) requiring listed solutions for countertop or work surface applications was not accepted as sufficient substantiation was not provided that would support this action. Additional TC Statement for PC#56: The removal of language as part of 210.52(C) for the locations kitchens, pantries, breakfast rooms, dining rooms, and similar areas was not accepted as sufficient substantiation was not provided that would support this action.
Statement: The addition of “work surfaces” was made to align with changes in 210.52(A) and to add clarity.

The language in 210.52(C)(3) was modified to not create language that reduces the coverage of receptacles but rather to better define how a peninsular countertop is measured for clarity or when additional receptacles to serve the peninsular countertop space should be provided.
(3) Peninsular Countertop Spaces.

At least one receptacle outlet shall be installed at each peninsular countertop long dimension space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater. A peninsular countertop is measured from the connected perpendicular wall, outer end to the connection to the perpendicular countertop surface.

A receptacle in a wall countertop space shall be permitted to serve as the receptacle for a peninsular countertop space where the spaces are contiguous and the receptacle is located within 1.8 m (6 ft) of the outside edge, end, of the peninsular countertop.

Statement of Problem and Substantiation for Public Comment

The original wording was unclear. A peninsular counter does not always connect to a wall but sometimes connects to another counter. The comment hopefully suggests clearer wording.

Related Item
First Revision No. 356-NFPA 70-2015 [Section No. 210.52(C)(3)]

Submitter Information Verification

Submitter Full Name: J. Grant Hammett
Organization: Colorado State Electrical Board
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 03 15:51:52 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed revision does not add any clarity.
Public Comment No. 572-NFPA 70-2015 [Section No. 210.52(C)(3)]

(3) Peninsular Countertop Spaces.
At least one receptacle outlet shall be installed at each peninsular countertop long dimension space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater. A peninsular countertop is measured from the connected perpendicular wall. A receptacle in a wall countertop space shall be permitted to serve as the receptacle for a peninsular countertop space where the spaces are contiguous and the receptacle is located within 1.8 m (6 ft) of the outside edge of the peninsular countertop connecting edge.

Additional Proposed Changes

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<tr>
<th>File Name</th>
<th>Description</th>
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<td>210.52_C_3_.docx</td>
<td>210.52(C)(3)</td>
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Statement of Problem and Substantiation for Public Comment

I urge CMP-2 to accept this Public Comment and return this Code language to its previous text in the 2014 NEC. By accepting the Public Input and First Revision at 210.52(C)(3), safety for the user (typically the homeowner) is lessened from the previous requirements for a receptacle at a peninsular countertop. The language accepted at the First Draft stage would allow a receptacle outlet at the connecting wall (which serves the base countertop) to also serve the peninsular countertop. The end of the peninsular countertop could be as far away from the wall receptacle as 1.8 m (6 ft). Under the 2014 NEC, a peninsular countertop that measures 600 mm (24 in.) by 900 mm (36 in.) (measured from the connecting edge) would require at least one receptacle outlet (located at the peninsular countertop) to serve that peninsular countertop. Under the proposed text of the 2017 NEC, this same peninsular countertop would require ZERO receptacles at the peninsular countertop as the countertop could be served by the wall receptacle [that could be up to 1.8 m (6 ft) away from the end of said countertop].

Related Item

First Revision No. 356-NFPA 70-2015 [Section No. 210.52(C)(3)]
Public Input No. 3605-NFPA 70-2014 [Section No. 210.52(C)(3)]

Submitter Information Verification

Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 08 11:12:38 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-309-NFPA 70-2015 Additional TC Statement for PC#58: The removal of language as part of 210.52(C)(5) requiring listed solutions for countertop or work surface applications was not accepted as sufficient substantiation was not provided that would support this action. Additional TC Statement for PC#56: The removal of language as part of 210.52(C) for the locations kitchens, pantries, breakfast rooms, dining rooms, and similar areas was not accepted as sufficient substantiation was not provided that would support this action.
Statement: The addition of “work surfaces” was made to align with changes in 210.52(A) and to add clarity.

The language in 210.52(C)(3) was modified to not create language that reduces the coverage of receptacles but rather to better define how a peninsular countertop is measured for clarity or when additional receptacles to serve the peninsular countertop space should be provided.
Public Comment No. 58-NFPA 70-2015 [Section No. 210.52(C)(5)]

(5) Countertop and Work Surface Receptacle Outlet Location.

Receptacle outlets shall be located on or above, but not more than 500 mm (20 in.) above, the countertop or work surface. Receptacle outlet assemblies listed for use in countertops shall be permitted to be installed in countertops. Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1). Exception, or appliances occupying dedicated space shall not be considered as these required outlets.

Informational Note: See 406.5(E) and 406.5(G) for requirements for installation of receptacles in countertops and 406.5(F) and 406.5(G) for requirements for installation of receptacles in work surfaces.

Exception to (5): To comply with the conditions specified in (1) or (2), receptacle outlets shall be permitted to be mounted not more than 300 mm (12 in.) below the countertop or work surface. Receptacles mounted below a countertop or work surface in accordance with this exception shall not be located where the countertop or work surface extends more than 150 mm (6 in.) beyond its support base.

(1) Construction for the physically impaired
(2) On island and peninsular countertops where the countertop is flat across its entire surface (no backsplashes, dividers, etc.) and there are no means to mount a receptacle within 500 mm (20 in.) above the countertop, such as an overhead cabinet

Statement of Problem and Substantiation for Public Comment

First Revision FR 308 to 210.52(C)(5) as written will add confusion, and reduce readability of the Code, and result in misinterpretations.

210.52(C)(5) by its title is intended to specify the LOCATION of REQUIRED countertop receptacle outlets, not the TYPE of eligible receptacles or receptacle assemblies already covered in 406.5(E) in 2014 NEC® [First Revision FR5108 divides that 406.5(E) into 406.5(E), (F) and (G) and renumbers the remainder for the 2017 NEC®]. The Informational Note already directs the reader to 406.5(E); that Information Note, however, DOES need to be correlated with FR 5108 for the requirements now separated off into NEW 406.5(G). The second sentence of the mandatory requirement is nonetheless redundant to the mandatory requirement of referenced 406.5(E) and should therefore be deleted.

First Revision FR 308 to 210.52(C)(5) raised the issue of installation of receptacles in work surfaces by revising the Information Note to additionally include work surfaces. Nothing in the MANDATORY requirements of 210.52(C)(5) however addresses WORK SURFACE receptacle outlets as being REQUIRED outlets or imposes any location requirements upon WORK SURFACE receptacle outlets. The Committee Statement for First Revision FR324 nonetheless makes it clear that the intent is not to address kitchen countertops alone.

Consequently, 210.52(C)(5), 210.52(A)(2), 210.52(A)(4), and 210.52(C) need to include requirements for receptacles outlets in work surfaces.

Related Item
First Revision No. 308-NFPA 70-2015 [Section No. 210.52(C)(5)]
First Revision No. 5108-NFPA 70-2015 [Sections 406.5(E), 406.5(F), 406.5(G), 406.5(H)]
First Revision No. 324-NFPA 70-2015 [Section No. 210.52(A)(2)]

Submitter Information Verification

Submitter Full Name: BRIAN ROCK
Organization: HUBBELL INCORPORATED
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 12:06:47 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-309-NFPA 70-2015 Additional TC Statement for PC#58: The removal of language as part of 210.52(C)(5) requiring listed solutions for countertop or work surface applications was not accepted as sufficient substantiation was not provided that would support this action. Additional TC Statement for PC#56: The removal of language as part of 210.52(C) for the locations kitchens, pantries, breakfast rooms, dining rooms, and similar areas was not accepted as sufficient.
substantiation was not provided that would support this action.

**Statement:** The addition of "work surfaces" was made to align with changes in 210.52(A) and to add clarity.

The language in 210.52(C)(3) was modified to not create language that reduces the coverage of receptacles but rather to better define how a peninsular countertop is measured for clarity or when additional receptacles to serve the peninsular countertop space should be provided.
(5) Receptacle Outlet Location.

Receptacle outlets shall be located on or above, but not more than 500 mm (20 in.) above, the countertop. Receptacle outlet assemblies listed for use in countertops shall be permitted to be installed in countertops. Receptacle outlet assemblies listed for use in countertops or work surfaces shall be permitted to be installed in work surfaces. Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception, or appliances occupying dedicated space shall not be considered as these required outlets.

Informational Note: See 406.5(E) and 406.5(G) for requirements for installation of receptacles in countertops and 406.5(F) and 406.5(G) for requirements for installation of receptacles in work surfaces.

Exception to (5): To comply with the conditions specified in (1) or (2), receptacle outlets shall be permitted to be mounted not more than 300 mm (12 in.) below the countertop. Receptacles mounted below a countertop in accordance with this exception shall not be located where the countertop extends more than 150 mm (6 in.) beyond its support base.

(1) Construction for the physically impaired

(2) On island and peninsular countertops where the countertop is flat across its entire surface (no backsplashes, dividers, etc.) and there are no means to mount a receptacle within 500 mm (20 in.) above the countertop, such as an overhead cabinet

Statement of Problem and Substantiation for Public Comment

The First Revision FR 308 to 210.52(C)(5) raised the issue of installation of receptacles in work surfaces by revising the Information Note to additionally include work surfaces. Consequently, 210.52(C)(5) need to correlate to First Revision FR5108 that divides 406.5(E) into 406.5(E), (F) and (G) and renumbers the remainder for the 2017 NEC®, to include requirements for receptacles in work surfaces.

Related Item

First Revision No. 308-NFPA 70-2015 [Section No. 210.52(C)(5)]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 09:29:57 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-309-NFPA 70-2015 Additional TC Statement for PC#58: The removal of language as part of 210.52(C)(5) requiring listed solutions for countertop or work surface applications was not accepted as sufficient substantiation was not provided that would support this action. Additional TC Statement for PC#56: The removal of language as part of 210.52(C) for the locations kitchens, pantries, breakfast rooms, dining rooms, and similar areas was not accepted as sufficient substantiation was not provided that would support this action.

Statement: The addition of “work surfaces” was made to align with changes in 210.52(A) and to add clarity.

The language in 210.52(C)(3) was modified to not create language that reduces the coverage of receptacles but rather to better define how a peninsular countertop is measured for clarity or when additional receptacles to serve the peninsular countertop space should be provided.
(D) Bathrooms.

At least one receptacle outlet shall be installed in bathrooms within 900 mm (3 ft) of the outside edge of each basin. The receptacle outlet shall be located on a wall or partition that is adjacent to the basin or basin countertop, located on the countertop, or installed on the side or face of the basin cabinet. In no case shall the receptacle be located more than 300 mm (12 in.) below the top of the basin or basin countertop. Receptacle outlet assemblies listed for the application shall be permitted to be installed in the countertop.

Informational Note: See 406.5(E) and 406.5(G) for requirements for installation of receptacles in countertops.

Statement of Problem and Substantiation for Public Comment

“Listed for the application” is considered to be a vague and unenforceable term per the NEC® Style Manual Clause 3.2.1. The First Revision FR 308 to 210.52(C)(5) revised “Receptacle outlet assemblies listed for the application …” to “Receptacle outlet assemblies listed for use in countertops …”. FR 309 should similarly revise 210.52(D), for consistency. BUT …

210.52(D) is intended to specify the LOCATION of REQUIRED countertop receptacle outlets, not the TYPE of eligible receptacles or receptacle assemblies ALREADY covered in 406.5(E) in 2014 NEC® [First Revision FR5108 divides that 406.5(E) into 406.5(E), (F) and (G) and renumbers the remainder for the 2017 NEC®]. The Informational Note already directs the reader to 406.5(E); that Informational Note, however, DOES need to be correlated with FR 5108 for the requirements now separated off into NEW 406.5(G). The third sentence of the mandatory requirement is nonetheless redundant to the mandatory requirement of referenced 406.5(E) and should therefore be deleted.

Additionally, FR 309 shows a sentence-case “At” being added to the start of this requirement but did not delete the lowercase “at”, resulting in “At at …”.

Related Item
First Revision No. 309-NFPA 70-2015 [Section No. 210.52(D)]
First Revision No. 5108-NFPA 70-2015 [Sections 406.5(E), 406.5(F), 406.5(G), 406.5(H)]

Submitter Information Verification

Submitter Full Name: BRIAN ROCK
Organization: HUBBELL INCORPORATED
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 12:44:06 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-310-NFPA 70-2015 Additional TC statement for PC#59: The removal of language as part of 210.52(D) requiring listed solutions for countertops was not accepted as sufficient substantiation was not provided that supports this action.
Statement: For clarity, “listed for the application” was replaced with “listed for use in countertops”.

The addition of 406.5(G) in the informational note correlates with changes made in the First Revision for requirements that were separated into a new 406.5(G)
Public Comment No. 821-NFPA 70-2015 [Section No. 210.52(D)]

(D) Bathrooms.

At least one receptacle outlet shall be installed in bathrooms within 900 mm (3 ft) of the outside edge of each basin. The receptacle outlet shall be located on a wall or partition that is adjacent to the basin or basin countertop, located on the countertop, or installed on the side or face of the basin cabinet. In no case shall the receptacle be located more than 300 mm (12 in.) below the top of the basin or basin countertop. Receptacle outlet assemblies listed for the application use in countertops shall be permitted to be installed in the countertop.

Informational Note: See 406.5(E) for requirements for installation of receptacles in countertops.

Statement of Problem and Substantiation for Public Comment

The First Revision FR 308 to 210.52(C)(5) revised “Receptacle outlet assemblies listed for the application…” to “Receptacle outlet assemblies listed for use in countertops …”. Similarly, FR 309 to 210.52(D) should make the same revision for consistency.

Related Item
First Revision No. 309-NFPA 70-2015 [Section No. 210.52(D)]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 09:34:21 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-310-NFPA 70-2015 Additional TC statement for PC#59: The removal of language as part of 210.52(D) requiring listed solutions for countertops was not accepted as sufficient substantiation was not provided that supports this action.
Statement: For clarity, “listed for the application” was replaced with “listed for use in countertops”.

The addition of 406.5(G) in the informational note correlates with changes made in the First Revision for requirements that were separated into a new 406.5(G)
Outdoor receptacle outlets shall be installed in accordance with 210.52(E)(1) through (E)(3). When an addition is made to an existing dwelling which includes the addition of receptacle outlets required in accordance with 210.52(A), at least one exterior GFCI receptacle outlet shall be provided.

Informational Note: See 210.8(A)(3).

Statement of Problem and Substantiation for Public Comment

The intent is to require that when an addition is being made including electrical work for the addition, the finished building shall be provided with an exterior protected (GFCI) outlet. This could be an existing exterior receptacle outlet that is changed to include GFCI, or it could be a whole new exterior receptacle outlet with GFCI.

Related Item

Public Input No. 2904-NFPA 70-2014 [Section No. 210.52(E)]

Submitter Information Verification

Submitter Full Name: Jim Muir
Organization: Building Safety Division, Clark County, WA
Affiliation: NFPAs Building Code Development Committee (BCDC)
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 15:10:45 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Substantiation was not provided that warrant the addition of an exterior GFCI receptacle outlet any time a change is made anywhere in the structure that adds a receptacle outlet in accordance with 210.52(A).
Exception.
A receptacle outlet shall not be required if no walking surface is available and the receptacle outlet cannot be installed accessible from the opening leading to the balcony, deck or porch.

Statement of Problem and Substantiation for Public Comment
the receptacle cannot be reached in this type of installation Please see photo attached, an exception should be provide for this situation.

Related Item
Public Input No. 4235-NFPA 70-2014 [Section No. 210.52(3)]

Committee Statement
Committee Action: Rejected
Resolution: The proposed exception could promote the use of extension cords through doors and windows.
(1) Garages.
In each attached garage and in each detached garage with electric power, the branch circuit supplying this receptacle(s) shall not supply outlets outside of the garage. At least one receptacle outlet shall be installed in each vehicle bay and not more than 1.7 m (5 1/2 ft) above the floor.

Exception: Recepticals required by 210.52 (E) shall be permitted to be supplied by this branch circuit.

Statement of Problem and Substantiation for Public Comment

There is no adequate substantiation to support that other receptacles should not be allowed on this circuit. Article 210.11(C)(3) will now require this circuit to be a 20 amp circuit. A power tool that draws 16 amps was used as substantiation in the FR. Power tools are seldom used in the average homeowner’s garage. Hair dryers that draw 16 amps are more likely to be used in bathrooms and at times more than one at the same because of multiple bathrooms. The NEC does not require individual branch circuits to bathrooms.

Related Item
First Revision No. 317-NFPA 70-2015 [Section No. 210.52(G)(1)]

Submitter Information Verification

Submitter Full Name: Michael Weaver
Organization: M&W Electric
Affiliation: NECA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:03:03 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-326-NFPA 70-2015
Statement: The language related to outlets outside of the garage has been deleted from this section to correlate with changes made to 210.11(C)(4).
Garages.

In each attached garage and in each detached garage with electric power, the branch circuit supplying this receptacle(s) shall not supply outlets outside of the garage. At least one receptacle outlet shall be installed in each vehicle bay and not more than 1.7 m (5 1/2 ft) above the floor.

### Statement of Problem and Substantiation for Public Comment

This is a design issue and not an electrical safety issue and does not belong in the cord. Also it is an attempt to provide power for electrical vehicle charging, but many such charging systems will require more power than required by the rule. Also vehicle bay is an undefined term. It is often considered the area where a vehicle would be parked and/or stored, but may not be defined by a wall where a receptacle could be installed.

### Related Item

First Revision No. 317-NFPA 70-2015 [Section No. 210.52(G)(1)]

### Submitter Information Verification

- **Submitter Full Name:** DON GANIERE
- **Organization:** [ Not Specified ]
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Fri Jul 31 16:53:55 EDT 2015

### Committee Statement

- **Committee Action:** Rejected
- **Resolution:** The existing language in 210.52(G) is not an attempt to provide power for electric vehicle charging but rather for loads typically seen in a garage.
Garages.

In each attached garage and in each detached garage with electric power, the branch circuit supplying this receptacle(s) shall not supply outlets outside of the garage. At least one receptacle outlet shall be installed in each vehicle bay and not more than 1.7 m (5 1/2 ft) above the floor.

Exception: The branch circuit shall be permitted to supply a receptacle outlet(s) on the outside of the garage.

Statement of Problem and Substantiation for Public Comment

Although the exception will restore the option to supply outdoor receptacle outlets on the garage from the required branch circuit inside the garage, the revised wording will restrict lighting or other receptacle outlets from being supplied. The revised text “shall not supply other outlets” is consistent with other language in 210 restricting the use of branch circuits. Additionally, CMP 2 created a minimum requirement of 20 amperes for the garage branch circuit as a means of recognizing the increased use of the circuit for the First Draft. The requirements for the EV charging circuit are not considered by this section as the last sentence of 210.52(G) specifies the required receptacle(s) is in addition to those installed for specific equipment. The type of circuit required for EV charging will be addressed in 625 and/or the manufactures installation instructions for the equipment.

Related Item
Public Input No. 4303-NFPA 70-2014 [Section No. 210.52(G)(1)]

Submitter Information Verification

Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSP
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 12:45:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-326-NFPA 70-2015
Statement: The language related to outlets outside of the garage has been deleted from this section to correlate with changes made to 210.11(C)(4).
Public Comment No. 954-NFPA 70-2015 [Section No. 210.52(G)(1)]

(1) Garages.
In each attached garage and in each detached garage with electric power, the branch circuit supplying this receptacle(s) shall not supply outlets outside of the garage. At least one receptacle outlet shall be installed in each vehicle bay and not more than 1.7 m (5 1/2 ft) above the floor.

Statement of Problem and Substantiation for Public Comment

A similar requirement for "no other outlets" is being proposed at 210.11(C)(4). Section 210.52 is requirements for dwelling unit receptacle outlets. A more appropriate location for this text that deals with the branch circuit supplying these receptacle outlets is 210.11(C), which deals with required branch circuits for dwelling units. The proposed deleted text deals with the branch circuit supplying the garage, not the receptacle outlet(s) itself.

Related Item
First Revision No. 317-NFPA 70-2015 [Section No. 210.52(G)(1)]

Submitter Information Verification
Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 15:17:32 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-326-NFPA 70-2015
Statement: The language related to outlets outside of the garage has been deleted from this section to correlate with changes made to 210.11(C)(4).
General.
Guest rooms or guest suites in hotels, motels, sleeping rooms in dormitories, and similar occupancies shall have receptacle outlets installed in accordance with 210.52(A) and (D). Guest rooms or guest suites provided with permanent provisions for cooking shall have receptacle outlets and branch circuits installed in accordance with all of the applicable rules in 210.52 for dwelling units.

Statement of Problem and Substantiation for Public Comment
eliminating 201.17 and bring all the requirements in one section making it easier to understand and enforce

Related Item
Public Input No. 2728-NFPA 70-2014 [Section No. 210.60(A)]

Submitter Information Verification
Submitter Full Name: ALFIO TORRISI
Organization: master
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 16 18:58:57 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Section 210.17 is in Part I of Article 210 which pertains to general provisions, and 210.60 is in Part III which pertains to required outlets. Therefore both sections are needed.
210.64. Electrical Service Areas.

At least one 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed in an accessible location within 7.5 m (25 ft) of the indoor electrical service equipment. The required receptacle outlet shall be located within the same room or area as the service equipment.

*Exception No. 1:* The receptacle outlet shall not be required to be installed in one- and two-family dwellings.

*Exception No. 2:* Where the service voltage is greater than 120 volts to ground, a receptacle outlet shall not be required for services dedicated to equipment covered in Articles 675 and 682.

**Statement of Problem and Substantiation for Public Comment**

This rule mandates that the customer owned substations that I've dealt with would need a 120V receptacle. This wasn't substantiated, and is absurd.

**Related Item**

Public Input No. 1937-NFPA 70-2014 [Section No. 210.64]

**Submitter Information Verification**

Submitter Full Name: RYAN JACKSON
Organization: RYAN JACKSON
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 16:23:09 EDT 2015

**Committee Statement**

Committee Action: Rejected
Resolution: There is a need for a 125 volt receptacle outlet near electrical service equipment in certain locations. The purpose for this receptacle is for the testing and servicing of electrical equipment in the vicinity of the service.
**Public Comment No. 33-NFPA 70-2015 [Section No. 210.64]**

**210.64  Electrical Service Areas.**

At least one 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed in an accessible location within 7.5 m (25 ft) of the indoor electrical service equipment. The required receptacle outlet shall be located within the same room or area as the service equipment.

*Exception No. 1: The receptacle outlet shall not be required to be installed in one- and two-family dwellings.*

*Exception No. 2: Where the service voltage is greater than $120_{150}$ volts to ground, a receptacle outlet shall not be required for services dedicated to equipment covered in Articles 675 and 682.*

**Additional Proposed Changes**

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<th>Description</th>
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<tr>
<td>210_64.jpg</td>
<td>Oil Well Service</td>
<td></td>
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**Statement of Problem and Substantiation for Public Comment**

For the sake of consistency with other NEC references, the voltage threshold should be 150 volts, not 120, as 150 is generally used throughout the NEC to refer to wye-connected systems with a line to neutral voltage greater than 120 volts. See 210.13, 215.10, 225.18, 230.24, 230.95, to name a few of many such references.

As proposed, the exception applies to only two categories of many. Removing the references to specific articles permits the exception to be used in any case where there is no 120 volt, nominal system available. Please see attached photo of a recent oil well service I inspected where the electrical contractor had attempted to comply with 210.64, adding over $700. to the project cost, for a receptacle which might never be used.

**Related Item**

First Revision No. 323-NFPA 70-2015 [Section No. 210.64]

**Submitter Information Verification**

Submitter Full Name: J GRANT HAMMETT  
Organization: COLORADO STATE ELECTRICAL BOARD  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Jun 24 11:16:09 EDT 2015

**Committee Statement**

Committee Action: Rejected  
Resolution: The receptacle required by this section is needed for services greater than 150 volts. The purpose for this receptacle is for the testing and servicing of electrical equipment in the vicinity of the service.
Public Comment No. 1034-NFPA 70-2015 [ Section No. 210.70(A)(3) ]

(3) Storage or Equipment Spaces.
For attics, underfloor spaces, utility rooms, and basements, at least one lighting outlet containing a switch or controlled by a wall switch shall be installed where these spaces are used for storage or contain equipment requiring servicing. At least one point of control shall be at the usual point of entry to these spaces. The lighting outlet shall be provided at or near the equipment requiring servicing. Lamps installed in lighting outlets in these spaces, such as in lamp sockets, shall be protected from physical damage.

Statement of Problem and Substantiation for Public Comment

The protection warranted to prevent electric shock caused by contact from broken lamps would eliminate needs for other forms of required protections such as GFCI or AFCI to be extended in this area. The referenced 2014 death in North Carolina caused by a worker in a crawl space accidently breaking a lamp bulb exposing the worker to contact with 120 volts could have been prevented by a small device such as those accepted in other areas for the same protection being placed over the lamp or bulb.

Code Making Panel 2 had stated that this protection was not under their purview however in other Code Sections the consideration that Luminaires subject to damage are specifically referenced to require protection from damage. The intent of the Public Input was to assure protection from the broken lamp exposing the energized filament.

Related Item

Public Input No. 2734-NFPA 70-2014 [Section No. 250.94]

Submitter Information Verification

Submitter Full Name: Ron Chilton
Organization: North Carolina Code Clearing Committee
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 10:22:31 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Attics, underfloor spaces, utility rooms, and basements do not provide the same hazards that are found in crawl spaces which can be constricted.
Public Comment No. 985-NFPA 70-2015 [Section No. 210.70(C)]

(C) All Occupancies.
For attics and underfloor spaces, utility rooms, and basements, at least one lighting outlet containing a switch or controlled by a wall switch shall be installed where these spaces are used for storage or contain equipment requiring servicing. At least one point of control shall be at the usual point of entry to these spaces. The lighting outlet shall be provided at or near the equipment requiring servicing.

A lighting outlet installed in a crawl space shall be protected from physical damage or be provided with GFCI protection.

Statement of Problem and Substantiation for Public Comment

Although this requirement has merit, it is related to the type of lampholder or luminaire and should not be located in 210. It should be located in 410 where protection of lampholders, luminaires and their associated lamps are covered. Further, 210.70 is for required lighting outlets and therefore does address lampholders or luminaires. Other than enclosing the conductors, how do you protect a lighting outlet from physical damage? Additionally, providing GFCI protection for the lighting outlet in instead of guarding the lamp from contact by an individual does not address the true hazards of inadvertently contacting a hot lamp or from broken glass.

Related Item
First Revision No. 315-NFPA 70-2015 [Section No. 210.70(C)]
Public Input No. 2702-NFPA 70-2014 [Section No. 210.70(A)(3)]

Submitter Information Verification
Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSPECTORS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 18:24:53 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-311-NFPA 70-2015
Statement: Lighting outlets installed in crawl spaces shall be provided with GFCI protection. This requirement has been moved to 210.8. Physical protection does not provide the appropriate shock protection.
210.71 - Meeting Rooms.

(A) - General.

Each meeting room in other than dwelling units shall have nonlocking-type, 125-volt, 15- and 20-ampere receptacles installed in accordance with 210.71(B) through (E). Where a room or space is provided with movable partition(s), the room size shall be determined with the partition in the position that results in the smallest size meeting room.

Informational Note No. 1: For the purposes of this section, meeting rooms are typically designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where portable electronic equipment such as computers, projectors, or similar equipment is likely to be used.

Informational Note No. 2: The types of receptacles covered by this requirement are identified as 5-15 and 5-20 in ANSI/NEMA WD 6-2002, National Electrical Manufacturers Association, Standard for Dimensions of Attachment Plugs and Receptacles.

(B) - Receptacle Outlets in Fixed Walls.

In meeting rooms having a floor area of 70 m$^2$ (760 ft$^2$) or less, receptacle outlets shall be installed in accordance with 210.52(A)(1) through (A)(4). These receptacle outlets shall be in addition to any receptacle outlets that are located within cabinets or cupboards, or located more than 1.7 m (5 4/12 ft) above the floor.

(C) - Floor Receptacle Outlets.

A meeting room that is at least 3.6 m (12 ft) wide and that has a floor area of at least 21 m$^2$ (225 ft$^2$) and not more than 70 m$^2$ (760 ft$^2$) shall have at least one duplex- or quadruplex-type receptacle located in the floor at a distance not less than 1.8 m (6 ft) from any fixed wall.

(D) - Receptacle Outlets at Moveable Room Partitions.

At least one floor receptacle outlet shall be installed for each 3.7 linear m (12 linear ft) or major fraction thereof of movable wall measured horizontally along the floor line. These receptacle outlets shall be located within 450 mm (18 in.) of the partition.

(E) - Receptacle Outlet Placement.

In applying the provisions of this section, the total number of receptacle outlets shall not be less than as determined in (B), (C), and (D). The receptacle outlets required by this section shall be permitted to be located in accordance with municipal, state, federal, or other codes and regulations, or as determined by the designer/building owner.

Informational Note No. 1: See Section 314.27(B) for floor boxes used for receptacles located in the floor.

Informational Note No. 2: See Article 518 for assembly occupancies designed for 100 or more persons.

delete section

Statement of Problem and Substantiation for Public Comment

No data or sufficient substantiation was provided that there have been problems or hazards with insufficient receptacles installed in meeting rooms to warrant adding this section. The committee statement was "the new section addresses the inherent life safety concerns relating to inadequate access to electrical power in meeting rooms" If data or substantiation were to be provided it is likely the same issues would still exist as this section is written.

Related Item

First Revision No. 7517-NFPA 70-2015 [New Section after 210.70(B)]

Submitter Information Verification

Submitter Full Name: Michael Weaver
Organization: M&W Electric
Affiliation: NECA
Street Address: City: State: Zip:
Submittal Date: Fri Sep 25 14:58:35 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The panel reaffirms the need for receptacle outlets in meeting rooms. These receptacle outlets are needed to provide power along wall lines for displays, coffee pots, heating of catered food, and other electrical/electronic equipment, and to minimize the need for extension cords and multi-outlet devices when employing projectors and the like.
210.71. Meeting Rooms.

(A). General.

Each meeting room in other than dwelling units shall have nonlocking-type, 125-volt, 15- and 20-ampere receptacles installed in accordance with 210.71(B) through (E). Where a room or space is provided with movable partition(s), the room size shall be determined with the partition in the position that results in the smallest size meeting room.

Informational Note No. 1: For the purposes of this section, meeting rooms are typically designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where portable electronic equipment such as computers, projectors, or similar equipment is likely to be used.

Informational Note No. 2: The types of receptacles covered by this requirement are identified as 5-15 and 5-20 in ANSI/NEMA WD 6-2002, National Electrical Manufacturers Association Standard for Dimensions of Attachment Plugs and Receptacles.

(B). Receptacle Outlets in Fixed Walls.

In meeting rooms having a floor area of 70 m² (760 ft²) or less, receptacle outlets shall be installed in accordance with 210.52(A) (A)(1) through (A)(4). These receptacle outlets shall be in addition to any receptacle outlets that are located within cabinets or cupboards, or located more than 1.7 m (5 1/2 ft) above the floor.

(C). Floor Receptacle Outlets.

A meeting room that is at least 3.6 m (12 ft) wide and that has a floor area of at least 21 m² (225 ft²) and not more than 70 m² (760 ft²) shall have at least one duplex- or quadruplex-type receptacle located in the floor at a distance not less than 1.8 m (6 ft) from any fixed wall.

(D). Receptacle Outlets at Moveable Room Partitions.

At least one floor receptacle outlet shall be installed for each 3.7 linear m (12 linear ft) or major fraction thereof of movable wall measured horizontally along the floor line. These receptacle outlets shall be located within 450 mm (18 in.) of the partition.

(E). Receptacle Outlet Placement.

In applying the provisions of this section, the total number of receptacle outlets shall not be less than as determined in (B), (C), and (D). The receptacle outlets required by this section shall be permitted to be located in accordance with municipal, state, federal, or other codes and regulations, or as determined by the designer/building owner.

Informational Note No. 1: See Section 314.27(B) for floor boxes used for receptacles located in the floor.

Informational Note No. 2: See Article 518 for assembly occupancies designed for 100 or more persons.

Statement of Problem and Substantiation for Public Comment

This is a design issue and is outside of the purpose of the NEC, as described in 90.1(A). Furthermore, the substantiation provided by the submitter (CMP 2) would never have been adequate from anyone other than CMP2. The requirement for providing technical substantiation is proving to be a requirement for everyone but the panel. How many dead bodies are there? How many fires? What were the results of the cost benefit study that was performed? These are questions that panel two asks others, what are panel two’s answers here?

Related Item

First Revision No. 7517-NFPA 70-2015 [New Section after 210.70(B)]

Submitter Information Verification

Submitter Full Name: RYAN JACKSON
Organization: RYAN JACKSON
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 16:33:47 EDT 2015
Committee Statement
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210.71 - Meeting Rooms.

(A) - General.
Each meeting room in other than dwelling units shall have nonlocking-type, 125-volt, 15- and 20-ampere receptacles installed in accordance with 210.71(B) through (E). Where a room or space is provided with movable partition(s), the room size shall be determined with the partition in the position that results in the smallest size meeting room.

Informational Note No. 1: For the purposes of this section, meeting rooms are typically designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where portable electronic equipment such as computers, projectors, or similar equipment is likely to be used.

Informational Note No. 2: The types of receptacles covered by this requirement are identified as 5-15 and 5-20 in ANSI/NEMA WD 6-2002, National Electrical Manufacturers Association, Standard for Dimensions of Attachment Plugs and Receptacles.

(B) - Receptacle Outlets in Fixed Walls.
In meeting rooms having a floor area of 70 m² (760 ft²) or less, receptacle outlets shall be installed in accordance with 210.52(A) (A)(1) through (A)(4). These receptacle outlets shall be in addition to any receptacle outlets that are located within cabinets or cupboards, or located more than 1.7 m (5 1/2 ft) above the floor.

(C) - Floor Receptacle Outlets.
A meeting room that is at least 3.6 m (12 ft) wide and that has a floor area of at least 21 m² (225 ft²) and not more than 70 m² (760 ft²) shall have at least one duplex- or quadruplex-type receptacle located in the floor at a distance not less than 1.8 m (6 ft) from any fixed wall.

(D) - Receptacle Outlets at Moveable Room Partitions.
At least one floor receptacle outlet shall be installed for each 3.7 linear m (12 linear ft) or major fraction thereof of movable wall measured horizontally along the floor line. These receptacle outlets shall be located within 450 mm (18 in.) of the partition.

(E) - Receptacle Outlet Placement.
In applying the provisions of this section, the total number of receptacle outlets shall not be less than as determined in (B), (C), and (D). The receptacle outlets required by this section shall be permitted to be located in accordance with municipal, state, federal, or other codes and regulations, or as determined by the designer/building owner.

Informational Note No. 1: See Section 314.27(B) for floor boxes used for receptacles located in the floor.

Informational Note No. 2: See Article 518 for assembly occupancies designed for 100 or more persons.

Statement of Problem and Substantiation for Public Comment

Three concerns were raised during the balloting, that BOMA agrees should be revisited by the committee during the second draft meeting. First and foremost is the fact that there was no substantiation or data presented to the committee or to the public to justify this design requirement being incorporated into the National Electrical Code, nor does the proposed language cure the perceived problem on meeting rooms not being provided with properly located receptacles to eliminate the use of extension cords. By design, conference and meeting rooms serve the function of providing work space to conduct business. To assume that a building owner or designer is not going to provide receptacles in these locations is ludicrous, businesses and tenants need electricity to function and power will be provided.

The new code language also does not address the concern about eliminating the reliance on extension cords. Depending on the function of the space and furniture configurations, the receptacles may still be in a location where the use of extension cords will be needed and based on the number of occupants needing power may require additional power strips. In addition, based on the 210.71(E) the designer can take the total number of receptacles required by (B), (C) & (D) and lump them all in one single location and extensions cords will still be used. Along with creating confusion referring the designer to go to the dwelling unit receptacle outlets for meeting room receptacles, the requirements for the installing these receptacles in accordance with 210.52 (A)(1)- (4), was not justified, analyzed or supported by any data to support the need for meeting rooms to follow the same installation requirements for residential dwellings. BOMA encourages the committee to remove this language and continue to allow designers and architects the ability to design these rooms without these arbitrary restraints.

Related Item
First Revision No. 7517-NFPA 70-2015 [New Section after 210.70(B)]

Submitter Information Verification
Submitter Full Name: STEVEN ORLOWSKI
<table>
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### Public Comment No. 790-NFPA 70-2015 [Section No. 210.71]

#### 210.71 Meeting Rooms

**(A) General.**

Each meeting room in other than dwelling units shall have nonlocking-type, 125-volt, 15- and 20-ampere receptacles installed in accordance with **210.71(B)** through (E). Where a room or space is provided with movable partition(s), the room size shall be determined with the partition in the position that results in the smallest size meeting room.

**Informational Note No. 1:** For the purposes of this section, meeting rooms are typically designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where portable electronic equipment such as computers, projectors, or similar equipment is likely to be used.

**Informational Note No. 2:** The types of receptacles covered by this requirement are identified as 5-15 and 5-20 in ANSI/NEMA WD 6-2002, National Electrical Manufacturers Association, Standard for Dimensions of Attachment Plugs and Receptacles.

**(B) Receptacle Outlets in Fixed Walls.**

In meeting rooms having a floor area of 70 m² (760 ft²) or less, receptacle outlets shall be installed in accordance with **210.52(A)** (A)(1) through (A)(4). These receptacles outlets shall be in addition to any receptacle outlets that are located within cabinets or cupboards, or located more than 1.7 m (5 4/12 ft) above the floor.

**(C) Floor Receptacle Outlets.**

A meeting room that is at least 3.6 m (12 ft) wide and that has a floor area of at least 21 m² (225 ft²) and not more than 70 m² (760 ft²) shall have at least one duplex- or quadruplex-type receptacle located in the floor at a distance not less than 1.8 m (6 ft) from any fixed wall.

**(D) Receptacle Outlets at Moveable Room Partitions.**

At least one floor receptacle outlet shall be installed for each 3.7 linear m (12 linear ft) or major fraction thereof of movable wall measured horizontally along the floor line. These receptacle outlets shall be located within 450 mm (18 in.) of the partition.

**(E) Receptacle Outlet Placement.**

In applying the provisions of this section, the total number of receptacle outlets shall not be less than as determined in (B), (C), and (D). The receptacle outlets required by this section shall be permitted to be located in accordance with municipal, state, federal, or other codes and regulations, or as determined by the designer/building owner.

**Informational Note No. 1:** See Section 314.27(B) for floor boxes used for receptacles located in the floor.

**Informational Note No. 2:** See Article 518 for assembly occupancies designed for 100 or more persons.

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### Statement of Problem and Substantiation for Public Comment

IEC’s position is to delete 210.71 – (FR 7517)

This is a design issue and there are a variety of ways to provide power in meeting rooms. The NEC cannot make mandatory requirements for receptacle placement in meeting rooms because the configuration of the room can change depending on the needs of a particular meeting. When applying the mandatory rules for receptacle placement in (B), (C) or (D) it is possible to have a meeting room, with a moveable partition, of 1296 square feet to require 16 receptacles. It is also possible to have a meeting room, with a moveable partition, of 2934 square feet to require only 3 receptacles. The mandatory language is unenforceable because of Item (E) and a designer may determine only one receptacle is needed or no receptacles are needed. IEC agrees with the negative ballot comment of Thomas Wood that “this is a design issue that Architects and owners are currently addressing to meet consumer needs”.

### Related Item

First Revision No. 7517-NFPA 70-2015 [New Section after 210.70(B)]

### Submitter Information Verification

**Submitter Full Name:** JOHN MASARICK  
**Organization:** Independent Electrical Contractors, Inc.  
**Affiliation:** Independent Electrical Contractors, Inc  
**Street Address:**  
**City:**
### Committee Statement

<table>
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<td>Resolution:</td>
<td>The panel reaffirms the need for receptacle outlets in meeting rooms. These receptacle outlets are needed to provide power along wall lines for displays, coffee pots, heating of catered food, and other electrical/electronic equipment, and to minimize the need for extension cords and multi-outlet devices when employing projectors and the like.</td>
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210.71 Meeting Rooms.

(A) General.
Each meeting room in other than dwelling units shall have nonlocking-type, 125-volt, 15- and 20-ampere receptacles installed be provided with receptacle outlets. The number and type of receptacle outlets shall be determined in accordance with 210.71(B) through (E). Placement of receptacles shall be in accordance with 210.71(E). Where a room or space is provided with movable partition(s), the room size shall be determined with the partition(s) in the position that results in the smallest size meeting room.

Informational Note No. 1: For the purposes of this section, meeting rooms are typically designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where portable electronic equipment such as computers, projectors, or similar equipment is likely to be used.

Informational Note No. 2: The types of receptacles covered by this requirement are identified as 5-15 and 5-20 in ANSI/NEMA WD 6-2002, National Electrical Manufacturers Association, Standard for Dimensions of Attachment Plugs and Receptacles.

(B) Receptacle Outlets in Fixed Walls.
In meeting rooms having a floor area of 20.93 m² (220.1000 ft²) or less, receptacle outlets shall be installed in accordance with 210.52(A)(1) through (A)(4). These receptacle outlets shall be in addition to any receptacle outlets that are located within cabinets or cupboards, or located more than 1.7 m (5 1/2 ft) above the floor.

(C) Floor Receptacle Outlets.
A meeting room that is at least 3.67 m (12 ft) wide and that has a floor area of at least 21.20 m² (225.215 ft²) and not more than 70.93 m² (760.1000 ft²) shall have at least one duplex- or quadruplex-type receptacle located in the floor at a distance not less than 1.8 m (6 ft) from any fixed wall for each 20 m² (215 ft²) or major portion of floor space.

(D) Receptacle Outlets at Moveable Room Partitions.
At least one floor receptacle outlet shall be installed for each 3.7 linear m (12 linear ft) or major fraction thereof of movable wall measured horizontally along the floor line to serve each meeting room created by the partition. These receptacle outlets shall be located within 450 mm (18 in.) of the partition.

(E) Receptacle Outlet Placement.
In applying the provisions of this section, the total number of receptacle outlets shall not be less than as determined in (B), (C), and (D). The receptacle outlets required by this section shall be permitted to be located in accordance with municipal, state, federal, or other codes and regulations, or as determined by the designer/building owner.

Informational Note No. 1: See Section 314.27(B) for floor boxes used for receptacles located in the floor.

Informational Note No. 2: See Article 518 for assembly occupancies designed for 100 or more persons.

Statement of Problem and Substantiation for Public Comment

The suggested modifications are intended to address the logical negative comments from Mr. Buuck. The proposed changes clarify that Parts (B), (C), and (D) are intended to establish the number and type of receptacle outlets to be installed, and (E) allows the designer/owner to locate those receptacle outlets to best suit the anticipated use of the meeting room. Contrary to some of the comments, there are not an unworkable number of configurations for meeting rooms; they are set up in classroom style, closed “O” or “D”, open ended or horse shoe. In all but the classroom style, electrical power needs are similar for each set-up. This Code addition gives the same design flexibility as found in 210.60.

As was stated by Mr. Woods, designers have recognized the need and are already specifying receptacle outlets in meeting rooms in order to meet the needs of the room users. Most hotel/motel chains and office building owners already have specifications for receptacle outlets, so this requirement will have little impact to those businesses. What it will accomplish is to give the inspection community a means of making sure that there is a minimum number of access points for electrical power in the event that a “value engineered” design might result in an inadequate number of receptacle outlets.

The safety concerns are the same as those in all other locations where a minimum number and type of receptacle outlets are specified in the National Electrical Code: to minimize the use of extension cords and multi-outlet strips that would violate other sections of the Code and the product standards.

Conversions from metric to imperial have been revised where needed, to be consistent with NEC Style Manual Annex C.

NEMA stands on the balance of its substantiation to PI 2872 and urges the Panel to continue to support this revision as modified by this comment.

Related Item
First Revision No. 7517-NFPA 70-2015 [New Section after 210.70(B)]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 10:09:20 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement:

Changes were made to 210.71(A) for clarity. The square footage was increased to accommodate a reasonable sized meeting room without including convention halls. These requirements apply to meeting rooms not more than 1000 ft² in area. Informational Note No. 2 was deleted and replaced with a new Informational note to give examples of rooms that are not intended to be meeting rooms.

New 210.71(B) clarifies the number and type of receptacle outlets to be installed. Receptacle outlets in fixed wall and floors are now included in 210.71B(1) and B(2) respectively. These changes also clarify that the building designer or owner is allowed to locate these receptacle outlets to best suit the anticipated use of the meeting room.

Section 210.71(D) for moveable room partitions has been deleted. Section 210.71(E) was also deleted as it is no longer needed.
Public Comment No. 1188-NFPA 70-2015 [Section No. 210.71(D)]

(D) Receptacle Outlets at Moveable Room Partitions.

At least one floor receptacle outlet shall be installed on each side of the moveable room partition, for each 3.7 linear m (12 linear ft) or major fraction thereof of movable wall measured horizontally along the floor line. These receptacle outlets shall be located within 450 mm (18 in.) of the partition.

Statement of Problem and Substantiation for Public Comment

As currently proposed for floor receptacle outlets serving movable room partitions, an installer could install all the required floor receptacles on one side of the partition and meet this proposed Code requirement. This would result in serviceable floor receptacles on one side of a closed room partition and no floor receptacles on the other side, therefore leaving one side of the meeting room space no better off than what we currently have now. If the scenario described above was the intent of the submitter and CMP-2, then ignore this comment. Otherwise, take this public comment as a starting point to address this seemingly inefficiency in this proposed meeting room receptacle outlet requirement, which has merit.

Related Item

Public Input No. 2872-NFPA 70-2014 [New Section after 210.70]
First Revision No. 7517-NFPA 70-2015 [New Section after 210.70(B)]

Submitter Information Verification

Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 11:24:35 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: Changes were made to 210.71(A) for clarity. The square footage was increased to accommodate a reasonable sized meeting room without including convention halls. These requirements apply to meeting rooms not more than 1000 ft² in area. Informational Note No. 2 was deleted and replaced with a new informational note to give examples of rooms that are not intended to be meeting rooms.

New 210.71(B) clarifies the number and type of receptacle outlets to be installed. Receptacle outlets in fixed wall and floors are now included in 210.71B(1) and B(2) respectively. These changes also clarify that the building designer or owner is allowed to locate these receptacle outlets to best suit the anticipated use of the meeting room.

Section 210.71(D) for moveable room partitions has been deleted. Section 210.71(E) was also deleted as it is no longer needed.
Public Comment No. 762-NFPA 70-2015 [Section No. 210.71(D)]

(D) Receptacle Outlets at Moveable Room Partitions.

At least one floor receptacle outlet shall be installed for each 3.7 linear m (12 linear ft) or major fraction thereof of movable wall measured horizontally along the floor line. Where the moveable partition forms two meeting spaces at least one receptacle outlet, meeting the spacing requirements above shall be accessible from both sides of the partition when it is closed. These receptacle outlets shall be located within 450 mm (18 in.) of the partition.

Statement of Problem and Substantiation for Public Comment

Many partitions when closed will form two meeting spaces. If CMP 2 has determined a need to mitigate the use of extension cords (and I agree with such an initiative) it should make sense that this new section should be clear and enforceable in addressing occupancy use on either side of a close partition.

Related Item

Public Input No. 2872-NFPA 70-2014 [New Section after 210.70]

Submitter Information Verification

Submitter Full Name: Charles Palmieri
Organization: Town of Norwell
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 19 10:17:21 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: Changes were made to 210.71(A) for clarity. The square footage was increased to accommodate a reasonable sized meeting room without including convention halls. These requirements apply to meeting rooms not more than 1000 ft² in area. Informational Note No. 2 was deleted and replaced with a new Informational note to give examples of rooms that are not intended to be meeting rooms.

New 210.71(B) clarifies the number and type of receptacle outlets to be installed. Receptacle outlets in fixed wall and floors are now included in 210.71B(1) and B(2) respectively. These changes also clarify that the building designer or owner is allowed to locate these receptacle outlets to best suit the anticipated use of the meeting room.

Section 210.71(D) for moveable room partitions has been deleted. Section 210.71(E) was also deleted as it is no longer needed.
Public Comment No. 1761-NFPA 70-2015 [Section No. 210.71(E)]

(E) Receptacle Outlet Placement.

In applying the provisions of this section, the total number of receptacle outlets shall not be less than as determined in (B), (C), and (D). The receptacle outlets required by this section shall be permitted to be located in accordance with municipal, state, federal, or other codes and regulations, or as determined by the designer/building owner.

Informational Note No. 1: See Section 314.27(B) for floor boxes used for receptacles located in the floor.

Informational Note No. 2: See Article 518 for assembly occupancies designed for 100 or more persons.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that the panel reconsider the text of (E) to remove the slash combining two terms and Informational Note No. 2 to remove language that references an entire Article to comply with the NEC Style Manual.

Related Item

First Revision No. 7517-NFPA 70-2015 [New Section after 210.70(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 28 15:12:06 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: Changes were made to 210.71(A) for clarity. The square footage was increased to accommodate a reasonable sized meeting room without including convention halls. These requirements apply to meeting rooms not more than 1000 ft² in area. Informational Note No. 2 was deleted and replaced with a new Informational note to give examples of rooms that are not intended to be meeting rooms.

New 210.71(B) clarifies the number and type of receptacle outlets to be installed. Receptacle outlets in fixed wall and floors are now included in 210.71B(1) and B(2) respectively. These changes also clarify that the building designer or owner is allowed to locate these receptacle outlets to best suit the anticipated use of the meeting room.

Section 210.71(D) for moveable room partitions has been deleted. Section 210.71(E) was also deleted as it is no longer needed.
(1) General.

Feeder conductors shall have an ampacity not less than required to supply the load as calculated in Parts III, IV, and V of Article 220. Conductors shall be sized to carry not less than the larger of 215.2(A)(1)(a) or (b).

(a) Where a feeder supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum feeder conductor size shall have an allowable ampacity not less than the noncontinuous load plus 125 percent of the continuous load.

Exception No. 1: If the assembly, including the overcurrent devices protecting the feeder(s), is listed for operation at 100 percent of its rating, the allowable ampacity of the feeder conductors shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load.

Exception No. 2: Where a portion of a feeder is connected at both its supply and load ends to separately installed pressure connections as covered in 110.14(C)(2), it shall be permitted to have an allowable ampacity not less than the sum of the continuous load plus the noncontinuous load. No portion of a feeder installed under the provisions of this exception shall extend into an enclosure containing either the feeder supply or the feeder load terminations, as covered in 110.14(C)(1).

Exception No. 3: Grounded conductors that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the continuous and noncontinuous load.

(b) The minimum feeder conductor size shall have an allowable ampacity, an ampacity, not less than the maximum load to be served after the application of any adjustment or correction factors.

Informational Note No. 1: See Examples D1 through D11 in Informative Annex D.

Informational Note No. 2: Conductors for feeders, as defined in Article 100, sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent, will provide reasonable efficiency of operation.

Informational Note No. 3: See 210.19(A), Informational Note No. 4, for voltage drop for branch circuits.

Statement of Problem and Substantiation for Public Comment

I agree with the Panel's statement for PI 1269, that two separate comparisons are required to size the conductor properly. I still maintain that the current text is confusing. I would first ask the Panel if there is a difference between ampacity, which is defined in Article 100, and allowable ampacity which is not. I have asked numerous users of the Code to read the current text of 215.2(A)(1) and describe the difference between allowable ampacity and ampacity. The majority respond that an ampacity is read from a table in 310.15 such as Table 310.15(B)(16), and an allowable ampacity results from considering conditions of use and applying adjustment and correction factors. Although this is incorrect and actually backwards, the language in the text of 215.2(A)(1)(b) of "an allowable ampacity not less than the maximum load to be served after the application of any adjustment or correction factors." leads users of the Code to believe an allowable ampacity results from considering conditions of use. Again, this is incorrect. If ampacity is defined in Article 100 as considering the conditions of use, and an allowable ampacity is from an allowable ampacity table in 310.15 such as Table 310.15(B)(16), how can there be an allowable ampacity after conditions of use? After conditions of use and adjustment and correction factors have been applied, is not the result an ampacity, not an allowable ampacity? The current charging text of 215.2(A)(1) requires the conductor to have an ampacity not less than the maximum load to be served. How is the intent of that statement any different than the intent of 215.2(A)(1)(b)? In 215.2(A)(1)(b), I have removed the word allowable as the current text is technically incorrect and inconsistent with the definition of ampacity and allowable ampacity tables of 310.15 and it is causing confusion. If the panel disagrees, then I ask for the Panel to clarify the two separate comparisons by defining the difference between ampacity and allowable ampacity as used in this section since both terms are used.

Related Public Comments for This Document

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<thead>
<tr>
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<tr>
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<td>Related Comment</td>
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<tr>
<td>Public Comment No. 1555-NFPA 70-2015 [Section No. 230.42(A)]</td>
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Submitter Information Verification

Submitter Full Name: DERRICK ATKINS
Organization: Minneapolis Electrical JATC
Street Address:
<table>
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<th>Committee Statement</th>
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<tr>
<td><strong>Committee Action:</strong></td>
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<tr>
<td><strong>Resolution:</strong></td>
</tr>
</tbody>
</table>
(1) General. Feeder conductors shall have an allowable ampacity, after the application of any adjustment or correction factors, not less than required to supply the load as calculated in Parts III, IV, and V of Article 220. Conductors shall be sized to carry not less than the larger of 215.2(A)(1)(a) or (b). Where a feeder supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum feeder conductor size shall have an allowable ampacity, and coordinated with 240.4 for overcurrent protection. Additionally, conductor size shall be coordinated with 110.14(C) temperature limitation under same temperature column of Table 310.15(B)(16) to have an allowable ampacity, without adjustment and correction, not less than the noncontinuous load plus 125 percent of the continuous load.

Exception No. 1: If the assembly, including the overcurrent devices protecting the feeder(s), is listed for operation at 100 percent of its rating, the allowable ampacity of the feeder conductors shall be permitted to be not less than the sum of the continuous load plus the noncontinuous load.

Exception No. 2: Where a portion of a feeder is connected at both its supply and load ends to separately installed pressure connections as covered in 110.14(C)(2), it shall be permitted to have an allowable ampacity not less than the sum of the continuous load plus the noncontinuous load. No portion of a feeder installed under the provisions of this exception shall extend into an enclosure containing either the feeder supply or the feeder load terminations, as covered in 110.14(C)(1).

Exception No. 3: Grounded conductors that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the continuous and noncontinuous load.

• The minimum feeder conductor size shall have an allowable ampacity not less than the maximum load to be served after the application of any adjustment or correction factors.

Informational Note No. 1: See Examples D1 through D11 in Informative Annex D.

Informational Note No. 2: Conductors for feeders, as defined in Article 100, sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent, will provide reasonable efficiency of operation.

Informational Note No. 3: See 210.19(A), Informational Note No. 4, for voltage drop for branch circuits.

Statement of Problem and Substantiation for Public Comment

Through previous editions apprentices and indirectly-related tradespersons have had difficulty understanding how to properly determine the minimum rating and size feeder conductor which meets all the requirements. Such determination requires taking not just this section, but others sections into consideration as well. Proposed wording indicates the other sections which influence this determination and eliminates redundant or excessive wording.

If accepted, wording similar to this should be correlated to other sections using similar wording, e.g. 210.19(A) and 230.42(A).

Related Item

First Revision No. 337-NFPA 70-2015 [Section No. 215.2(A)(1)]

Submitter Information Verification

Submitter Full Name: JOSEPH HREN
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jun 26 17:12:49 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The NEC is intended for use by trained persons. Attempting to incorporate all of the installation rules into each specific application area can create unintended restrictions and potentially not include other requirements that drive the safe installation of the electrical system.
(2) Grounded Conductor.

The size of the feeder circuit grounded conductor shall not be

a. Not smaller than the ungrounded conductors, or

b. Not smaller than that required by 250.122, except that 250.122(F) shall not apply where grounded conductors are run in parallel. If a grounded conductor is sized smaller than the ungrounded conductors, it shall be protected by an Overcurrent Protection Device so that its ampacity is not exceeded under fault conditions of the ungrounded conductors. The Overcurrent Protection device shall open all the ungrounded conductors.

c. Additional minimum sizes shall be as specified in 215.2(A)(3) under the conditions stipulated.

Statement of Problem and Substantiation for Public Comment

As 215.2A@ currently reads, Fault conditions on the ungrounded conductors (for example, single phasing of a 3-phase motor or transformer) can cause a grounded conductor which is downsized (smaller than the ungrounded conductors) to exceed its ampacity, and carry a load equal to that of the remaining ungrounded conductors, possibly causing a fire. This proposed change would prevent that, by sensing the over-current on the grounded conductor, and opening up all the ungrounded conductors. This brings the NEC into conformity with British Standard BS7671 of 2008, 17th edition, where section 524.3 permits downsizing of neutral if (among other conditions) the neutral is protected against overcurrents appropriate to its crosssection area. British Standard BS7671, 17th edition of 2008, Section 431.2.1 says the overcurrent detection on the neutral shall cause the line conductors to be disconnected.

Related Item
First Revision No. 336-NFPA 70-2015 [Section No. 215.2(A)(2)]

Submitter Information Verification

Submitter Full Name: david kelman
Organization: Sallyportglobal.com
Affiliation: Michael Baker International, mbakerintl.com
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 02 09:24:21 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The sizing of the grounded conductor is addressed by referencing 250.122 which includes motor circuits. Protection of the grounded conductor is addressed in 240.22 and is outside the scope of CMP-2.
215.9 Ground-Fault Circuit-Interrupter Protection for Personnel. Feeders supplying 15- and 20-ampere receptacle branch circuits shall be permitted to be protected by a ground-fault circuit interrupter or a special-purpose ground-fault circuit interrupter installed in a readily accessible location in lieu of the provisions for such interrupters as specified in 210.8 and 590.6(A).

Statement of Problem and Substantiation for Public Comment

Fatality Statistics continue to show electrocutions as a significant cause of death at the work place. The 2015 NFPA 70E Standard, Annex K states that electrocutions are the fourth leading cause of industrial fatalities. It also stated that the National Safety Council estimates that about 1000 fatalities every year are due to electrocution, where more that 50% of them take place on system voltage less than 600 V. Moreover, approximately 30,000 non-fatal electrical shock accidents occur every year.

UL 943C identifies protective devices designated as special purpose GFCI (SPGFCI) and thus designed to meet the both NEC and NFPA 70E definition of devices intended for personnel protection. Updating the NFPA 70E code to include SPGFCIs designed and approved for industrial applications per UL 943C holds the promise of significantly reducing loss of life at the work place.

References:

Related Item
Public Input No. 2194-NFPA 70-2014 [Section No. 215.9]
First Revision No. 339-NFPA 70-2015 [New Definition after Definition: Ground-Fault Circuit Inter., ]
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification
Submitter Full Name: NEHAD EL-SHERIF
Organization: Littelfuse Startco
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 13 22:50:25 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: References to SPGFCI have not been added to Articles 210 and 215.
(2) Feeder Suppliers from Direct-Current Systems.

Where a feeder is supplied from a dc system operating at more than 50–60 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 215.12(C)(2)(a) and (b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.

(a) Positive Polarity, Sizes 6 AWG or Smaller. Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(2) A continuous red outer finish
(3) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black
(4) Imprinted plus signs (+)

±

(1) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

(e) Negative Polarity, Sizes 6 AWG or Smaller. Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(6) A continuous black outer finish
(7) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red
(8) Imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

Statement of Problem and Substantiation for Public Comment

The CMP accepted the proposal, PI-4607, to change the DC voltage from 50V to 60V to align with new Art 712 in 210.5.(C)(2) for branch circuits. It follows that for the same reason 50V should be changed to 60V in 215.12(C)(2) for feeders. Both the feeder and branch voltages should use the same break point voltage and having two different voltages would be a major discrepancy in the NEC.

Related Item
Public Input No. 4616-NFPA 70-2014 [Section No. 215.12(C)(2)]
Public Input No. 4607-NFPA 70-2014 [Section No. 210.5(C)(2)]
First Revision No. 303-NFPA 70-2015 [Section No. 210.5(C)(2)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: City: State: Zip:
Submittal Date: Wed Sep 23 11:36:13 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-327-NFPA 70-2015
<table>
<thead>
<tr>
<th>Statement:</th>
<th>A list item has been added to the identification means of positive and negative polarity conductors. This addition supports the re-use of feeder conductors for DC applications.</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Section 215.12(C)(2) is revised to support consistency in moving from 50V to 60V.</td>
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</table>
(2) Feeders Supplied from Direct-Current Systems.

Where a feeder is supplied from a dc system operating at more than 50–60 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means for existing wiring circuits in buildings which are being converted to a dc system; for new construction buildings where new wiring circuits are being installed, each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 215.12(C)(2)(a) and (b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.

(a) Positive Polarity, Sizes 6 AWG or Smaller. Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(2) A continuous red outer finish

(3) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black

(4) Imprinted plus signs (+)

±

(1) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

(e) Negative Polarity, Sizes 6 AWG or Smaller. Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(6) A continuous black outer finish

(7) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red

(8) Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

Statement of Problem and Substantiation for Public Comment

Robert Bosch LLC (Bosch) proposes two amendments to Article 215.12(C)(2).

The first amendment changes the 50 volts requirement to 60 volts to align with articles 210.5(C)(2) and 712.

The second amendment clarifies how existing wiring circuits in buildings being converted to a dc system will be identified. The reason for this amendment is that existing ungrounded conductors of 6 AWG or smaller in buildings being converted to a dc system can also be safely reused and identified per the same requirements as ungrounded conductors of 4 AWG or larger without any safety or reliability concerns. It is reasonable for the present requirements for 6 AWG or smaller in Article 215.12(C)(2)(a) and (b) to apply to new building construction, however for existing buildings it would in essence require perfectly usable existing wiring to be removed/disposed of and new wiring to be installed. This adds extra unnecessary waste/cost with the potential to create a less reliable and safe wiring environment through the extensive rework necessary, for zero benefit as the existing wiring does not need replacement and can be properly identified. The retrofit of specific existing wiring circuits to operate on a dc system, such as lighting circuits in commercial buildings, rather than having to install new wiring represents a tremendous improvement in utilization of renewable energy, overall system reliability, and resiliency to power outages with long-term cost effective savings and no impact to safety and reliability. Conversion to DC circuits also offers the opportunity to utilize high-resistance midpoint grounding schemes, which substantially reduces the chances of electric shock, since both current-carrying conductors have a high-resistance path to ground in this configuration.

Related Public Comments for This Document

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<th>Related Comment</th>
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<tr>
<td>First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]</td>
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**Submitter Information Verification**

<table>
<thead>
<tr>
<th>Submitter Full Name: Andrew Yip</th>
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<tbody>
<tr>
<td>Organization: Robert Bosch LLC</td>
</tr>
<tr>
<td>Street Address:</td>
</tr>
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<td>Submittal Date: Fri Sep 25 01:43:47 EDT 2015</td>
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**Committee Statement**

| Committee Action: Rejected but see related SR |
| Resolution: SR-327-NFPA 70-2015 |
| Statement: A list item has been added to the identification means of positive and negative polarity conductors. This addition supports the re-use of feeder conductors for DC applications. |

Section 215.12(C)(2) is revised to support consistency in moving from 50V to 60V.
Public Comment No. 1378-NFPA 70-2015 [Section No. 215.12(C)(2)]

(2) Feeders Supplied from Direct-Current Systems.

Where a feeder is supplied from a dc system operating at more than 50 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 215.12(C)(2)(a) and (b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.

(a) Positive Polarity, Sizes 6 AWG or Smaller. Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(2) A continuous red outer finish
(3) A continuous red stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or black
(4) Imprinted plus signs (+)

±

(1) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)
(2) A permanent listed marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted plus signs (+) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black. Marking tape shall not be permitted.

(e) Negative Polarity, Sizes 6 AWG or Smaller. Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(6) A continuous black outer finish
(7) A continuous black stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or red
(8) Imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)
(9) A permanent listed marking means such as sleeving or shrink-tubing that is suitable for the conductor size, at all termination, connection, and splice points, with imprinted minus signs (−) or the word NEGATIVE or NEG durably marked on insulation of a color other than green white, gray, or red. Marking tape shall not be permitted.

Statement of Problem and Substantiation for Public Comment

215.12(C)(2) was a new requirement in the 2014 NEC. It was a positive step forward in requiring clear identification of dc wiring and its polarity. Looking forward, a large part of the application of dc microgrids (see Article 712) and the LED retrofit business will involve dc power distribution through existing branch circuits. The 2014 Code did not consider this re-use case for marking, and essentially requires new cable to be pulled when a modern permanent marking method such as printed heat shrink sleeves would be quite adequate. This change is proposed in order to support this emerging, environmentally important LED retrofit industry. It allows marking by up to date, permanent means (e.g. heat shrink sleeve), and re-use of branch conductors for dc lighting and dc microgrid applications.

Regarding the safety of re-use of 277 Vac branch circuits and feeders for dc applications, building wire is typically rated for 600V ac and dc. The nominal voltage to ground of most dc microgrids is 190 Vdc (380 V center-resistively grounded). This imparts significantly less stress on insulation than 277 Vac which impresses 277 x root(2) = 390 Vpeak to ground. Ungrounded dc microgrid systems are also required to have ground fault protection by both articles 250 and 712.

Related Item
Public Input No. 4616-NFPA 70-2014 [Section No. 215.12(C)(2)]

Submitter Information Verification
Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
### Committee Statement

<table>
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<tr>
<th>Committee Action:</th>
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<td>SR-327-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement:</td>
<td>A list item has been added to the identification means of positive and negative polarity conductors. This addition supports the re-use of feeder conductors for DC applications. Section 215.12(C)(2) is revised to support consistency in moving from 50V to 60V.</td>
</tr>
</tbody>
</table>
Public Comment No. 1454-NFPA 70-2015 [Section No. 215.12(C)(2)]

(2) Feeders Supplied from Direct-Current Systems.

Where a feeder is supplied from a dc system operating at more than 50 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 215.12(C)(2)(a) and (b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.

(a) Positive Polarity, Sizes 6 AWG or Smaller.

Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(2) A continuous red outer finish

(3) A continuous red stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or black

(4) Imprinted plus signs (+)

±

(1) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

(2) In retrofit work, a permanent sleeve or tube marked /POSITIVE/POS at all splices and terminations shall be permitted

(e) Negative Polarity, Sizes 6 AWG or Smaller.

Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(6) A continuous black outer finish

(7) A continuous black stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or red

(8) Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

(9) In retrofit work, a permanent sleeve or tube marked -/NEGATIVE/NEG at all splices and terminations shall be permitted

Statement of Problem and Substantiation for Public Comment

There is increasing interest in retrofitting DC microgrids into buildings for improved energy efficiency, reliability, and self-generation of power from e.g. solar. The proposed change will provide a safe, permanent means of marking DC circuits without pulling new wire.

Related Item

Public Input No. 4607-NFPA 70-2014 [Section No. 210.5(C)(2)]

Submitter Information Verification

Submitter Full Name: Ben Polito
Organization: Pika Energy Inc
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 12:22:07 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
<table>
<thead>
<tr>
<th>Resolution:</th>
<th>SR-327-NFPA 70-2015</th>
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<tr>
<td>Statement:</td>
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(2) Feeders Supplied from Direct-Current Systems.

Where a feeder is supplied from a dc system operating at more than 50 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with 215.12(C)(2)(a) and (b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.

(a) Positive Polarity, Sizes 6 AWG or Smaller. Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:

(2) A continuous red outer finish

(3) A continuous red stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or black

(4) Imprinted plus signs (+)

±

(1) or the word POSITIVE or POS durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

(e) Negative Polarity, Sizes 6 AWG or Smaller. Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:

(6) A continuous black outer finish

(7) A continuous black stripe durably marked along the conductor’s entire length on insulation of a color other than green, white, gray, or red

(8) Imprinted minus signs (–) or the word NEGATIVE or NEG durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B)

Exception: In retrofit installations where existing conductors are to be converted to dc, it is permissible to mark only the dc voltage, “dc,” and polarity at each termination, connection, and splice point in compliance with 215.12(C)(1)(a) and (b).

Statement of Problem and Substantiation for Public Comment

The Code requires continuous identification of ungrounded dc feeders via markings every 24”. This puts undue financial burden on retrofit installations.

The EMerge Alliance proposes to allow the re-use of existing conductors in retrofit situations through suitable marking means as accepted elsewhere in the Code.

We do not believe there will be any adverse safety risk caused by this change.

The previously accepted exception to 210.5(C)1 in FR 302 above should apply to 215.12(C)2, with suitable contextual wording changes.

Related Item

First Revision No. 303-NFPA 70-2015 [Section No. 210.5(C)(2)]

Submitter Information Verification

Submitter Full Name: BEN HARTMAN
Organization: NEXTEK POWER SYSTEMS
Affiliation: EMerge Alliance
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:18:31 EDT 2015

Committee Statement
<table>
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<tr>
<td>Resolution:</td>
<td>SR-327-NFPA 70-2015</td>
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<tr>
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</tr>
</tbody>
</table>
220.3 Application of Other Articles for Specific-Purpose Calculations.

In other articles applying to the calculation of loads in specialized applications, there are requirements provided in Table 220.3 that are in addition to, or modifications of, those within lists references for specific-purpouse calculation requirements not located in Chapters 5, 6 or 7 that amend or supplement the requirements of this article.

### Table 220.3 Additional Load Specific-Purpose Calculation References

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Article</th>
<th>Section (or Part)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-conditioning and refrigerating equipment, branch-circuit conductor sizing</td>
<td>440</td>
<td>Part IV</td>
</tr>
<tr>
<td>Cranes and hoists, rating and size of conductors 610 610.14 Electric vehicle charging system branch-circuit and feeder calculations 625 625.41 Electric welders, ampacity calculations 630 630.11, 630.31 Electrically driven or controlled irrigation machines 675 675.7(A), 675.22(A) Electrified truck parking space 626 Electrolytic cell lines 668 668.3(C) Electroplating, branch-circuit conductor sizing 669 669.5 Elevator feeder demand factors 620 620.14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Fixed electric heating equipment for pipelines and vessels, branch-circuit sizing | 427     | 427.4            |
| Fixed electric space-heating equipment, branch-circuit sizing                   | 424     | 424.3            |
| Fixed outdoor electric deicing and snow-melting equipment, branch-circuit sizing | 426     | 426.4            |
| Industrial machinery, supply conductor sizing 670 670.4(A) Marinas and boatyards, feeder and service load calculations 555 555.12 Mobile homes, manufactured homes, and mobile home parks, total load for determining power supply 550 550.18(B) Mobile homes, manufactured homes, and mobile home parks, allowable demand factors for park electrical wiring systems 550 550.31 Motion picture and television studios and similar locations — sizing of feeder conductors for television studio sets 530 530.19 |
| Motors, feeder demand factor                                                   | 430     | 430.26           |
| Motors, multimotor and combination-load equipment                              | 430     | 430.25           |
| Motors, several motors or a motor(s) and other load(s)                        | 430     | 430.24           |
| Over 600-volt branch-circuit calculations                                      | 210     | 210.19(B)        |
| Over 600-volt feeder calculations                                              | 215     | 215.2(B)         |
| Phase converters, conductors                                                  | 455     | 455.6            |
| Recreational vehicle parks, basis of calculations 551 551.73(A)               |         |                   |
| Storage-type water heaters                                                    | 422     | 422.11(E)        |
| Theaters, stage switchboard feeders 520 520.27                                |         |                   |

### Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>220.3_Comment-MH.docx</td>
<td>The Word File is provided in case the changes are not clear in Terra View.</td>
<td></td>
</tr>
</tbody>
</table>

### Statement of Problem and Substantiation for Public Comment

Section 220.3 was revised to clarify the application of the table and for consistency with the title of Table 210.3.

Other than for listing requirements not amended by Chapters 5, 6 & 7, Table 220.3 is not necessary nor is it all inclusive as it exists. Section 90.3 already provides the guidance that specific equipment and applications in Chapters 5, 6 & 7 can amend or supplement the calculations in Article 220 so the sections referencing calculations in those Chapters can be removed.

Tables such as this are helpful and benefit readers when they remain all inclusive. However, it would be a challenging task to provide readers with a continually updated list of all the sections that include calculations that amend or supplement those in Article 220 so only the references that do not amend or supplement those in Article 220 via 90.3 were kept.

### Related Item

First Revision No. 340-NFPA 70-2015 [Section No. 220.3]
Submitter Information Verification

Submitter Full Name: Mark Hilbert
Organization: MR Hilbert Electrical Insp & Training
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 11:28:16 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-312-NFPA 70-2015
Statement: Section 220.3 is revised to clarify the application of the table. Other than for listing specific purpose requirements in Chapters 2, 3 & 4, Table 220.3 is not necessary nor is it all inclusive as it exists. Section 90.3 already provides the guidance that specific equipment and applications in Chapters 5, 6 & 7 can amend or supplement the feeder requirements in Article 220, so the sections referencing feeder requirements in those chapters can been removed.

National Fire Protection Association Report http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
220.12 Lighting Load for Specified Occupancies.

A unit load of not less than that specified in Table 220.12 for occupancies specified shall constitute the minimum lighting load. The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use.

Informational Note: The unit values are based on minimum load conditions and 100 percent power factor and may not provide sufficient capacity for the installation contemplated.

Exception No. 1: Where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at the values specified in the energy code where the following conditions are met:

(1) A power monitoring system is installed that will provide continuous information regarding the total general lighting load of the building.

(2) The power monitoring system will be set with alarm values to alert the building owner or manager if the lighting load exceeds the values set by the energy code.

(3) The demand factors specified in 220.42 are not applied to the general lighting load.

Exception No. 2: Where an building is entirely an office or a bank type occupancy and the lighting is designed and constructed to comply with an energy code adopted by the local authority with a lighting density of less than 13.5 Volt-Amperes/Square Meter (1 Volt-Amperes/Square Foot), the unit lighting load for those type occupancies in Table 220.12 shall be permitted to be reduced by 11 Volt-Amperes/Square Meter (1 Volt-Ampers/Square Foot).

Table 220.12 General Lighting Loads by Occupancy

<table>
<thead>
<tr>
<th>Type of Occupancy</th>
<th>Unit Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Volt-Amperes/</td>
</tr>
<tr>
<td></td>
<td>Square Meter</td>
</tr>
<tr>
<td>Armories and auditoriums</td>
<td>11</td>
</tr>
<tr>
<td>Banks</td>
<td>39&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Barber shops and beauty parlors</td>
<td>33</td>
</tr>
<tr>
<td>Churches</td>
<td>11</td>
</tr>
<tr>
<td>Clubs</td>
<td>22</td>
</tr>
<tr>
<td>Court rooms</td>
<td>22</td>
</tr>
<tr>
<td>Dwelling units&lt;sup&gt;a&lt;/sup&gt;</td>
<td>33</td>
</tr>
<tr>
<td>Garages — commercial (storage)</td>
<td>6</td>
</tr>
<tr>
<td>Hospitals</td>
<td>22</td>
</tr>
<tr>
<td>Hotels and motels, including apartment houses without provision for cooking by tenants&lt;sup&gt;a&lt;/sup&gt;</td>
<td>22</td>
</tr>
<tr>
<td>Industrial commercial (loft) buildings</td>
<td>22</td>
</tr>
<tr>
<td>Lodge rooms</td>
<td>17</td>
</tr>
<tr>
<td>Office buildings</td>
<td>39&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Restaurants</td>
<td>22</td>
</tr>
<tr>
<td>Schools</td>
<td>33</td>
</tr>
<tr>
<td>Stores</td>
<td>33</td>
</tr>
<tr>
<td>Warehouses (storage)</td>
<td>3</td>
</tr>
</tbody>
</table>

<sup>a</sup>See 220.14(J).

<sup>b</sup>See 220.14(K).
Statement of Problem and Substantiation for Public Comment

The typical light fixture of choice to provide illumination for office buildings, banks, and most other occupancies is the 2’x4 Lay-in Troffer. In the late 1980’s this fixture provide illumination with 4 fluorescent lamps using an electromagnetic ballast. The wattage for this fixture was approximately 180 watts. This fixture was normally installed on 8’ by 10’ centers or 1 fixture for every 80 square feet of office space. This equated out to a lighting power density of 2.2 watts per square foot. If you move ahead into the mid to late 1990’s the original T-12 lamps of the 1980’s were being replaced with T-8 and electronic ballasts. The same 2x4 Fluorescent fixture with T-8 lamps now required only 110 watts of power. Using the same standard fluorescent light fixture placement of 1 fixture for every 80 square feet the lighting power density was reduced to 1.375 watts per square foot.

Fast forwarding to the last few years two things have happened. First, the original 1980’s illumination standards of 70 footcandles has been reduced downward to 40 to 50 footcandles. Studies have been shown that with the advent of the computer screen and for other reasons the original illumination level was outdated. Second the invention of LED’s has driven wattage down again. An equivalent 2’x4’ LED fixture that would produce the same lumen output as a 4 lamp T-8 Troffer now draws 71 watts. With the same 80 square foot per fixture we are now down to .8875 watts per square foot. If you take into account the reduced lighting levels of 40 to 50 footcandles lighting designers are no longer installing 4 lamps fluorescents but are moving to 2 or 3 lamps fixture to achieve the lower light levels. LED 2’x4 fixtures with equivalent lumen output of 2 to 3 lamps are around 38 watts per fixture or .475 watts per square foot.

The reduction in lighting power is also a result of Nationally Recognized Energy standards such as ASHRAE and IECC. These documents, where adopted, have steadily mandated lower and lower lighting power densities in various occupancy types across the country. While the adoption of these standards was sparse 10 to 15 years ago, in today’s world they are commonplace. In the 2013 version of ASHRAE, the lighting power densities for office type buildings is mandated to be less than .82 watts per square foot.

I have attached excerpts from both the ASHRAE and IECC lighting power allowance standards to show the required allowances if a building department or AHJ requires these standards to be adopted. We are seeking relief on the decades old lighting power allowance of 3.5 watts per square foot for offices and banks. We are asking that this value be reduced to 2.5 watts per square foot for office or bank type occupancies where it can be shown that the building is designed based on a Nationally recognized lighting power density of 1.2 watts per square foot or less. We this this is a safe value based upon the standards in place and are providing a 200% safety factor.

We also think that this is a safety issue. By reducing the lighting allowance we are allowing services to be reduced in size which will in turn reduce the size of the main overcurrent device. Utilities, when calculating their demand for their system, already take into account the reduced lighting load and size their system accordingly. Installing smaller transformer provides a lower fault current level but installing large breakers that are mandated by NEC sizing rules facilitates the possibility for larger incident energy values.

We have attached portions of Table 9.6.1 from a ASHRAE 2013 Energy standard that shows a lighting power density for banking areas at 1.01 watts per square foot and also attached Table 9.5.1 which shows a lighting power density for offices at .82 watts per square foot.

Related Item
Public Input No. 3685-NFPA 70-2014 [Section No. 220.14(K)]

Submitter Information Verification

Submitter Full Name: Lawrence Ayer
Organization: Biz Com Electric, Inc.
Affiliation: IEC
Street Address: City:
State:
Zip:
Submittal Date: Wed Sep 23 15:26:47 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-313-NFPA 70-2015
Statement: The new exception establishes the path by which the energy code will reduce the lighting load to a level of 2.5VA / sq. ft. for office and bank areas.
Public Comment No. 125-NFPA 70-2015 [Article 225]

Article 225. Outside Branch Circuits and Feeders

225.1 Scope.

This article covers requirements for outside branch circuits and feeders run on or between buildings, structures, or poles on the premises; and electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles.

Informational Note: For additional information on wiring over 1000 volts, see ANSI C2-2007, National Electrical Safety Code.

225.3 Other Articles.

Application of other articles, including additional requirements to specific cases of equipment and conductors, is shown in Table 225.3.

Table 225.3 Other Articles

<table>
<thead>
<tr>
<th>Equipment/Conductors</th>
<th>Article</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branch circuits</td>
<td>210</td>
</tr>
<tr>
<td>Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits</td>
<td>725</td>
</tr>
<tr>
<td>Communications circuits</td>
<td>800</td>
</tr>
<tr>
<td>Community antenna television and radio distribution systems</td>
<td>820</td>
</tr>
<tr>
<td>Conductors for general wiring</td>
<td>310</td>
</tr>
<tr>
<td>Electrically driven or controlled irrigation machines</td>
<td>675</td>
</tr>
<tr>
<td>Electric signs and outline lighting</td>
<td>600</td>
</tr>
<tr>
<td>Feeders</td>
<td>215</td>
</tr>
<tr>
<td>Fire alarm systems</td>
<td>760</td>
</tr>
<tr>
<td>Fixed outdoor electric deicing and snow-melting equipment</td>
<td>426</td>
</tr>
<tr>
<td>Floating buildings</td>
<td>553</td>
</tr>
<tr>
<td>Grounding and bonding</td>
<td>250</td>
</tr>
<tr>
<td>Hazardous (classified) locations</td>
<td>500</td>
</tr>
<tr>
<td>Hazardous (classified) locations — specific</td>
<td>510</td>
</tr>
<tr>
<td>Marinas and boatyards</td>
<td>555</td>
</tr>
<tr>
<td>Messenger-supported wiring</td>
<td>396</td>
</tr>
<tr>
<td>Mobile homes, manufactured homes, and mobile home parks</td>
<td>550</td>
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<tr>
<td>Open wiring on insulators</td>
<td>398</td>
</tr>
<tr>
<td>Over 1000 volts, general</td>
<td>490</td>
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<tr>
<td>Overcurrent protection</td>
<td>240</td>
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<tr>
<td>Radio and television equipment</td>
<td>810</td>
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<tr>
<td>Services</td>
<td>230</td>
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<tr>
<td>Solar photovoltaic systems</td>
<td>690</td>
</tr>
<tr>
<td>Swimming pools, fountains, and similar installations</td>
<td>680</td>
</tr>
<tr>
<td>Use and identification of grounded conductors</td>
<td>200</td>
</tr>
</tbody>
</table>

Part I. General

225.4 Conductor Covering.

Where within 3.0 m (10 ft) of any building or structure other than supporting poles or towers, open individual (aerial) overhead conductors shall be insulated for the nominal voltage. The insulation of conductors in cables or raceways, except Type MI cable, shall be of thermoset or thermoplastic type and, in wet locations, shall comply with 310.10(C). The insulation of conductors for festoon lighting shall be of the rubber-covered or thermoplastic type.

Exception: Equipment grounding conductors and grounded circuit conductors shall be permitted to be bare or covered as specifically permitted elsewhere in this Code.

225.5 Size of Conductors 600 Volts, Nominal, or Less.

The ampacity of outdoor branch-circuit and feeder conductors shall be in accordance with 310.15 based on loads as determined under 220.10 and Part III of Article 220.

225.6 Conductor Size and Support.
Overhead Spans.

Open individual conductors shall not be smaller than the following:

1. For 1000 volts, nominal, or less, 10 AWG copper or 8 AWG aluminum for spans up to 15 m (50 ft) in length, and 8 AWG copper or 6 AWG aluminum for a longer span unless supported by a messenger wire.

2. For over 1000 volts, nominal, 6 AWG copper or 4 AWG aluminum where open individual conductors, and 8 AWG copper or 6 AWG aluminum where in cable.

Festoon Lighting.

Overhead conductors for festoon lighting shall not be smaller than 12 AWG unless the conductors are supported by messenger wires. In all spans exceeding 12 m (40 ft), the conductors shall be supported by messenger wire. The messenger wire shall be supported by strain insulators. Conductors or messenger wires shall not be attached to any fire escape, downspout, or plumbing equipment.

Lighting Equipment Installed Outdoors.

(A) General.

For the supply of lighting equipment installed outdoors, the branch circuits shall comply with Article 210 and 225.7(B) through (D).

(B) Common Neutral.

The ampacity of the neutral conductor shall not be less than the maximum net calculated load current between the neutral conductor and all ungrounded conductors connected to any one phase of the circuit.

(C) 277 Volts to Ground.

Circuits exceeding 120 volts, nominal, between conductors and not exceeding 277 volts, nominal, to ground shall be permitted to supply luminaires for illumination of outdoor areas of industrial establishments, office buildings, schools, stores, and other commercial or public buildings.

(D) 1000 Volts Between Conductors.

Circuits exceeding 277 volts, nominal, to ground and not exceeding 1000 volts, nominal, between conductors shall be permitted to supply the auxiliary equipment of electric-discharge lamps in accordance with 210.6(D) (1).

Calculation of Loads 1000 Volts, Nominal, or Less.

(A) Branch Circuits.

The load on outdoor branch circuits shall be as determined by 220.10.

(B) Feeders.

The load on outdoor feeders shall be as determined by Part III of Article 220.
225.10  Wiring on Buildings (or Other Structures).
The installation of outside wiring on surfaces of buildings (or other structures) shall be permitted for circuits of not over 1000 volts, nominal, as the following:

(1) Auxiliary gutters
(2) Busways
(3) Cable trays
(4) Cablebus
(5) Electrical metallic tubing (EMT)
(6) Flexible metal conduit (FMC)
(7) Intermediate metal conduit (IMC)
(8) Liquidtight flexible metal conduit (LFMC)
(9) Liquidtight flexible nonmetallic conduit (LFNC)
(10) Messenger-supported wiring
(11) Multiconductor cable
(12) Open wiring on insulators
(13) Reinforced thermosetting resin conduit (RTRC)
(14) Rigid metal conduit (RMC)
(15) Rigid polyvinyl chloride conduit (PVC)
(16) Type MC cable
(17) Type MI cable
(18) Type UF cable
(19) Wireways

Circuits of over 1000 volts, nominal, shall be installed as provided in 300.37.

225.11  Feeder and Branch-Circuit Conductors Entering, Exiting, or Attached to Buildings or Structures.
Feeder and branch-circuit conductors entering or exiting buildings or structures shall be installed in accordance with the requirements of 230.52. Overhead branch circuits and feeders attached to buildings or structures shall be installed in accordance with the requirements of 230.54.

225.12  Open-Conductor Supports.
Open conductors shall be supported on knobs, racks, brackets, or strain insulators, that are made of glass, porcelain, or other approved materials.

225.14  Open-Conductor Spacings.
(A)  1000 Volts, Nominal, or Less.
Conductors of 1000 volts, nominal, or less, shall comply with the spacings provided in Table 230.51(C).

(B)  Over 1000 Volts, Nominal.
Conductors of over 1000 volts, nominal, shall comply with the spacings provided in 110.36 and 490.24.

(C)  Separation from Other Circuits.
Open conductors shall be separated from open conductors of other circuits or systems by not less than 100 mm (4 in.).

(D)  Conductors on Poles.
Conductors on poles shall have a separation of not less than 300 mm (1 ft) where not placed on racks or brackets. Conductors supported on poles shall provide a horizontal climbing space not less than the following:

(1) Power conductors below communications conductors — 750 mm (30 in.)
(2) Power conductors alone or above communications conductors:
   (3)  300 volts or less — 600 mm (24 in.)
   (4)  Over 300 volts — 750 mm (30 in.)

(5) Communications conductors below power conductors — same as power conductors
(6) Communications conductors alone — no requirement

225.15  Supports over Buildings.
Supports over a building shall be in accordance with 230.29.

225.16  Attachment to Buildings.
(A) Point of Attachment.

The point of attachment to a building shall be in accordance with 230.26.

(B) Means of Attachment.

The means of attachment to a building shall be in accordance with 230.27.

225.17 Masts as Supports.

Only feeder or branch-circuit conductors specified within this section shall be permitted to be attached to the feeder and/or branch-circuit mast. Masts used for the support of final spans of feeders or branch circuits shall be installed in accordance with 225.17(A) and (B).

(A) Strength.

The mast shall have adequate strength or be supported by braces or guys to safely withstand the strain imposed by the overhead feeder or branch-circuit conductors. Hubs intended for use with a conduit serving as a mast for support of feeder or branch-circuit conductors shall be identified for use with a mast.

(B) Attachment.

Feeder and/or branch-circuit conductors shall not be attached to a mast where the connection is between a weatherhead or the end of the conduit and a coupling where the coupling is located above the last point of securement to the building or other structure, or where the coupling is located above the building or other structure.

225.18 Clearance for Overhead Conductors and Cables.

Overhead spans of open conductors and open multicore cables of not over 1000 volts, nominal, shall have a clearance of not less than the following:

1. 3.0 m (10 ft) — above finished grade, sidewalks, or from any platform or projection from which they are reachable where the voltage does not exceed 150 volts to ground and accessible to pedestrians only.

2. 3.7 m (12 ft) — over residential property and driveways, and those commercial areas not subject to truck traffic where the voltage does not exceed 300 volts to ground.

3. 4.5 m (15 ft) — for those areas listed in the 3.7 m (12 ft) classification where the voltage exceeds 300 volts to ground.

4. 5.5 m (18 ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles, such as cultivated, grazing, forest, and orchard.

5. 7.5 m (24 1/2 ft) — over track rails of railroads.

225.19 Clearances from Buildings for Conductors of Not over 1000 Volts, Nominal.

(A) Above Roofs.

Overhead spans of open conductors and open multicore cables shall have a vertical clearance of not less than 2.7 m (8 ft 6 in.) above the roof surface. The vertical clearance above the roof level shall be maintained for a distance not less than 900 mm (3 ft) in all directions from the edge of the roof.

Exception No. 1: The area above a roof surface subject to pedestrian or vehicular traffic shall have a vertical clearance from the roof surface in accordance with the clearance requirements of 225.18.

Exception No. 2: Where the voltage between conductors does not exceed 300, and the roof has a slope of 100 mm in 300 mm (4 in. in 12 in.) or greater, a reduction in clearance to 900 mm (3 ft) shall be permitted.

Exception No. 3: Where the voltage between conductors does not exceed 300, a reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.8 m (6 ft) of the conductors, 1.2 m (4 ft) horizontally, pass above the roof overhang, and (2) they are terminated at a through-the-roof raceway or approved support.

Exception No. 4: The requirement for maintaining the vertical clearance 900 mm (3 ft) from the edge of the roof shall not apply to the final conductor span where the conductors are attached to the side of a building.

(B) From Nonbuilding or Nonbridge Structures.

From signs, chimneys, radio and television antennas, tanks, and other nonbuilding or nonbridge structures, clearances — vertical, diagonal, and horizontal — shall not be less than 900 mm (3 ft).

(C) Horizontal Clearances.

Clearances shall not be less than 900 mm (3 ft).

(D) Final Spans.

Final spans of feeders or branch circuits shall comply with 225.19(D)(1), (D)(2), and (D)(3).

1. Clearance from Windows.

Final spans to the building they supply, or from which they are fed, shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, and from doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

Exception: Conductors run above the top level of a window shall be permitted to be less than the 900 mm (3 ft) requirement.
(2) Vertical Clearance.

The vertical clearance of final spans above or within 900 mm (3 ft) measured horizontally of platforms, projections, or surfaces from which they are reachable shall be maintained in accordance with 225.18.

(3) Building Openings.

The overhead branch-circuit and feeder conductors shall not be installed beneath openings through which materials may be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these openings.

(E) Zone for Fire Ladders.

Where buildings exceed three stories or 15 m (50 ft) in height, overhead lines shall be arranged, where practicable, so that a clear space (or zone) at least 1.8 m (6 ft) wide will be left either adjacent to the buildings or beginning not over 2.5 m (8 ft) from them to facilitate the raising of ladders when necessary for fire fighting.

225.20 Protection Against Physical Damage.

Conductors installed on buildings, structures, or poles shall be protected against physical damage as provided for services in 230.50.

225.21 Multiconductor Cables on Exterior Surfaces of Buildings (or Other Structures).

Supports for multiconductor cables on exterior surfaces of buildings (or other structures) shall be as provided in 230.51.

225.22 Raceways on Exterior Surfaces of Buildings or Other Structures.

Raceways on exteriors of buildings or other structures shall be arranged to drain and shall be listed or approved for use in wet locations.

225.24 Outdoor Lampholders.

Where outdoor lampholders are attached as pendants, the connections to the circuit wires shall be staggered. Where such lampholders have terminals of a type that puncture the insulation and make contact with the conductors, they shall be attached only to conductors of the stranded type.

225.25 Location of Outdoor Lamps.

Locations of lamps for outdoor lighting shall be below all energized conductors, transformers, or other electric utilization equipment, unless either of the following apply:

(1) Clearances or other safeguards are provided for relamping operations.

(2) Equipment is controlled by a disconnecting means that is lockable in accordance with 110.25.

225.26 Vegetation as Support.

Vegetation such as trees shall not be used for support of overhead conductor spans.

225.27 Raceway Seal.

Where a raceway enters a building or structure from outside, it shall be sealed. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.

Part II. Buildings or Other Structures Supplied by a Feeder(s) or Branch Circuit(s)

225.30 Number of Supplies.

A building or other structure that is served by a branch circuit or feeder on the load side of a service disconnecting means shall be supplied by only one feeder or branch circuit unless permitted in 225.30(A) through (F). For the purpose of this section, a multiwire branch circuit shall be considered a single circuit.

Where a branch circuit or feeder originates in these additional buildings or other structures, only one feeder or branch circuit shall be permitted to supply power back to the original building or structure, unless permitted in 225.30(A) through (F).

(A) Special Conditions.

Additional feeders or branch circuits shall be permitted to supply the following:

(1) Fire pumps

(2) Emergency systems

(3) Legally required standby systems

(4) Optional standby systems

(5) Parallel power production systems

(6) Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability

(7) Electric vehicle charging systems listed, labeled, and identified for more than a single branch circuit/feeder
Special Occupancies.
By special permission, additional feeders or branch circuits shall be permitted for either of the following:

1. Multiple-occupancy buildings where there is no space available for supply equipment accessible to all occupants
2. A single building or other structure sufficiently large to make two or more supplies necessary

Capacity Requirements.
Additional feeders or branch circuits shall be permitted where the capacity requirements are in excess of 2000 amperes at a supply voltage of 1000 volts or less.

Different Characteristics.
Additional feeders or branch circuits shall be permitted for different voltages, frequencies, or phases, or for different uses such as control of outside lighting from multiple locations.

Documented Switching Procedures.
Additional feeders or branch circuits shall be permitted to supply installations under single management where documented safe switching procedures are established and maintained for disconnection.

One- or Two-Family Dwelling Unit(s).
For a one- or two-family dwelling unit(s) with multiple feeders, it shall be permissible to install not more than six disconnects grouped at one location where the feeders enter the building, provided the feeder conductors are sized 1/0 or larger and originate at the same location.

Disconnecting Means.
Means shall be provided for disconnecting all ungrounded conductors that supply or pass through the building or structure.

Location.
The disconnecting means shall be installed either inside or outside of the building or structure served or where the conductors pass through the building or structure. The disconnecting means shall be at a readily accessible location nearest the point of entrance of the conductors. For the purposes of this section, the requirements in 230.6 shall be utilized.

Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained for disconnection, and where the installation is monitored by qualified individuals, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 2: For buildings or other structures qualifying under the provisions of Article 685, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 3: For towers or poles used as lighting standards, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 4: For poles or similar structures used only for support of signs installed in accordance with Article 600, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 5: For electric vehicle charging systems, the disconnecting means shall be installed in accordance with 625.42.

Maximum Number of Disconnects.
(A) General.
The disconnecting means for each supply permitted by 225.30 shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard or switchgear. There shall be no more than six disconnects per supply grouped in any one location.

Exception: For the purposes of this section, disconnecting means used solely for the control circuit of the ground-fault protection system, or the control circuit of the power-operated supply disconnecting means, installed as part of the listed equipment, shall not be considered a supply disconnecting means.

(B) Single-Pole Units.
Two or three single-pole switches or breakers capable of individual operation shall be permitted on multwire circuits, one pole for each ungrounded conductor, as one multipole disconnect, provided they are equipped with identified handle ties or a master handle to disconnect all ungrounded conductors with no more than six operations of the hand.

Grouping of Disconnects.
(A) General.
The two to six disconnects as permitted in 225.33 shall be grouped. Each disconnect shall be marked to indicate the load served.

Exception: One of the two to six disconnecting means permitted in 225.33, where used only for a water pump also intended to provide fire protection, shall be permitted to be located remote from the other disconnecting means.

(B) Additional Disconnecting Means.
The one or more additional disconnecting means for fire pumps or for emergency, legally required standby or optional standby system permitted by 225.30 shall be installed sufficiently remote from the one to six disconnecting means for normal supply to minimize the possibility of simultaneous interruption of supply.
225.35  Access to Occupants.

In a multiple-occupancy building, each occupant shall have access to the occupant's supply disconnecting means.

*Exception: In a multiple-occupancy building where electric supply and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the supply disconnecting means supplying more than one occupancy shall be permitted to be accessible to authorized management personnel only.*

225.36  Type of Disconnecting Means.

The disconnecting means specified in 225.31 shall be comprised of a circuit breaker, molded case switch, general-use switch, snap switch, or other approved means. Where applied in accordance with 250.32(B), Exception No. 1, the disconnecting means shall be suitable for use as service equipment.

225.37  Identification.

Where a building or structure has any combination of feeders, branch circuits, or services passing through it or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location denoting all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.

*Exception No. 1: A plaque or directory shall not be required for large-capacity multibuilding industrial installations under single management, where it is ensured that disconnection can be accomplished by establishing and maintaining safe switching procedures.*

*Exception No. 2: This identification shall not be required for branch circuits installed from a dwelling unit to a second building or structure.*

225.38  Disconnect Construction.

Disconnecting means shall meet the requirements of 225.38(A) through (D).

(A)  Manually or Power Operable.

The disconnecting means shall consist of either (1) a manually operable switch or a circuit breaker equipped with a handle or other suitable operating means or (2) a power-operable switch or circuit breaker, provided the switch or circuit breaker can be opened by hand in the event of a power failure.

(B)  Simultaneous Opening of Poles.

Each building or structure disconnecting means shall simultaneously disconnect all ungrounded supply conductors that it controls from the building or structure wiring system.

(C)  Disconnection of Grounded Conductor.

Where the building or structure disconnecting means does not disconnect the grounded conductor from the grounded conductors in the building or structure wiring, other means shall be provided for this purpose at the location of the disconnecting means. A terminal or bus to which all grounded conductors can be attached by means of pressure connectors shall be permitted for this purpose.

In a multisection switchboard or switchgear, disconnects for the grounded conductor shall be permitted to be in any section of the switchboard or switchgear, if the switchboard section or switchgear section is marked to indicate a grounded conductor disconnect is located within.

(D)  Indicating.

The building or structure disconnecting means shall plainly indicate whether it is in the open or closed position.

225.39  Rating of Disconnect.

The feeder or branch-circuit disconnecting means shall have a rating of not less than the calculated load to be supplied, determined in accordance with Parts I and II of Article 220 for branch circuits, Part III or IV of Article 220 for feeders, or Part V of Article 220 for farm loads. Where the branch circuit or feeder disconnecting means consists of more than one switch or circuit breaker, as permitted by 225.33, combining the ratings of all the switches or circuit breakers for determining the rating of the disconnecting means shall be permitted. In no case shall the rating be lower than specified in 225.39(A), (B), (C), or (D).

(A)  One-Circuit Installation.

For installations to supply only limited loads of a single branch circuit, the branch circuit disconnecting means shall have a rating of not less than 15 amperes.

(B)  Two-Circuit Installations.

For installations consisting of not more than two 2-wire branch circuits, the feeder or branch-circuit disconnecting means shall have a rating of not less than 30 amperes.

(C)  One-Family Dwelling.

For a one-family dwelling, the feeder disconnecting means shall have a rating of not less than 100 amperes, 3-wire.

(D)  All Others.

For all other installations, the feeder or branch-circuit disconnecting means shall have a rating of not less than 60 amperes.

225.40  Access to Overcurrent Protective Devices.

Where a feeder overcurrent device is not readily accessible, branch-circuit overcurrent devices shall be installed on the load side, shall be mounted in a readily accessible location, and shall be of a lower ampere rating than the feeder overcurrent device.
Part III. Over 1000 Volts.

225.50 Sizing of Conductors.

The sizing of conductors over 1000 volts shall be in accordance with 210.19(B) for branch circuits and 215.2(B) for feeders.

225.51 Isolating Switches.

Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute a building disconnecting means, an isolating switch with visible break contacts and meeting the requirements of 230.204(B), (C), and (D) shall be installed on the supply side of the disconnecting means and all associated equipment.

Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.

225.52 Disconnecting Means.

(A) Location.

A building or structure disconnecting means shall be located in accordance with 225.32, or, if not readily accessible, it shall be operable by mechanical linkage from a readily accessible point. For multibuilding industrial installations under single management, it shall be permitted to be electrically operated by a readily accessible, remote-control device in a separate building or structure.

(B) Type.

Each building or structure disconnect shall simultaneously disconnect all ungrounded supply conductors it controls and shall have a fault-closing rating not less than the maximum available short-circuit current available at its supply terminals.

Exception: Where the individual disconnecting means consists of fused cutouts, the simultaneous disconnection of all ungrounded supply conductors shall not be required if there is a means to disconnect the load before opening the cutouts. A permanent legible sign shall be installed adjacent to the fused cutouts and shall read DISCONNECT LOAD BEFORE OPENING CUTOUTS.

Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault closing rating of the disconnecting means.

(C) Locking.

Disconnecting means shall be lockable in accordance with 110.25.

Exception: Where an individual disconnecting means consists of fused cutouts, a suitable enclosure capable of being locked and sized to contain all cutout fuse holders shall be installed at a convenient location to the fused cutouts.

(D) Indicating.

Disconnecting means shall clearly indicate whether they are in the open “off” or closed “on” position.

(E) Uniform Position.

Where disconnecting means handles are operated vertically, the “up” position of the handle shall be the “on” position.

Exception: A switching device having more than one “on” position, such as a double throw switch, shall not be required to comply with this requirement.

(F) Identification.

Where a building or structure has any combination of feeders, branch circuits, or services passing through or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location that denotes all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.

225.56 Inspections and Tests.

(A) Pre-Energization and Operating Tests.

The complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be performance tested when first installed on-site. Each protective, switching, and control circuit shall be adjusted in accordance with the system design and tested by actual operation using current injection or equivalent methods as necessary to ensure that each and every such circuit operates correctly to the satisfaction of the authority having jurisdiction.

(1) Instrument Transformers.

All instrument transformers shall be tested to verify correct polarity and burden.

(2) Protective Relays.

Each protective relay shall be demonstrated to operate by injecting current or voltage, or both, at the associated instrument transformer output terminal and observing that the associated switching and signaling functions occur correctly and in proper time and sequence to accomplish the protective function intended.

(3) Switching Circuits.

Each switching circuit shall be observed to operate the associated equipment being switched.
(4) Control and Signal Circuits.
Each control or signal circuit shall be observed to perform its proper control function or produce a correct signal output.

(5) Metering Circuits.
All metering circuits shall be verified to operate correctly from voltage and current sources in a similar manner to protective relay circuits.

(6) Acceptance Tests.
Complete acceptance tests shall be performed, after the substation installation is completed, on all assemblies, equipment, conductors, and control and protective systems, as applicable, to verify the integrity of all the systems.

(7) Relays and Metering Utilizing Phase Differences.
All relays and metering that use phase differences for operation shall be verified by measuring phase angles at the relay under actual load conditions after operation commences.

(B) Test Report.
A test report covering the results of the tests required in 225.56(A) shall be delivered to the authority having jurisdiction prior to energization.


225.60 Clearances over Roadways, Walkways, Rail, Water, and Open Land.

(A) 22 kV, Nominal, to Ground or Less.
The clearances over roadways, walkways, rail, water, and open land for conductors and live parts up to 22 kV, nominal, to ground or less shall be not less than the values shown in Table 225.60.

(B) Over 22 kV Nominal to Ground.
Clearances for the categories shown in Table 225.60 shall be increased by 10 mm (0.4 in.) per kV above 22,000 volts.

(C) Special Cases.
For special cases, such as where crossings will be made over lakes, rivers, or areas using large vehicles such as mining operations, specific designs shall be engineered considering the special circumstances and shall be approved by the authority having jurisdiction.

Informational Note: For additional information, see ANSI, see IEEE C2-2007, National Electrical Safety Code.
Table 225.60 Clearances over Roadways, Walkways, Rail, Water, and Open Land

<table>
<thead>
<tr>
<th>Location</th>
<th>Clearance</th>
<th>m</th>
<th>ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open land subject to vehicles, cultivation, or grazing</td>
<td>5.6</td>
<td>18.5</td>
<td></td>
</tr>
<tr>
<td>Roadways, driveways, parking lots, and alleys</td>
<td>5.6</td>
<td>18.5</td>
<td></td>
</tr>
<tr>
<td>Walkways</td>
<td>4.1</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>Rails</td>
<td>8.1</td>
<td>26.5</td>
<td></td>
</tr>
<tr>
<td>Spaces and ways for pedestrians and restricted traffic</td>
<td>4.4</td>
<td>14.5</td>
<td></td>
</tr>
<tr>
<td>Water areas not suitable for boating</td>
<td>5.2</td>
<td>17.0</td>
<td></td>
</tr>
</tbody>
</table>

225.61 Clearances over Buildings and Other Structures.

(A) 22 kV Nominal to Ground or Less.
The clearances over buildings and other structures for conductors and live parts up to 22 kV, nominal, to ground or less shall be not less than the values shown in Table 225.61.
(B) Over 22 kV Nominal to Ground.

Clearances for the categories shown in Table 225.61 shall be increased by 10 mm (0.4 in.) per kV above 22,000 volts.

Informational Note: For additional information, see ANSI, see IEEE, C2-2007 2012, National Electrical Safety Code.

Table 225.61 Clearances over Buildings and Other Structures

<table>
<thead>
<tr>
<th>Clearance from Conductors or Live Parts from:</th>
<th>Horizontal</th>
<th>Vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
<td>ft</td>
</tr>
<tr>
<td>Building walls, projections, and windows</td>
<td>2.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Balconies, catwalks, and similar areas accessible to people</td>
<td>2.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Over or under roofs or projections not readily accessible to people</td>
<td>4.1</td>
<td>13.5</td>
</tr>
<tr>
<td>Over roofs accessible to vehicles but not trucks</td>
<td>4.1</td>
<td>13.5</td>
</tr>
<tr>
<td>Over roofs accessible to trucks</td>
<td>5.6</td>
<td>18.5</td>
</tr>
<tr>
<td>Other structures</td>
<td>2.3</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Updated ANSI C2-2007 to read IEEE C2-2012 throughout the chapter.

Related Item
Public Input No. 3671-NFPA 70-2014 [New Section after 225.61]
Public Input No. 3826-NFPA 70-2014 [Article 225]

Submitter Information Verification
Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
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Submittal Date: Mon Jul 06 13:08:57 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-916-NFPA 70-2015
Statement: This revision updates references to current editions in several places.
225.10  Wiring on Buildings (or Other Structures).

The installation of outside wiring on surfaces of buildings (or other structures) shall be permitted for circuits of not over 1000 volts, nominal, as the following:

(1) Auxiliary gutters
(2) Busways
(3) Cable trays
(4) Cablebus
(5) Electrical metallic tubing (EMT)
(6) Flexible metal conduit (FMC)
(7) Intermediate metal conduit (IMC)
(8) Liquidtight flexible metal conduit (LFMC)
(9) Liquidtight flexible nonmetallic conduit (LFNC)
(10) Messenger-supported wiring
(11) Multiconductor cable
(12) Open wiring on insulators
(13) Reinforced thermosetting resin conduit (RTRC)
(14) Rigid metal conduit (RMC)
(15) Rigid polyvinyl chloride conduit (PVC)
(16) Type MC cable
(17) Type MI cable
(18) Type UF cable
(19) Wireways

Circuits of over 1000 volts, nominal, shall be installed as provided in 300.37.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to reconsider the action on FR 1023 relative to the use of the phrase “of over 1000 volts” and consider the use of the preferred phrase “exceeding 1000 volts” to comply with the NEC Style Manual.

Related Item
First Revision No. 1023-NFPA 70-2015 [Section No. 225.10]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 28 15:02:40 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-901-NFPA 70-2015
Statement: The text was revised to comply with the Style Manual for consistent language.
225.18 Clearance for Overhead Conductors and Cables.

Overhead spans of open conductors and open multiconductor cables of not over 1000 volts, nominal, shall have a clearance of not less than the following:

1. 3.0 m (10 ft) — above finished grade, sidewalks, or from any platform or projection from which they are reachable platforms or projections, where the voltage does not exceed 150 volts to ground and accessible to pedestrians only

2. 3.7 m (12 ft) — over residential property and driveways, and those commercial areas not subject to truck traffic where the voltage does not exceed 300 volts to ground

3. 4.5 m (15 ft) — for those areas listed in the 3.7 m (12 ft) classification where the voltage exceeds 300 volts to ground

4. 5.5 m (18 ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles, such as cultivated, grazing, forest, and orchard

5. 7.5 m (24 1/2 ft) — over track rails of railroads

Statement of Problem and Substantiation for Public Comment

Proposed wording is awkward, at best. I believe the thought can be accurately conveyed using less words. And, I couldn't find 'reachable' in the dictionary.

Related Item
First Revision No. 907-NFPA 70-2015 [Section No. 225.18]

Submitter Information Verification
Submitter Full Name: J. Grant Hammett
Organization: Colorado State Electrical Board
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 03 16:30:44 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Statement: The text was revised to remove the word "reachable," which is considered to be vague.
Public Comment No. 527-NFPA 70-2015 [Section No. 225.19(D)(2)]

(2) Vertical Clearance.
The vertical clearance of final spans above finished grade or above and within 900 mm (3 ft) measured horizontally of platforms, projections, or surfaces from which they are reachable shall be maintained in accordance with 225.18.

Statement of Problem and Substantiation for Public Comment

Proposed wording is awkward, at best. I believe the thought can be accurately conveyed using less words. And, I couldn't find 'reachable' in the dictionary.

Related Item
First Revision No. 909-NFPA 70-2015 [Section No. 225.19(D)(2)]

Submitter Information Verification

Submitter Full Name: J. Grant Hammett
Organization: Colorado State Electrical Board
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Zip:
Submittal Date: Thu Sep 03 16:39:44 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-908-NFPA 70-2015
Statement: The text was revised to remove the word "reachable," which is considered to be vague.
### Public Comment No. 332-NFPA 70-2015 [Section No. 225.22]

**225.22 Raceways on Exterior Surfaces of Buildings or Other Structures.**
Raceways on exteriors of buildings or other structures shall be arranged to drain and shall be listed or approved (listed) for use in wet locations.

### Statement of Problem and Substantiation for Public Comment

All of the raceway articles require the use of listed raceways. The use of the words "or approved" add confusion as they suggest that the use of a raceway that is not listed would be permitted in a wet location.

**Related Item**
First Revision No. 919-NFPA 70-2015 [Section No. 225.22]

### Submitter Information Verification

**Submitter Full Name:** DON GANIERE  
**Organization:** [Not Specified]  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Fri Jul 31 17:17:40 EDT 2015

### Committee Statement

**Committee Action:** Rejected  
**Resolution:** The word “Approved” is intended to be used here. The submitter is correct in that the various raceway articles use language relative to listing. The reason the word approved is used here is that there are times when custom raceways are built on site that are not covered by this code and that also do not bear listing marks. In these special cases it is intended that the AHJ has the ability to approve the use of such raceways.
Public Comment No. 1134-NFPA 70-2015 [Section No. 225.27]

225.27 Raceway Seal.
Where a raceway enters a building or structure from outside an underground distribution system, it shall be sealed in accordance with 300.5(G). Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or and other components.

Statement of Problem and Substantiation for Public Comment

Requiring that all conduits entering a building from outside will create corrosion issues for many metallic wiring methods entering a building from outside. Whereas most underground systems are nonmetallic wiring methods, or galvanized rigid, many times EMT is used to run conductors from inside a building to equipment outside the building. We have seen local instances where branch circuit conduit systems were sealed, trapping moisture that then corroded the conduit from the inside out. Requiring these conductors to be sealed can also conflict with the requirement that they be "arranged to drain" as required in 225.22.

Multiple example of this have been observed by local contractors in the Las Vegas area. One such installation problem discovered by a local contractor, Roberts Electric, is described below:

"During the summer of 2013, approximately June or July, our company received an emergency call regarding loss of power to three (3) roof mounted evaporative coolers. All three (3) of the existing coolers were fed from the same branch circuit with separate switching to each cooler.

The pictures illustrate the conduit that left the internal ceiling mounted junction box and traveled approximately ten (10') feet across the warehouse ceiling to the point where it proceeded to pierce the roof membrane and terminate in the combination motor starter located on the roof. The conduit in the pictures had a ninety degree bend where it traveled up through the roof and an additional ninety degree bend where it terminated in the aforementioned electrical junction box. The conduit had been sealed at the electrical junction box and on the roof where it entered the combination motor starter.

Because of the EMT and the temperature difference between the roof conduit and the warehouse conduit, condensation had formed in the conduit. This condensation with nowhere to evaporate began corroding the interior of the conduit and the conductors were sitting in moisture. Eventually this caused the conductor insulation to degrade and this resulted in a fault.

Our company has had several calls for this same commercial property with the exact same scenario. The only difference seems to be the degree of the fault and the damage sustained to the conduit and the conductors."

The photographs referenced above and further details are available if desired.

Related Item

First Revision No. 920-NFPA 70-2015 [Section No. 225.27]

Submitter Information Verification

Submitter Full Name: HOWARD HERNDON
Organization: SOUTHWEST ELECTRITECH SVCS LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 21:24:51 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: It is intended to have all raceways that enter a building or structure to be sealed. The requirement to seal raceways where they enter buildings that have temperatures inside that are different from outside (conditioned and unconditioned spaces) is already located in Section 300.7. This requirement simply supports that requirement.
225.27 Raceway Seal.
Where a raceway enters a building or structure from outside an underground distribution system, it shall be sealed in accordance with 300.5(G). Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.

Statement of Problem and Substantiation for Public Comment

No substantiation was made to make this change which fundamentally revises the requirement in 225.27. In addition, no parallel change was made to 230.8 which puts the two requirements for the same situation out of correlation between Article 225 Outside Branch Circuits and Feeders and Article 230 Services. The purpose of sealing the raceway is discussed in 300.5(G) and in the Informational Note of that same section. Not all raceways entering the building from outside would need to be sealed.

Related Item
First Revision No. 920-NFPA 70-2015 [Section No. 225.27]

Submitter Information Verification

Submitter Full Name: TIMOTHY CROUSHORE
Organization: FIRSTENERGY
Affiliation: FirstEnergy
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 27 15:31:33 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: It is intended to have all raceways that enter a building or structure to be sealed. The requirement to seal raceways where they enter buildings that have temperatures inside that are different from outside (conditioned and unconditioned spaces) is already located in Section 300.7. This requirement simply supports that requirement.
225.30 Number of Supplies.
A building or other structure that is served by a branch circuit or feeder on the load side of a service disconnecting means shall be supplied by only one feeder or branch circuit unless permitted in 225.30(A) through (F). For the purpose of this section, a multiwire branch circuit shall be considered a single circuit.

Where a branch circuit or feeder originates in these additional buildings or other structures, only one feeder or branch circuit shall be permitted to supply power back to the original building or structure, unless permitted in 225.30(A) through (F).

(A) Special Conditions.
Additional feeders or branch circuits shall be permitted to supply the following:

1. Fire pumps
2. Emergency systems
3. Legally required standby systems
4. Optional standby systems
5. Parallel power production systems
6. Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability
7. Electric vehicle charging systems listed, labeled, and identified for more than a single branch circuit/feeder

(B) Special Occupancies.
By special permission, additional feeders or branch circuits shall be permitted for either of the following:

1. Multiple-occupancy buildings where there is no space available for supply equipment accessible to all occupants
2. A single building or other structure sufficiently large to make two or more supplies necessary

(C) Capacity Requirements.
Additional feeders or branch circuits shall be permitted where the capacity requirements are in excess of 2000 amperes at a supply voltage of 1000 volts or less.

(D) Different Characteristics.
Additional feeders or branch circuits shall be permitted for different voltages, frequencies, or phases, or for different uses such as control of outside lighting from multiple locations.

(E) Documented Switching Procedures.
Additional feeders or branch circuits shall be permitted to supply installations under single management where documented safe switching procedures are established and maintained for disconnection.

(F) One- or Two-Family Dwelling Unit(s).
For a one- or two-family dwelling unit(s) with multiple feeders, it shall be permissible to install not more than six disconnects grouped at one location where the feeders enter the building, provided the feeder conductors are sized 1/0 or larger and originate at the same location.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that this First Revision be rewritten to comply with the NEC Style Manual and to clarify the phrase “for more than a single branch circuit/feeder.” Slash markings are not permitted by the NEC Style Manual. In addition, the panel is directed to clarify the phrase “and originate at the same location” in new (F) with the specifics of the feeder origin.

Related Item
First Revision No. 921-NFPA 70-2015 [Section No. 225.30]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:  
City:  
State:  
Zip:  

11/19/2015 12:04 PM
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-902-NFPA 70-2015
Statement: Part (A)(7) was revised to comply with the Style Manual.

Part (F) was revised to clarify where the feeder connectors are intended to originate.
Section 225.30(F)

One- or Two-Family Dwelling Unit(s).

For a one- or two-family dwelling unit(s) with multiple feeders, it shall be permissible to install not more than six disconnects grouped at one location where the feeders enter the building, provided the feeder conductors are sized 1/0 or larger and originate at the same location.

Statement of Problem and Substantiation for Public Comment

This is an excellent change! We have for years wrestled with the code where the power company would only provide service from a meter pedestal with one or two 200 A breakers. If the structure requirements exceeded 200 A for a single feeder, we were forced to rely on the logic found in 230.2(C)(2), understanding we had feeder, not service conductors. This solves that problem! Good work!

Related Item

First Revision No. 921-NFPA 70-2015 [Section No. 225.30]

Submitter Information Verification

Submitter Full Name: J GRANT HAMMETT
Organization: COLORADO STATE ELECTRICAL BOARD
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 24 15:08:59 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter has not presented any recommended changes.
Public Comment No. 793-NFPA 70-2015 [Section No. 225.30(F)]

(F) One- or Two-Family Dwelling Unit(s).

For multiple feeders shall be permitted for one- or two-family dwelling unit(s) with multiple feeders, it shall be permissible to install not more than six disconnects grouped at one location where the feeders enter the building, provided the feeder conductors are sized 1/0 or larger and originate at the same location.

Statement of Problem and Substantiation for Public Comment

IEC’s position is to delete wording and revise wording in 225.30(F) to improve clarity—(FR 921)

The grouping of disconnects is already required in 225.34 and the maximum number is stated in 225.33; adding this to 225.30(F) is redundant. The location of the disconnecting means is covered in 225.32.

IEC respects the safety concern of the panel and recognizes that feeders are very different than service conductors in that feeders have overcurrent protection. Multiple feeders are installed in buildings in accordance with Article 215 and there is no requirement to have a disconnecting means at the termination point of the feeder. The words “where the feeders enter the building” could cause problems for the installer and additional expense for the home owner without enhancing safety. For instance, a service structure could be built 15 feet away from the house and all service equipment is installed on the structure. The main disconnect and the feeder disconnects are in a main distribution panel at the service structure. An AHJ could require additional disconnects at the house even though the required disconnects are readily accessible and grouped in the main distribution panel. Firefighters would be able to disconnect all power by turning off the main disconnect.

IEC does not understand the minimum size of 1/0 or larger for a feeder. What Code provision is being violated with a #3 THWN conductor that is protected at its supply with a 100 amp overcurrent protective device, provided the conditions of use allow the #3 to be used at its 100 amp rating? The minimum size of feeders is addressed in 215.2.

Related Item

First Revision No. 921-NFPA 70-2015 [Section No. 225.30]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 18:09:11 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The original language that the CMP approved in the First Draft was intended to limit the number of feeders entering a building to no more than six. This number aligns with similar requirements found elsewhere in the NEC relative to power entering buildings. The minimum size of 1/0 was chosen to align with the minimum sizing allowed for parallel conductor installations. Multiple feeders with conductors smaller than 1/0, such as the #3 that the submitter references, could be combined into a single larger feeder.
225.32 Location.

The disconnecting means shall be installed either inside or outside of the building or structure served or where the conductors pass through the building or structure. The disconnecting means shall be at a readily accessible location nearest the point of entrance of the conductors. For the purposes of this section, the requirements in 230.6 shall be utilized.

Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained for disconnection, and where the installation is monitored by qualified individuals, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 2: For buildings or other structures qualifying under the provisions of Article 685, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 3: For towers or poles used as lighting standards, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 4: For poles or similar structures used only for support of signs installed in accordance with Article 600, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 5: For electric vehicle charging systems, the disconnecting means shall be installed in accordance with 625.42.

Statement of Problem and Substantiation for Public Comment

Delete the proposed new exception.

The action taken by CMP-1 on FR 13 to revise the defined term "structure" resolves the issue and concern raised by the submitters of PI's 3924 and 4610. The revised definition will be as follows:

Structure. That which is built or constructed, other than equipment.

The addition of the words "other than equipment" addresses the issue raised in the PI's. Additionally the proposed revision would allow unlimited lengths of conductors inside a building or structure. Vehicle charging equipment is not limited to outdoors only and 625.42 only requires the disconnecting means be "readily accessible". There is no requirement in Article 625 that addresses an outside branch circuit or feeder entering a building or structure. Article 625 relies on the general rule in 225.32 for the location of the disconnect.

Related Item
First Revision No. 922-NFPA 70-2015 [Section No. 225.32]
Public Input No. 3924-NFPA 70-2014 [Section No. 225.32]
Public Input No. 4610-NFPA 70-2014 [Section No. 225.32]

Submitter Information Verification

Submitter Full Name: James Dollard
Organization: IBEW Local Union 98
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 08:48:47 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-903-NFPA 70-2015
Statement: Exception 5 was removed, as this requirement was already addressed elsewhere in the Code.
(C) Disconnection of Grounded Conductor.

Where the building or structure disconnecting means does not disconnect the grounded conductor from the grounded conductors in the building or structure wiring, other means shall be provided for this purpose at the location of the disconnecting means. A terminal or bus to which all grounded conductors can be attached by means of pressure connectors shall be permitted for this purpose.

In a multisection switchboard or switchgear, disconnects for the grounded conductor shall be permitted to be in any section of the switchboard or switchgear, if the switchboard section or switchgear section is marked to indicate a grounded conductor disconnect is located within.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that Code-Making Panel 4 clarify the use of the phrase “is located within.”

**Related Item**

First Revision No. 924-NFPA 70-2015 [Section No. 225.38(C)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC  
Organization: NFPA  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Mon Sep 28 15:06:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR  
Resolution: SR-904-NFPA 70-2015  
Statement: The text was revised to better indicate where the grounded conductor disconnect is located.
TITLE OF NEW CONTENT

Type your content here ...

225.41 Surge Protection for Outside Feeders. All outside feeders supplying buildings or other structures shall include a listed
Type 1 or Type 2 surge protective device (SPD). The SPD shall be located in the disconnecting means, or immediately adjacent
to the disconnecting means that is required by 225.31.

Exception: Surge protection is not required for non-habitable buildings or other structures supplied from outside feeders that
originate in one- and two-family dwellings.

Statement of Problem and Substantiation for Public Comment

The Committee Statement to resolve PI 2796 suggests that surge protection should be optional, at the discretion of the property owner.
Surge protection is very similar to overcurrent protection in that it is needed to minimize equipment damage due to voltage surges.
Since it is unreasonable to claim that surge voltages are not causing property damage, CMP 4 is encouraged to treat overvoltage
protection in a manner similar to overcurrent protection.

Related Item
Public Input No. 2796-NFPA 70-2014 [New Section after 225.40]

Submitter Information Verification

Submitter Full Name: Vincent Saporita
Organization: Eaton
Affiliation: Eaton
Street Address: Eaton
City:
State:
Zip:
Submittal Date: Wed Sep 23 16:32:09 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Surge protection may protect some electrical equipment from unwanted electrical surges that enter the electrical system.
The submitter has not presented any technical substantiation to support mandating this equipment for every feeder that
enters a building. Building occupants that are concerned with potential electrical surges are permitted to install this
equipment in either service equipment or feeder equipment already.
225.41 Electrical Service Areas

At least one 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed in an accessible location within 7.5 m (25 ft) of the outdoor electrical service equipment.

Exception No. 1: The receptacle outlet shall not be required to be installed outside of one- and two-family dwellings.

Exception No. 2: Where the service voltage is greater than 120 volts to ground, a receptacle outlet shall not be required for services dedicated to equipment covered in Articles 675 and 682.

Statement of Problem and Substantiation for Public Comment

In creating First Revision FR 323 to 210.64 to address cord sets running through open doors of electrical service areas, Code-Making Panel 2 explicitly rejected those portions of PI 1439 and 3344 that advocated for removal of these requirements for outdoor electrical service areas other than irrigation machines of Article 675 and artificial bodies of water of Article 682 due to remoteness. CMP-2 Statement for First Revision 323 reads:

"PI 1439 and 3344: The panel did NOT AGREE that the receptacle required should ONLY BE REQUIRED FOR INDOOR SERVICES. A requirement that the receptacle be included in the service ROOM did not address similar needs for OUTSIDE SERVICES."

These requirements prior to FR 323 nonetheless encompass both indoor and outdoor electrical service areas. Outdoor electrical service areas however are addressed by Article 225 under the responsibility of CMP-4, not CMP-2. Accordingly, for correlation, the existing requirements for outdoor electrical service areas, except for the revisions for 25 ft distance and the exemptions for irrigation machines and artificial bodies of water, should be now maintained in Article 225.

Committee Statement

Committee Action: Rejected

Resolution: Article 225 addresses outside feeder installations not service equipment. Requirements for the placement of receptacle outlets is under the purview of CMP 2 and should be addressed there.
Public Comment No. 40-NFPA 70-2015 [Section No. 225.61]

225.61 Clearances over Buildings and Other Structures.

(A) 22 kV Nominal to Ground or Less.

The clearances over buildings and other structures for conductors and live parts up to 22 kV, nominal, to ground or less shall be not less than the values shown in Table 225.61.

(B) Over 22 kV Nominal to Ground.

Clearances for the categories shown in Table 225.61 shall be increased by 10 mm (0.4 in.) per kV above 22,000 volts.

Informational Note: For additional information, see ANSI C2-2007, IEEE C2-2012, National Electrical Safety Code.

Table 225.61 Clearances over Buildings and Other Structures

<table>
<thead>
<tr>
<th>Clearance from Conductors or Live Parts from:</th>
<th>Horizontal</th>
<th>Vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
<td>ft</td>
</tr>
<tr>
<td>Building walls, projections, and windows</td>
<td>2.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Balconies, catwalks, and similar areas accessible to people</td>
<td>2.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Over or under roofs or projections not readily accessible to people</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Over roofs accessible to vehicles but not trucks</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Over roofs accessible to trucks</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Other structures</td>
<td>2.3</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

Referenced correct SDO name, and edition.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 43-NFPA 70-2015 [Section No. B.310.15(B)(2)]</td>
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<tr>
<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
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<tr>
<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
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<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
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<td>Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]</td>
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<td>Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]</td>
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<tr>
<td>Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]</td>
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<tr>
<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
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<tr>
<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
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<tr>
<td>Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]</td>
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<tr>
<td>Public Comment No. 95-NFPA 70-2015 [Section No. 620.1]</td>
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<tr>
<td>Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]</td>
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<tr>
<td>Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]</td>
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<tr>
<td>Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]</td>
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</tbody>
</table>

Committee Input No. 1000-NFPA 70-2015 [New Section after 225.61]

Public Input No. 3671-NFPA 70-2014 [New Section after 225.61]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
<table>
<thead>
<tr>
<th><strong>Committee Statement</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Committee Action:</strong> Rejected but see related SR</td>
</tr>
<tr>
<td><strong>Resolution:</strong> SR-916-NFPA 70-2015</td>
</tr>
<tr>
<td><strong>Statement:</strong> This revision updates references to current editions in several places.</td>
</tr>
</tbody>
</table>
Statement of Problem and Substantiation for Public Comment

Add a new item (7) to the list to coordinate with the new item (7) that was added in 225.30.

Related Item
First Revision No. 921-NFPA 70-2015 [Section No. 225.30]

Submitter Information Verification
Submitter Full Name: TIMOTHY CROUSHORE
Organization: FIRSTENERGY
Affiliation: FirstEnergy
Street Address: City: State: Zip:
Submittal Date: Mon Jul 27 13:41:21 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: There is no technical rationale to allow supplying electric vehicle charging equipment with more than one service. The requirements located in Section 225.30 and those located in Section 230.2 are similar but are dramatically different based on the source of electricity supplying each.
Public Comment No. 346-NFPA 70-2015 [New Section after 230.3]

230.4 Services Separate on Load-Side of Service Disconnect - PI 1187

Committee Comment – PI 1187, Additional Substantiation

The resolution statement doesn’t address the issue of two utility sources tied together through customer wiring as depicted on the previously submitted PI files. In addition to the initial PI substantiation, the equipment grounding conductors between the two services creates a parallel path with the utility’s grounded system neutral. The utility’s fault or unbalanced current can flow through the customer’s wiring. Obviously, this creates the opportunity for stray voltage/current through customer wiring. This is a safety concern and can create a possible catastrophic event. From a NEC standpoint, this PI will help mitigate possible stray voltage/current caused by customer wiring.

Statement of Problem and Substantiation for Public Comment

Committee Comment – PI 1187, Additional Substantiation

The resolution statement doesn’t address the issue of two utility sources tied together through customer wiring as depicted on the previously submitted PI files. In addition to the initial PI substantiation, the equipment grounding conductors between the two services creates a parallel path with the utility’s grounded system neutral. The utility’s fault or unbalanced current can flow through the customer’s wiring. Obviously, this creates the opportunity for stray voltage/current through customer wiring. This is a safety concern and can create a possible catastrophic event. From a NEC standpoint, this PI will help mitigate possible stray voltage/current caused by customer wiring.

Related Item

Public Input No. 1187-NFPA 70-2014 [New Section after 230.3]

Submitter Information Verification

Submitter Full Name: DARRELL SUMBERA
Organization: CENTERPOINT ENERGY
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 03 11:03:46 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter has not presented any recommended change or recommended action to be taken by the panel. The original Public Input that is referenced was resolved by the panel in the first revision process and provided information to the submitter relative to existing NEC requirements that cover the installation that is being described in both the Public Input and the Public Comment
230.7 Other Conductors in Raceway or Cable.
Conductors other than service conductors shall not be installed in the same service raceway or service cable.

Exception No. 1: Grounding electrode conductors or supply side bonding jumpers or conductors.
Exception No. 2: Load management control conductors having overcurrent protection.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs that this FR 926 and Exception No. 2 be rewritten in complete sentences to comply with the NEC Style Manual, Section 3.1.4.1.

Related Item
First Revision No. 926-NFPA 70-2015 [Section No. 230.7]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:07:13 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-905-NFPA 70-2015
Statement: The text was revised to meet the Style Manual for complete sentences.
Public Comment No. 528-NFPA 70-2015 [Section No. 230.9(B)]

(B) Vertical Clearance.

The vertical clearance of final spans above finished grade, or above and within 900 mm (3 ft) measured horizontally of platforms, projections, or surfaces from which they are reachable, shall be maintained in accordance with 230.24(B).

Statement of Problem and Substantiation for Public Comment

Proposed wording is awkward, at best. I believe the thought can be accurately conveyed using less words. And, I couldn't find 'reachable' in the dictionary.

Related Item
First Revision No. 927-NFPA 70-2015 [Section No. 230.9(B)]

Submitter Information Verification

Submitter Full Name: J. Grant Hammett
Organization: Colorado State Electrical Board
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 03 16:55:27 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-906-NFPA 70-2015
Statement: The text was revised to remove the word "reachable," which is considered to be vague.
**Public Comment No. 1680-NFPA 70-2015 [Section No. 230.29]**

<table>
<thead>
<tr>
<th>230.29</th>
<th>Supports over Buildings.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service conductors passing over a roof shall be securely supported by substantial structures. For a grounded system, where the substantial structure is metal, it shall be bonded by means of a bonding jumper and listed connector to the grounded overhead service conductor. The bonding jumper shall be of the same conductor size and material as the grounded overhead service conductor. Where practicable, such supports shall be independent of the building. For ungrounded system, where the substantial structure is metal, it shall be bonded by means of a bonding jumper and listed connector to the grounding electrode system. The bonding jumper shall be sized per 250.102C. Where practicable, such supports shall be independent of the building.</td>
<td></td>
</tr>
</tbody>
</table>

**Statement of Problem and Substantiation for Public Comment**

Metal structures supporting ungrounded system still need to be bonded back to the grounding electrode system.

**Related Item**

First Revision No. 936-NFPA 70-2015 [Section No. 230.29]

**Submitter Information Verification**

- **Submitter Full Name:** WENDELL WHISTLER
- **Organization:** ALASKA JOINT ELECTRICAL APPREN
- **Affiliation:** IBEW
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Fri Sep 25 16:20:32 EDT 2015

**Committee Statement**

- **Committee Action:** Rejected
- **Resolution:** This type of connection could actually introduce a hazard as it does not provide a solid ground fault current return path back to the source. Bonding the metal structure to a local grounding electrode would energize this bonding conductor in the event of a conductor fault at the support structure location. With no ground detector system available this conductor and the associated electrode would be energized at the voltage level of the faulted conductor and would become a severe shock hazard and potentially a fire hazard. The structures that are being described in this Section are elevated at the rooftop location and thus even if energized do not pose a substantial shock hazard. When dealing with a grounded system connecting the system grounded conductor to the steel support tower provides a path for fault currents back to the utility transformer.
**Public Comment No. 360-NFPA 70-2015 [Section No. 230.29]**

230.29 - Supports over Buildings.

Service conductors passing over a roof shall be securely supported by substantial structures. For a grounded system, where the substantial structure is metal, it shall be bonded by means of a bonding jumper and listed connector to the grounded overhead service conductor. The bonding jumper shall be of the same conductor size and material as the grounded overhead service conductor. Where practicable, such supports shall be independent of the building.

**Statement of Problem and Substantiation for Public Comment**

I'm not trying to be rude, but this panel does not have the ability to write Grounding and Bonding rules. Either delete or have Panel 5 assist in the language. I don't want to go into the details on the many issues I have but let's just start with bonding jumper sizing?...

**Related Item**

First Revision No. 936-NFPA 70-2015 [Section No. 230.29]

**Submitter Information Verification**

Submitter Full Name: MIKE HOLT  
Organization: MIKE HOLT ENTERPRISES INC  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Tue Aug 04 14:56:34 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR  
Resolution: SR-909-NFPA 70-2015  
Statement: This modified language addresses the sizing of the bonding conductor in accordance with the requirements located in Article 250.
230.29 Supports over Buildings.

Service conductors passing over a roof shall be securely supported by substantial structures. For a grounded system, where the substantial structure is metal, it shall be bonded by means of a bonding jumper and listed connector to the grounded overhead service conductor. The bonding jumper shall be of the same conductor size and material as. For an ungrounded system, where the substantial structure is metal, it shall be bonded by means of a bonding jumper and listed connector to the grounded overhead service conductor. The bonding jumper shall be sized per 250.102(C)(1). Where practicable, such supports shall be independent of the building.

Statement of Problem and Substantiation for Public Comment

There is a shock hazard with ungrounded systems as well as with grounded systems. Sizing the supply side bonding jumper can be determined by using Table 250.102(C)(1), the material installation requirements is covered by 250.102 (A), (B), and (C)

Related Item
First Revision No. 936-NFPA 70-2015 [Section No. 230.29]

Submitter Information Verification

Submitter Full Name: Christine Porter
Organization: Intertek Testing Services
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 16:17:40 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-909-NFPA 70-2015
Statement: This modified language addresses the sizing of the bonding conductor in accordance with the requirements located in Article 250.
Public Comment No. 1758-NFPA 70-2015 [Section No. 230.30(A)]

(A) Insulation.
Underground service conductors shall be insulated for the applied voltage.

Exception: A grounded conductor shall be permitted to be uninsulated as follows:

(1) Bare copper used in a raceway
(2) Bare copper for direct burial where bare copper is approved for the soil conditions
(3) Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use
(4) Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly identified for underground use in a raceway or for direct burial

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that Code-Making Panel 4 reconsider the use of the word “approved” in this context.

Related Item
First Revision No. 930-NFPA 70-2015 [Section No. 230.30(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:09:00 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel accepted the word “approved” in this application as the local AHJ would have the knowledge of soil and environmental conditions and thus the applicability of a particular bare conductor type.
### Public Comment No. 1759-NFPA 70-2015 [Section No. 230.41]

<table>
<thead>
<tr>
<th>230.41</th>
<th>Insulation of Service-Entrance Conductors.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Service-entrance conductors entering or on the exterior of buildings or other structures shall be insulated.</td>
</tr>
<tr>
<td></td>
<td><strong>Exception:</strong> A grounded conductor shall be permitted to be uninsulated as follows:</td>
</tr>
<tr>
<td></td>
<td>(1) Bare copper used in a raceway or part of a service cable assembly</td>
</tr>
<tr>
<td></td>
<td>(2) Bare copper for direct burial where bare copper is approved for the soil conditions</td>
</tr>
<tr>
<td></td>
<td>(3) Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use</td>
</tr>
<tr>
<td></td>
<td>(4) Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly or identified for underground use in a raceway, or for direct burial</td>
</tr>
<tr>
<td></td>
<td>(5) Bare conductors used in an auxiliary gutter</td>
</tr>
</tbody>
</table>

### Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that Code-Making Panel 4 reconsider the use of the word “approved” in this context.

**Related Item**

First Revision No. 932-NFPA 70-2015 [Section No. 230.41]

### Submitter Information Verification

- **Submitter Full Name:** CC on NEC-AAC
- **Organization:** NFPA
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Mon Sep 28 15:09:44 EDT 2015

### Committee Statement

- **Committee Action:** Rejected
- **Resolution:** The panel accepted the word “approved” in this application as the local AHJ would have the knowledge of soil and environmental conditions and thus the applicability of a particular bare conductor type.
230.41 Insulation of Service-Entrance Conductors.

Service-entrance conductors entering or on the exterior of buildings or other structures shall be insulated.

*Exception: A grounded conductor shall be permitted to be uninsulated as follows:*

1. Bare copper used in a raceway or part of a service cable assembly
2. Bare copper for direct burial where bare copper is approved, is identified for the soil conditions
3. Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use
4. Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly or identified for underground use in a raceway, or for direct burial
5. Bare conductors used in an auxiliary gutter

Statement of Problem and Substantiation for Public Comment

This section has been proposed to be changed from "judged to be suitable" for the soil conditions to "approved" for the soil conditions. Perhaps a better choice of words here would be "identified" for the soil conditions. Who does approving? According to Article 100, the authority having jurisdiction (AHJ) does approving. The AHJ could "approve" any type of a conductor in this situation. As an AHJ, I greatly depended upon identified products by a third-party testing agency to base my approval. See the definition of "identified" in Article 100.

Related Item

First Revision No. 932-NFPA 70-2015 [Section No. 230.41]
Public Input No. 1206-NFPA 70-2014 [Section No. 230.41]

Submitter Information Verification

Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 14:36:33 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel accepted the word “approved” in this application as the local AHJ would have the knowledge of soil and environmental conditions and thus the applicability of a particular bare conductor type.
Public Comment No. 1120-NFPA 70-2015 [Section No. 230.42(A)]

(A) General.

The ampacity of service-entrance conductors shall not be smaller than the largest required in 230.42(A)(1), (A)(2), or (A)(3). Loads shall be determined in accordance with Part III, IV, or V of Article 220, as applicable. Ampacity shall be determined from 310.15. The maximum allowable current of busways shall be that value for which the busway has been listed or and labeled.

1. The sum of the noncontinuous loads plus 125 percent of continuous loads

   Exception: Grounded conductors that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the continuous and noncontinuous load.

2. The sum of the noncontinuous load plus the continuous load after the application of any adjustment or correction factors

3. The sum of the noncontinuous load plus the continuous load if the service-entrance conductors terminate in an overcurrent device where both the overcurrent device and its assembly are listed for operation at 100 percent of their rating

Additional Proposed Changes

<table>
<thead>
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<th>Description</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
</tr>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.
Related Item
Public Input No. 882-NFPA 70-2014 [Section No. 230.42(A)]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 19:56:03 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-910-NFPA 70-2015
Statement: The word "or" was changed to "and" to clarify that equipment that is listed shall also be labeled to assist AHJs in determining whether the equipment is listed during an inspection.

This section was modified to be expressed in a similar fashion to similar requirements found in other parts of the Code.
(A) General.

The ampacity of service entrance conductors shall have an ampacity of not be smaller than the largest less than the maximum load to be served. Conductors shall be sized to carry not less than the required in 230.42(A)(1), (A)(2), or (A)(3). Loads shall be determined in accordance with Part III, IV, or V of Article 220, as applicable. Ampacity shall be determined from 310.15. The maximum allowable current of busways shall be that value for which the busway has been listed or labeled.

(1) The sum of the. Where the service-entrance conductors carry continuous or any combination of noncontinuous and continuous loads, the minimum service-entrance conductor size shall have an allowable ampacity not less than the sum of the noncontinuous loads plus 125 percent of continuous loads.

Exception: Grounded conductors that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the continuous and noncontinuous load.

(2) The sum of the minimum service-entrance conductor size shall have an ampacity not less than the sum of the noncontinuous load plus the continuous load after the application of any adjustment or correction factors.

(3) The sum of the noncontinuous load plus the continuous load if the service-entrance conductors terminate in an overcurrent device where both the overcurrent device and its assembly are listed for operation at 100 percent of their rating.

Statement of Problem and Substantiation for Public Comment

Public Input 1270 was an attempt to provide consistency in the applications of 210.19(A)(1), 215.2(A)(1), and 230.42(A) and distinguish when allowable ampacity and ampacity should be used. As currently written, the ampacity of a service-entrance conductor is required to be not less than the noncontinuous load and 125% of the continuous load. Since ampacity is defined in Article 100 as being the maximum current the conductor can safely carry under conditions of use, 230.42(A)(2) is in conflict with 230.42(A)(1). As stated in 230.42(A)(2), is it not redundant to state after the application of adjustment and correction factors since the definition of ampacity already states conditions of use? If it is the panel's intent that 230.42(A)(1) would apply to a conductor's allowable ampacity, without adjustment and correction factors, then the text of the Code should clarify the rule by using the allowable ampacity and not ampacity. As stated in public comments 373 and 393, I would additionally ask the panel if there is a difference between allowable ampacity and ampacity? The allowable ampacity, which does not consider conditions of use, should be compared to the load as stated in 230.42(A)(1), and the ampacity, which considers conditions of use, should be compared to the load as stated in 230.42(A)(2).

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 393-NFPA 70-2015 [Section No. 215.2(A)(1)]</td>
<td></td>
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</tbody>
</table>
This section was modified to be expressed in a similar fashion to similar requirements found in other parts of the Code.
Public Comment No. 1760-NFPA 70-2015 [Section No. 230.42(A)]

(A) General.
The ampacity of service-entrance conductors shall not be smaller than the largest required in 230.42(A)(1), (A)(2), or (A)(3). Loads shall be determined in accordance with Part III, IV, or V of Article 220, as applicable. Ampacity shall be determined from 310.15. The maximum allowable current of busways shall be that value for which the busway has been listed or labeled.

1. The sum of the noncontinuous loads plus 125 percent of continuous loads
   
   Exception: Grounded conductors that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the continuous and noncontinuous load.

2. The sum of the noncontinuous load plus the continuous load after the application of any adjustment or correction factors

3. The sum of the noncontinuous load plus the continuous load if the service-entrance conductors terminate in an overcurrent device where both the overcurrent device and its assembly are listed for operation at 100 percent of their rating

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to FR 947 to correlate the language structure with 215.2 and 210.19. The difference in the positive language and exception structure can create confusion and in this case technical differences that may not have been intended.

Related Item
First Revision No. 947-NFPA 70-2015 [Section No. 230.42(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 28 15:10:31 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-910-NFPA 70-2015
Statement: The word "or" was changed to "and" to clarify that equipment that is listed shall also be labeled to assist AHJs in determining whether the equipment is listed during an inspection.

This section was modified to be expressed in a similar fashion to similar requirements found in other parts of the Code.
230.44 Cable Trays.
Cable tray systems shall be permitted to support service-entrance conductors. Cable trays used to support service-entrance conductors shall contain only service-entrance conductors and shall be limited to the following methods:

1. Type SE cable
2. Type MC cable
3. Type MI cable
4. Type IGS cable
5. Single conductors 1/0 and larger that are listed for use in cable tray, or cable assemblies with Type TC rating

Such cable trays shall be identified with permanently affixed labels with the wording “Service-Entrance Conductors.” The labels shall be located so as to be visible after installation with a spacing not to exceed 3 m (10 ft) so that the service-entrance conductors are able to be readily traced through the entire length of the cable tray.

Exception: Conductors, other than service-entrance conductors, shall be permitted to be installed in a cable tray with service-entrance conductors, provided a solid fixed barrier of a material compatible with the cable tray is installed to separate the service-entrance conductors from other conductors installed in the cable tray.

Statement of Problem and Substantiation for Public Comment

The language "or Cable Assemblies with Type TC rating" is confusing since "cable assemblies" is not defined and "Type TC" is a cable wiring method that has not been evaluated for use as service conductors in cable tray.

Related Item

First Revision No. 933-NFPA 70-2015 [Section No. 230.44]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 22:34:31 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-911-NFPA 70-2015
Statement: The section was revised to establish Power Tray Cable as an individual item and to clarify what cable types can be used as service-entrance conductors in cable trays.
230.44 Cable Trays.

Cable tray systems shall be permitted to support service-entrance conductors. Cable trays used to support service-entrance conductors shall contain only service-entrance conductors and shall be limited to the following methods:

(1) Type SE cable
(2) Type MC cable
(3) Type MI cable
(4) Type IGS cable
(5) Single conductors 1/0 and larger that are listed for use in cable tray or cable assemblies with Type TC rating

Such cable trays shall be identified with permanently affixed labels with the wording “Service-Entrance Conductors.” The labels shall be located so as to be visible after installation with a spacing not to exceed 3 m (10 ft) so that the service-entrance conductors are able to be readily traced through the entire length of the cable tray.

Exception: Conductors, other than service-entrance conductors, shall be permitted to be installed in a cable tray with service-entrance conductors, provided a solid fixed barrier of a material compatible with the cable tray is installed to separate the service-entrance conductors from other conductors installed in the cable tray.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the Panel to reconsider item (5) for correct terminology and consider the addition of "cable assemblies" as list item (6) with correct terminology is Power Tray Cable (Type TC)

Related Item
First Revision No. 933-NFPA 70-2015 [Section No. 230.44]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:13:25 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-911-NFPA 70-2015
Statement: The section was revised to establish Power Tray Cable as an individual item and to clarify what cable types can be used as service-entrance conductors in cable trays.
Revise FR 933 as follows:

230.44 Cable Trays.

Cable tray systems shall be permitted to support service-entrance conductors. Cable trays used to support service-entrance conductors shall contain only service-entrance conductors, and shall be limited to the following methods:

- Type SE cable
- Type MC cable
- Type MI cable
- Type IGS cable
- Single conductors 1/0 and larger that are listed for use in cable tray or cable assemblies with Type TC rating

Such cable trays shall be identified with permanently affixed labels with the wording “Service-Entrance Conductors.” The labels shall be located so as to be visible after installation with a spacing not to exceed 3 m (10 ft) so that the service-entrance conductors are able to be readily traced through the entire length of the cable tray.

Exception: Conductors, other than service-entrance conductors, shall be permitted to be installed in a cable tray with service-entrance conductors, provided a solid fixed barrier of a material compatible with the cable tray is installed to separate the service-entrance conductors from other conductors installed in the cable tray.

Statement of Problem and Substantiation for Public Comment

By limiting the service conductors permitted in cable trays systems to the five listed items many other methods permitted in 392.10(A) and 230.43 that provide safe physical protection of service conductors are prohibited without any substantiation. Cable tray systems are not a wiring method they are only a support system that may be used to support all types of wiring methods and single conductors under limited conditions. Please accept this change.

Related Item
First Revision No. 933-NFPA 70-2015 [Section No. 230.44]
First Revision No. 933-NFPA 70-2015 [Section No. 230.44]

Submitter Information Verification

Submitter Full Name: Richard Loyd
Organization: R & N Associates
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 17:42:39 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This Section is intended to define the cable wiring methods that are allowed to be used for service-entrance in cable trays. This does not prohibit the use of other acceptable wiring methods as defined in Section 230.43 from being supported by a cable tray provided the requirements for cable trays are followed.
230.53 Raceways to Drain.
Where exposed to the weather, raceways enclosing service-entrance conductors shall be listed or approved for listed and identified for use in wet locations and arranged to drain. Where embedded in masonry, raceways shall be arranged to drain.

Statement of Problem and Substantiation for Public Comment
This section has been proposed to be changed from "suitable for use" in wet locations to "listed or approved" in wet locations. Perhaps a better choice of words here would be "listed and identified" in wet locations. Who does approving? According to Article 100, the authority having jurisdiction (AHJ) does approving. The way this section has been proposed, the AHJ could accept a listed raceway here (listed for what?), or the AHJ could accept ANY raceway he or she "approved" (and it would not have to be listed). Changing this proposed text to "listed AND identified" in a wet location takes the guess work out of the equation as AHJ could now depend upon identified products by a third-party testing agency to base an approval on. See the definition of "identified" in Article 100.

Related Item
Public Input No. 3203-NFPA 70-2014 [Section No. 230.53]
First Revision No. 903-NFPA 70-2015 [Section No. 230.53]

Submitter Information Verification
Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 14:50:53 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: This section is intended to allow the use of raceways that are listed for wet locations or to allow the AHJ to approve a raceway for wet locations where they deem appropriate. There may be installation criteria where a particular raceway is not listed for wet locations but the AHJ deems it acceptable in that location. Therefore, that installation would fall under the definition of "approved."
Service heads on raceways equipped with a service head or service-entrance cables, and goosenecks in service-entrance cables shall be located above the point of attachment of the service-drop or overhead service conductors to the building or other structure.

Exception: Where it is impracticable to locate the service head or gooseneck above the point of attachment, the service head or gooseneck location shall be permitted not farther than 600 mm (24 in.) from the point of attachment.

Statement of Problem and Substantiation for Public Comment

The current wording requires that the raceway be installed above the point of the service drop or overhead service conductor point of attachment. It is the service head and not the complete raceway that needs to be above the point of attachment.

Related Item
First Revision No. 934-NFPA 70-2015 [Section No. 230.54(C)]

Submitter Information Verification
Submitter Full Name: DON GANIERE
Organization: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Jul 31 17:33:02 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-912-NFPA 70-2015
Statement: The current wording requires that the raceway be installed above the point of the service drop or overhead service conductor point of attachment. It is the service head and not the complete raceway that needs to be above the point of attachment.
Public Comment No. 1265-NFPA 70-2015 [New Section after 230.66]

Title of New Content
Type your content here ...

230.67 Surge Protection.
(A) Surge Protective Device. All services shall be provided with a surge protective device (SPD).
(B) Location. The surge protective device shall be an integral part of the service disconnecting means or shall be located immediately adjacent thereto.
(C) Type. The surge protective device shall be a Type 1 or Type 2 SPD.
(D) Replacement. Where service equipment is upgraded, all of the requirements of this section shall apply.

Statement of Problem and Substantiation for Public Comment
Surge protection is very much like overcurrent protection in that it is necessary to protect at every level within the system. Overcurrent protection is required at the service entrance, at the feeders and at the branch circuits. Proper surge protection is very similar. And, surge protection must be required, just like overcurrent protection is required. Significant losses occur every year because of voltage surges. That fact cannot be denied. Our real problem is that there are insufficient requirements for surge protection, allowing for such large amounts of surge damage. Surge protection is not optional if damage is to be avoided, just like overcurrent protection is not optional if damage is to be avoided.

Related Item
Public Input No. 1493-NFPA 70-2014 [New Section after 230.66]

Submitter Information Verification
Submitter Full Name: Vincent Saporita
Organization: Eaton
Affiliation: Eaton
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 17:23:55 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Surge protection may protect some electrical equipment from unwanted electrical surges that enter the electrical system. The submitter has not presented any technical substantiation to support mandating this equipment for every service that enters a building. Building occupants that are concerned with potential electrical surges are already permitted to install this equipment in either service equipment or feeder equipment.
230.66 Marking.

Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed and labeled, or field labeled. Individual meter socket enclosures shall not be considered service equipment but shall be listed and labeled, and rated for the voltage and ampacity of the service.

Exception: Meter sockets purchased or under the exclusive control of an electric utility are not required to be listed and labeled.

Additional Proposed Changes

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<th>Approved</th>
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Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product a as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item

Public Input No. 935-NFPA 70-2014 [Section No. 680.44(A)]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Sep 23 20:06:20 EDT 2015

**Committee Statement**

<table>
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<td>Resolution:</td>
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<td>The Exception was revised to clarify that meter socket enclosures that are both purchased and under the exclusive control of a utility company do not have to be listed. Listed equipment is also required to be labeled to assist AHJs in determining whether the equipment is listed during an inspection.</td>
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</tbody>
</table>
230.66 Marking.

Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed or field labeled. Individual meter socket enclosures shall not be considered service equipment but shall be listed and rated for the voltage, ampacity of the service, and maximum available fault current. *Exception: Meter sockets purchased or under the exclusive control of an electric utility are not required to be listed.*

**Statement of Problem and Substantiation for Public Comment**

It is critical that this equipment be rated for the maximum available fault current, not just the voltage and ampere rating of the service.

**Related Item**

First Revision No. 935-NFPA 70-2015 [Section No. 230.66]

**Submitter Information Verification**

Submitter Full Name: Vincent Saporita  
Organization: Eaton  
Affiliation: Eaton  
Street Address: Eaton  
City:  
State:  
Zip:  
Submittal Date: Fri Sep 25 08:10:40 EDT 2015

**Committee Statement**

Committee Action: Rejected  
Resolution: The language as submitted would only apply to meter socket enclosures. Article 110 already has requirements for the marking of equipment for available fault current.
230.66 Marking.
Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed or field labeled. Individual meter socket enclosures shall not be considered service equipment but shall be listed and rated for the voltage and ampacity of the service.

Exception: Meter sockets purchased or purchased and under the exclusive control of an electric utility are not required to be listed.

Statement of Problem and Substantiation for Public Comment

The original intent of the exception was to exempt only utility purchased meter sockets from being listed and labeled. The word "or" would exempt all meter sockets regardless of who purchased them once the meter is installed and the utility seal is applied, thus making the meter socket under the exclusive control of the utility. Therefore, the word "or" should be changed to "and".

Related Item
First Revision No. 935-NFPA 70-2015 [Section No. 230.66]

Submitter Information Verification

Submitter Full Name: Roger McDaniel
Organization: Georgia Power Company
Affiliation: Edison Electric Institute
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 18:26:50 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-913-NFPA 70-2015
Statement: The Exception was revised to clarify that meter socket enclosures that are both purchased and under the exclusive control of a utility company do not have to be listed.

Listed equipment is also required to be labeled to assist AHJs in determining whether the equipment is listed during an inspection.
230.66 Marking.

Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed or field labeled. Individual meter socket enclosures shall not be considered service equipment but shall be listed and rated for the voltage and ampacity of the service.

*Exception: Meter sockets purchased or under the exclusive control of an electric utility are not required to be listed.*

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the Panel to reconsider the addition of the exception based on correlation with 90.2(B)(5), since meter sockets under the exclusive control of an electric utility are outside the scope of the NEC®

Related Item

First Revision No. 935-NFPA 70-2015 [Section No. 230.66]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:14:29 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-913-NFPA 70-2015
Statement: The Exception was revised to clarify that meter socket enclosures that are both purchased and under the exclusive control of a utility company do not have to be listed.

Listed equipment is also required to be labeled to assist AHJs in determining whether the equipment is listed during an inspection.
230.66 Marking.
Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed or field labeled. Individual meter socket enclosures shall not be considered service equipment but shall be listed and rated for the voltage and ampacity of the service.

Exception: Meter sockets purchased or under the exclusive control of an electric utility are not required to be listed.

Statement of Problem and Substantiation for Public Comment

Does the panel really mean 'field labeled' without telling me what that means? Can I use a Sharpie to 'field label' equipment to indicate that it's suitable as service equipment?

Related Item
First Revision No. 935-NFPA 70-2015 [Section No. 230.66]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 16:05:49 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: A definition of "field labeled" is located in Article 100.
Marking.

Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed or field labeled. Individual meter socket enclosures shall not be considered service equipment but shall be listed and rated for the voltage and ampacity of the service.

Exception: Meter sockets purchased or socket enclosures under the exclusive control of an electric utility are not required to be listed.

Statement of Problem and Substantiation for Public Comment

The exception is about 'enclosures' not 'sockets' also delete 'purchased' since all meter socket enclosure will have to be purchased, they are not free...

Related Item
First Revision No. 935-NFPA 70-2015 [Section No. 230.66]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Aug 04 16:08:42 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-913-NFPA 70-2015
Statement: The Exception was revised to clarify that meter socket enclosures that are both purchased and under the exclusive control of a utility company do not have to be listed.

Listed equipment is also required to be labeled to assist AHJs in determining whether the equipment is listed during an inspection.
230.66 Marking.

Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed or field labeled. Individual meter socket enclosures shall not be considered service equipment but shall be listed and rated for the voltage and ampacity of the service.

Exception: Meter sockets purchased or purchased and under the exclusive control of an electric utility are not required to be listed.

Statement of Problem and Substantiation for Public Comment

By replacing "or" with "and" the text adds more clarity to reinforce the electric utility exclusion in 90.2 (B)(5).

Related Item
First Revision No. 935-NFPA 70-2015 [Section No. 230.66]

Submitter Information Verification

Submitter Full Name: ROLAND DEIKE
Organization: Edison Electric Institute
Affiliation: The Electric Light and Power National Electrical Code Task Force
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Aug 13 13:37:03 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-913-NFPA 70-2015
Statement: The Exception was revised to clarify that meter socket enclosures that are both purchased and under the exclusive control of a utility company do not have to be listed.

Listed equipment is also required to be labeled to assist AHJs in determining whether the equipment is listed during an inspection.
230.66 Marking.

Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed or field labeled. Individual meter socket enclosures shall not be considered service equipment but shall be listed and rated for the voltage and ampacity of the service.

Exception: Meter sockets purchased or under the exclusive control of an electric utility are not required to be listed.

Statement of Problem and Substantiation for Public Comment

IEC's position is to delete the exception for 230.66

The exception to allow meter sockets to be unlisted is unclear. By the literal reading of the text anytime a meter socket is purchased, whether the socket is under the exclusive control of the utility or not, it would not be required to be listed. We don’t think that was the intent. If a person were to go to the supply house to buy a meter socket that is approved by the local utility is the meter required to be listed? Or does this mean the meter sockets purchased from a utility are not required to be listed? All meter sockets need to be rated for load and short circuit current and allowing non-listed products appears to reduce safety. There will always be controversy over whether meter sockets are covered by the NEC as stated in 90.2(3) or if they fall under 90.2(B)(5)a. The meter socket should be covered by the NEC and the meter or metering equipment should not be covered.

Related Item

First Revision No. 935-NFPA 70-2015 [Section No. 230.66]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 19 14:33:12 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-913-NFPA 70-2015
Statement: The Exception was revised to clarify that meter socket enclosures that are both purchased and under the exclusive control of a utility company do not have to be listed.

Listed equipment is also required to be labeled to assist AHJs in determining whether the equipment is listed during an inspection.
(A) Dwellings
Where installed on one-family and two-family dwellings, the service disconnecting means shall be installed outside the structure at the nearest point of entrance of the service conductors.

Statement of Problem and Substantiation for Public Comment

This public comment is submitted on behalf of the IAFF in response to the resolution of PI 4224, wherein the Panel Statement reads: "This requirement is overly onerous and not necessary. Why is the hazard greater in a one or two family dwelling than it is in a multi-family dwelling or commercial building? Larger services for these types of buildings actually pose more of a hazard."
The PI was written to address the challenges on one-family and two-family dwellings. It does not take a position of comparable hazards levels of multi-family or high-rise occupancies. The key to this public comment request, is the lack of an external service disconnect for safe fire fighter operations within a residential structure. From the mid 1970’s forward, it has been acknowledged that using a meter as a service disconnect is a dangerous practice for fire fighters to secure utilities, yet the code has not been modified to provide a safer NFPA70E-compliant alternative. Many emergencies may make the need to cut electrical power such as fires, gas leaks, structural damage, & flooding. To require that personnel enter a potentially hazardous environment to perform this task, when a well-established method is available, is the basis of this reasonable safety code modification.
The comments on environmental effects on enclosures is a UL standards compliance issue, and should be addressed under use of the appropriate listed enclosure. This is not an overly onerous requirement as proven by the many utilities in many states that require an external method to disconnect power in an emergency without requiring responders to enter the structure to secure power.

Related Item
Public Input No. 4224-NFPA 70-2014 [Section No. 230.70(A)(1)]

Submitter Information Verification
Submitter Full Name: Matthew Paiss
Organization: International Association of Fire Fighters
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 17:41:23 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1004-NFPA 70-2015
Statement: By providing an external disconnect, this allows for the safe interruption of utility power from outside the structure. The requirement for a remote controlled device allows for exterior activation of an interior device as per 230.70(A)(3).

The effective date will allow time for implementation into new products.
(1) **Readily Accessible Location.**

The service disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the service conductors.

**Exception:** A service disconnecting means for residential occupancies shall be installed outside the structure nearest the point of entrance of the service entrance conductors.

**Statement of Problem and Substantiation for Public Comment**

Fire fighters should not be required to pull a meter in order to disconnect a residential service, unless of course, the meter and meter socket are tested and listed as a disconnecting means. In addition the the increased safety for firefighters trying to disconnect the service, acceptance of this Public Comment would provide an additional degree of safety by allowing for the incoming lugs of an indoor residential panelboard to be de-energized while work is being performed in the panelboard. Finally, if the service disconnecting means also includes the service overcurrent protective device, additional protection is provided for the service entrance conductors, conductors that are not now protected from short-circuits between the meter and the service entrance overcurrent protective device.

**Related Item**

Public Input No. 4224-NFPA 70-2014 [Section No. 230.70(A)(1)]

**Submitter Information Verification**

**Submitter Full Name:** Vincent Saporita  
**Organization:** Eaton  
**Affiliation:** Eaton  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Wed Sep 23 15:57:19 EDT 2015

**Committee Statement**

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-1004-NFPA 70-2015  
**Statement:** By providing an external disconnect, this allows for the safe interruption of utility power from outside the structure. The requirement for a remote controlled device allows for exterior activation of an interior device as per 230.70(A)(3). The effective date will allow time for implementation into new products.
Public Comment No. 1591-NFPA 70-2015 [Section No. 230.70(A)(1)]

(1) _Readily Accessible Location._

The service disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the service conductors. In new buildings, excluding one- and two-family dwellings, a disconnect to the building shall be provided as follows:

(a) In the Fire Command Center, where a Fire Command Center is provided in the building.
(b) At the fire alarm annunciator, where there is no Fire Command Center.
(c) In an appropriately sized and weatherproofed fire department access box on the address side of the building, where there is no fire alarm annunciator or Fire Command Center.

In existing buildings, excluding one- and two-family dwellings, where there are significant upgrades to the building electrical service, such as modifying or replacing the switchgear, a disconnecting means shall be provided as for new buildings.

Statement of Problem and Substantiation for Public Comment

This is a firefighter safety issue. It is intended to allow a firefighter to disconnect the power to a building without the need to go searching for the disconnect in an involved building. Down to the third floor or a parking garage below the building to kill the electricity to the entire building.

It is correct in assuming it will not de-energize ALL circuits. However whether you wait for the firefighter to locate the disconnecting means (losing valuable time) or if you shunt trip the main the result will be the same. The emergency circuits will still be energized. Throughout the NEC greater protection for emergency circuits and especially emergency feeders is required thus reducing the accidental physical damage by firefighter and or fire. By de-energizing the main you will reduce the number of energized circuits by 75% or greater. This will provide greater protection for our first responders. By shunt tripping the main at the fire command center it will save time and possibly reduce the threat of injury or death to our first responders. There are jurisdictions that will not allow firefighters into a building until the utility company arrives and de-energizes the building due to risking their responders lives while searching through the building for the disconnect.

It does require control wires but a shunt trip module (coil unit) must be factory installed on a new installation or field installable on existing breakers for substantial renovations. The cost varies. But in talking with various manufacturers, most of their main breakers (originating back to the 1950's) can be field installed with shunt trip devices at a cost of $1000 or less for the module. If the main disconnecting means uses fused disconnects, it might be more to meet the requirement on a remodel if this is the case.

This can be easily achieved at a cost much less than what we are currently requiring for rapid shutdown of photovoltaic systems. That requirement was adopted to protect our first responders, and so should this.

If the CMP wants to consider not applying this to existing buildings, then the last paragraph could be deleted. Consideration could also be made to applying this only to new buildings with Fire Command Centers.

Related Item
Public Input No. 2912-NFPA 70-2014 [Section No. 230.70(A)(1)]

Submitter Information Verification

Submitter Full Name: Jim Muir
Organization: Building Safety Division, Clark County, WA
Affiliation: NFPA's Building Code Development Committee (BCDC)
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 14:57:06 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This requirement if accepted is excessive and with no technical substantiation other than it would potentially enhance firefighter safety. The ease of compliance as described by the submitter is simplistic, and it would not be easy in all instances. As proposed the requirement would apply to all buildings other than one or two family dwellings. There are...
many buildings in this category that wouldn’t have any of the described locations for the initiation device to be located. Firefighter safety is of utmost importance, however, there is no technical information provided with the submittal to validate that it would in fact enhance safety. A requirement of this magnitude should be available for review by the general public and inserting it at the second revision stage would not allow for that type of review. The submitter may want to consider resubmitting the proposed change during the next cycle with more technical documentation.
(1) **Readily Accessible Location.**

The service disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the service conductors.

**(A) Dwellings**

Where installed on one family and two family dwellings, the service disconnecting means shall be installed outside the structure at the nearest point of entrance of the service conductors or provide a shunt trip breaker with actuation located on the outside of the structure near the service entrance.

**Statement of Problem and Substantiation for Public Comment**

This requirement would further enhance the safety of the emergency responders. Many emergencies may require disconnection of electrical power such as fires, gas leaks, structural damage, & flooding. Requiring that personnel enter a potentially hazardous environment to perform this task, when a well established method is available that would comply with the requirements of NFPA 70 E, is the basis of this reasonable safety code modification.

**Related Item**

Public Input No. 4224-NFPA 70-2014 [Section No. 230.70(A)(1)]

**Submitter Information Verification**

Submitter Full Name: WENDELL WHISTLER
Organization: ALASKA JOINT ELECTRICAL APPREN
Affiliation: IBEW
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:59:52 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR
Resolution: SR-1004-NFPA 70-2015
Statement: By providing an external disconnect, this allows for the safe interruption of utility power from outside the structure. The requirement for a remote controlled device allows for exterior activation of an interior device as per 230.70(A)(3). The effective date will allow time for implementation into new products.
Public Comment No. 1764-NFPA 70-2015 [Section No. 230.71(A)]

(A) General.

The service disconnecting means for each service permitted by 230.2, or for each set of service-entrance conductors permitted by 230.40, Exception No. 1, 3, 4, or 5, shall consist of not more than six switches or sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard or in switchgear. There shall be not more than six sets of disconnects per service grouped in any one location.

For the purpose of this section, disconnecting means installed as part of listed equipment and used solely for the following shall not be considered a service disconnecting means:

(1) Power monitoring equipment
(2) Surge-protective device(s) that are installed in accordance with 285.23
(3) Control circuit of the ground-fault protection system
(4) Power-operable service disconnecting means

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that Code-Making Panel 4 reconsider the added requirement to be installed in accordance with 285.3 since 90.3 already requires compliance with 285.23

Related Item

First Revision No. 937-NFPA 70-2015 [Section No. 230.71(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:15:16 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-914-NFPA 70-2015
Statement: The deleted text is unnecessary as it is already found in other parts of the NEC.
(C) **Performance Testing.**

The ground-fault protection system shall be performance tested when first installed on site. This testing shall be conducted by a qualified person(s) using a test process of primary or secondary current injection, in accordance with instructions that shall be provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction.

**Informational Note No. 1:** Ground-fault protection that functions to open the service disconnect affords no protection from faults on the line side of the protective element. It serves only to limit damage to conductors and equipment on the load side in the event of an arcing ground fault on the load side of the protective element.

**Informational Note No. 2:** This added protective equipment at the service equipment may make it necessary to review the overall wiring system for proper selective overcurrent protection coordination. Additional installations of ground-fault protective equipment may be needed on feeders and branch circuits where maximum continuity of electric service is necessary.

**Informational Note No. 3:** Where ground-fault protection is provided for the service disconnect and interconnection is made with another supply system by a transfer device, means or devices may be needed to ensure proper ground-fault sensing by the ground-fault protection equipment.

**Informational Note No. 4:** See 517.17(A) for information on where an additional step of ground-fault protection is required for hospitals and other buildings with critical areas or life support equipment.

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**Statement of Problem and Substantiation for Public Comment**

The following is from an article written by Howard Herndon and was published in the Nov/Dec 2010 edition of the IAEI magazine.

"Use of a secondary injection test set will test the electronics of the relay or trip unit, but does not insure the CT installation and wiring are correct. Use of the test-trip button will test the circuit within the relay or trip unit, but again does not insure the CT installation and wiring are correct. This does not meet the intent of performance testing as outlined in NEC 230.95(C). Use of the secondary test set or push-to-test button is like performance testing the safety features of a car while it is up on blocks — it may look good, but is not very effective."

**Related Item**

First Revision No. 941-NFPA 70-2015 [Section No. 230.95(C)]

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**Submitter Information Verification**

**Submitter Full Name:** DON GANIERE  
**Organization:** [ Not Specified ]  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Fri Jul 31 17:49:15 EDT 2015

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**Committee Statement**

**Committee Action:** Accepted  
**Resolution:** SR-915-NFPA 70-2015  
**Statement:** The secondary current injection test does not meet the requirements of a performance test for the ground fault system.
230.200  General.

Service conductors and equipment used on circuits exceeding 1000 volts, nominal, shall comply with all the applicable provisions of the preceding sections of this article and with the following sections that supplement or modify the preceding sections. In no case shall the provisions of Part VIII apply to equipment on the supply side of the service point.

Informational Note: For clearances of conductors of over 1000 volts, nominal, see ANSI see IEEE C2-2007 2012, National Electrical Safety Code.

Statement of Problem and Substantiation for Public Comment

Referenced correct SDO in the informational note.

Related Item
Public Input No. 2971-NFPA 70-2014 [Section No. 230.200]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jul 06 13:47:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-916-NFPA 70-2015
Statement: This revision updates references to current editions in several places.
Tap Conductor.

As used in this article, a tap conductor is defined as a conductor, other than a service conductor, that has overcurrent protection ahead of its point of supply that exceeds the value permitted for similar conductors that are protected as described elsewhere in 240.4.

Statement of Problem and Substantiation for Public Comment

The panel statement indicates that this change is merely editorial, but it has technical implications as well. Even though the definition is located in Article 240, unless the language limits its application to that article, the definition will apply to the term where used in other locations in the Code (just like the definitions of wiring methods found in Articles 320, 330, etc.). The term "tap conductor" is used in many places in the NEC, and the definition proposed will be in conflict with some of those uses. How will the grounding electrode tap conductors referred to in 250.30(A)(6) fit with the newly worded definition for tap conductors? What about the conductors that come out of a tap as allowed in 230.33 for services, how do they fit with this definition that specifically excludes service conductors but now applies generally to other Articles in the NEC? Will this create a conflict between 430.28 and 240.21? There are numerous other references to "tap conductor" in the NEC, and the definition approved in FR 2702 will create technical changes to the code that have not been substantiated or adequately addressed. These issues are far more important to code users than a possible conflict with the style manual.

Related Item
First Revision No. 2702-NFPA 70-2015 [Definition: Tap Conductors]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 21:51:40 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Definitions located in the XXX.2 section of an Article apply only to that Article. See the scope of Article 100 which indicates definitions in Article 100 apply to multiple articles.
A set of conductors feeding a single load, or each set of conductors feeding separate loads, shall be permitted to be connected to a transformer secondary, without overcurrent protection at the secondary, as specified in 240.21(C)(1) through (C)(6). The provisions of 240.4(B) shall not be permitted for transformer secondary conductors.

Exception: When the transformer primary overcurrent device has a rating or setting that does not exceed 150 percent of the value determined by multiplying the secondary conductor ampacity by the secondary-to-primary transformer voltage ratio, the provisions of 240.4(B) shall be permitted.

Informational Note: For overcurrent protection requirements for transformers, see 450.3.

Statement of Problem and Substantiation for Public Comment

PI 4635 was submitted to address the fact that industrial installations are permitted to use a simple formula to verify that secondary conductors are permitted to be protected by a primary overcurrent device and commercial customers should be afforded the same opportunity. The language in 240.92(C)(2) allows industrial users of the code to protect transformer secondary conductors as long as the transformer primary overcurrent device has a rating or setting that does not exceed 150 percent of the value determined by multiplying the secondary conductor ampacity by the secondary-to-primary transformer voltage ratio. This public comment seeks to copy that same language in the exception to 240.21(C).

At the present time transformers secondary conductors must be sized based upon on the secondary overcurrent devices and they cannot be smaller than the device rating. The method in 240.92(C)(2) is simple and will provide correlation between commercial and industrial users.

Related Item

Public Input No. 4635-NFPA 70-2014 [Section No. 240.21(C) [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: Lawrence Ayer
Organization: Biz Com Electric, Inc.
Affiliation: IEC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 15:02:02 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Adequate substantiation has not been provided to show that the secondary conductors would be adequately protected.
Public Comment No. 1440-NFPA 70-2015 [Section No. 240.21(C)(4)]

(4) Outside Secondary Conductors.

Where the conductors are located outside of a building or structure, except at the point of load termination, and comply with all of the following conditions:

(1) The conductors are protected from physical damage in an approved manner.

(2) The conductors terminate at a single circuit breaker or a single set of fuses that limit the load to the ampacity of the conductors. This single overcurrent device shall be permitted to supply any number of additional overcurrent devices on its load side.

(3) The overcurrent device for the conductors is an integral part of a disconnecting means or shall be located immediately adjacent thereto.

(4) The disconnecting means for the conductors is installed at a readily accessible location complying with one of the following:

(5) Outside of a building or structure

(6) Inside, nearest the point of entrance of the conductors

(7) Where installed in accordance with 230.6, nearest the point of entrance of the conductors

Exception to (3) Where Section 225.32, Exception No. 1 applies, and where the arc-flash hazard to operate the secondary disconnecting means is excessive, the primary transformer disconnecting means shall be allowed in lieu of and a secondary disconnect and the installation shall be permanently marked to indicate the location of the disconnecting means. All other requirements of 225.(C)(4) apply.

Statement of Problem and Substantiation for Public Comment

There is a correlation problem not addressed by the panel in their response to my Public Input on this subject, Public Input 1404. Article 225.32, Exception No. 1, specifically allows “For installations under single management, where documented safe switching procedures are established and maintained for disconnection, and where the installation is monitored by qualified individuals, the disconnecting means shall be permitted to be located elsewhere on the premises” however there is no such correlating language in 240.21(C)(4) so this cannot be applied without AHJ approval. AHJ’s are unwilling to approve such deviations under Article 90.4 because of liability concerns. For a recent project at our campus, we were relocating a close-coupled dry-type transformer outside of the building and replacing it with a less-flammable fluid filled pad-mount transformer in order to “phase in” the replacement project for the existing switchgear (using the space made available after the dry-type transformer was moved). As such, the transformer secondary conductors had to be routed from the outdoor location to the existing switchgear location. While we could install these conductors in conduit, the only way we could comply with the tap rules in 240.21 was to provide secondary protection outside the building (the conductors were just over 100 feet from the new transformer location to the switchgear main breaker). We asked for permission to install fuses outside the building in a custom fabricated enclosure to provide secondary protection but to allow the primary disconnecting device to be used in lieu of installing a secondary disconnect where the calculated arc-flash energy at the secondary disconnect would easily exceed 40 cal/cm². The primary disconnecting means in this case was within sight of the location where the fuses would be installed. While the language in Section 225.32 Exception #1 applied in our case, the AHJ was unwilling to take the associated liability with such a deviation under Section 90.4 as the code language in 240.21(C)(4)(3) required the secondary disconnecting means to be adjacent to the fuses. Providing such correlation with the proposed exception allows a safer installation and is in line with other language already in place in the code.

Related Item
Public Input No. 1404-NFPA 70-2014 [Section No. 240.21(C)(4)]

Submitter Information Verification

Submitter Full Name: Richard Holub
Organization: The DuPont Company, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 11:25:05 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>An &quot;excessive&quot; arc-flash hazard is vague and unenforceable. Section 450.14 already requires a disconnecting means on the primary side of the transformer. That disconnecting means can be utilized when the incident energy on the secondary is at a dangerous level. The Panel recognizes this as a correlation issue with Section 225.32 Exception No.1. This requirement is for outside secondary conductors that are not protected at their rated ampacity, while the general requirements in 225.32 address outside feeders that are protected at their rated ampacity.</td>
</tr>
</tbody>
</table>
Public Comment No. 1385-NFPA 70-2015 [Section No. 240.24(A)]

(A) Accessibility.

Switches containing fuses, and circuit breakers shall be readily accessible and installed so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 2.0 m (6 ft 7 in.) above the floor or working platform, unless one of the following applies:

1. For busways, as provided in 368.17(C).
2. For supplementary overcurrent protection, as described in 240.10.
3. For overcurrent devices, as described in 225.40 and 230.92.
4. For overcurrent devices adjacent to utilization equipment that they supply, access shall be permitted to be by portable means.

Exception: The use of a tool shall be permitted to access overcurrent devices located within listed industrial control panels or similar enclosures.

Statement of Problem and Substantiation for Public Comment

The word "devices" is removed to improve the readability of the requirement, without changing the intent.

Related Item
First Revision No. 2705-NFPA 70-2015 [Section No. 240.24(A)]

Submitter Information Verification

Submitter Full Name: Vincent Saporita
Organization: Eaton
Affiliation: Eaton
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 08:19:17 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2701-NFPA 70-2015
Statement: The word "devices" is removed to improve the readability of the requirement, without changing the intent.
Accessibility.

Switches containing fuses, and circuit breakers shall be readily accessible and shall be installed so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 2.0 m (6 ft 7 in.) above the floor or working platform, unless one of the following applies:

1. For busways, as provided in 368.17(C).
2. For supplementary overcurrent protection, as described in 240.10.
3. For overcurrent devices, as described in 225.40 and 230.92.
4. For overcurrent devices adjacent to utilization equipment that they supply, access shall be permitted to be by portable means.

Exception: The use of a tool shall be permitted to access overcurrent devices located within listed industrial control panels or similar enclosures.

Statement of Problem and Substantiation for Public Comment

Delete the exception. Although it appears the exception is meant to solve a problem created by the revision of the defined term "accessible, readily" it creates more problems. What is similar to an industrial control panel, a panelboard, door to an equipment room? A better solution is to return the definition of accessible, readily to that in the 2011 NEC and add a rule to require disconcerting means be readily accessible without the use of a tool.

Related Item
First Revision No. 2705-NFPA 70-2015 [Section No. 240.24(A)]

Submitter Information Verification

Submitter Full Name: Paul Dobrowsky
Organization: Innovative Technology Services
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 22:02:36 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed revision does not increase clarity or usability. The revised requirement in 240.24(A) and the new exception provide necessary clarity.
Public Comment No. 1765-NFPA 70-2015 [Section No. 240.24(A)]

(A) Accessibility.

Switches containing fuses, and circuit breakers devices shall be readily accessible and installed so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 2.0 m (6 ft 7 in.) above the floor or working platform, unless one of the following applies:

1. For busways, as provided in 368.17(C).
2. For supplementary overcurrent protection, as described in 240.10.
3. For overcurrent devices, as described in 225.40 and 230.92.
4. For overcurrent devices adjacent to utilization equipment that they supply, access shall be permitted to be by portable means.

Exception: The use of a tool shall be permitted to access overcurrent devices located within listed industrial control panels or similar enclosures.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that this First Revision be rewritten to comply with the NEC Style Manual relative to the term “devices” to meet the intent of this First Revision.

Related Item
First Revision No. 2705-NFPA 70-2015 [Section No. 240.24(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:17:06 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2701-NFPA 70-2015
Statement: The word “devices” is removed to improve the readability of the requirement, without changing the intent.
Public Comment No. 14-NFPA 70-2015 [ Section No. 240.60(C) ]

(C) Marking.
Fuses shall be plainly marked, either by printing on the fuse barrel or by a label attached to the barrel showing the following:

1. Ampere rating
2. Voltage rating
3. Interrupting rating where other than 10,000 amperes
4. Current limiting where applicable
5. The name or trademark of the manufacturer

The interrupting rating shall not be required to be marked on fuses used for supplementary protection.

The fuse marking or label shall not be blocked from view or covered by trim.

Statement of Problem and Substantiation for Public Comment

The fuse label is vital in determining both code compliance and trip characteristics. For purposes of determining arc flash incident energy levels, the exact fuse manufacturer and model must be determined, and the engineer or inspector should not be burdened or subjected to unsafe tasks such as removing trim cover on energized systems. Rejecting this proposed code change on the basis of not having enough room or added cost should be classified as criminal neglect should a person be harmed.

Related Item
Public Input No. 1636-NFPA 70-2014 [Section No. 240.60(C)]

Submitter Information Verification

Submitter Full Name: BARRY CALLOWAY
Organization: CENTURY 3
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jun 22 16:22:33 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter has not substantiated a problem with existing code requirements. It is not practical to require that these and other markings be provided in an unobstructed location that can be easily and safely read by an individual making a survey of energized equipment. Individuals performing an incident energy analysis on an existing system must follow all applicable OSHA regulations and the industry standard for electrical safety in the workplace, NFPA 70E.
240.67  Arc Energy Reduction.
Where the ampere rating of the fusible switch is 1200 A or higher, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

(A)  Documentation.
Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the fusible switch(es).

(B)  Method to Reduce Clearing Time.
One of the following shall be provided:

1. Differential relaying
2. Energy-reducing maintenance switching with local status indicator
3. Energy-reducing active arc flash mitigation system
4. A fuse that would open the circuit in 0.07 seconds or less, at or below the available arcing current
5. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the disconnect switch back to a normal setting after the potentially hazardous work is complete. Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: IEEE 1584, IEEE Guide for performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment

I have suggested under separate public comment that this proposal should be rejected. If the code panel does not agree and chooses to adopt this proposal, then the maintenance mode option in this proposal needs to be reconsidered.

If a maintenance mode feature is provided on a switch, an electrician will have two choices when he works. The switch can be turned off (and lock-out tag-out can be applied) or the electrician can activate the maintenance mode. If he chooses to turn the switch off, safety practices dictate that the electrician must assume that the downstream conductors are still energized until proven otherwise. After all, the conductors may be energized from a different source. If the choice is to activate the maintenance mode rather than turn the switch off, it stands to reason that the electrician must equally assume the conductors may be energized from a different source.

If the electrician turns the switch off, a meter can be used to verify the conductors are not energized. If the maintenance mode is used, there is no way to verify activation, other than to create an arc fault and see what happens.

A maintenance mode is a very bad choice. It offers a false sense of security. Turning the switch off is a far superior method. The option of a maintenance mode should be deleted.

Related Item
First Revision No. 2707-NFPA 70-2015 [New Section after 240.61]

Submitter Information Verification

Submitter Full Name: JAMES ERICKSON
Organization: BOLTSWITCH INC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:31:34 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>Energy reducing maintenance switches with local status indicators, when used as part of an electrical safety program within the guidelines of NFPA 70E, have a proven track record of increasing worker safety. Energy reduction maintenance switches reduce the clearing time of an upstream overcurrent protective device resulting in a significant reduction in arc energy where justified energized work must be performed.</td>
</tr>
</tbody>
</table>
Public Comment No. 1635-NFPA 70-2015 [ Section No. 240.67 ]

240.67  .  Arc Energy Reduction.

Where the ampere rating of the fusible switch is 1200 A or higher, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

(A)  .  Documentation.

Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the fusible switch(es).

(B)  .  Method to Reduce Clearing Time.

One of the following shall be provided:

(1)  .  Differential relaying

(2)  .  Energy-reducing maintenance switching with local status indicator

(3)  .  Energy-reducing active arc flash mitigation system

(4)  .  A fuse that would open the circuit in 0.07 seconds or less, at or below the available arcing current

(5)  .  An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the disconnect switch back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: IEEE 1584, IEEE Guide for performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment

The substantiation for the proposal is that the benefits of arc energy reduction requirements for circuit breakers in NEC 240.87 have been well established and thus should be added to the requirements for fusible switches. Boltswitch agrees that reducing arc flash energy is a wonderful goal. Never-the-less, it is important that the proposal is appropriate for switches; that it is appropriately placed in the NEC; that it does not conflict with other sections of the NEC, and that it does in fact promote safety. If it does not conform to all four of these criteria, then adoption of this proposal will do a disservice.

It is important to understand that this proposal is reactionary. If adopted, it will not prevent a single arc flash event because it only addresses energy release after an arc flash event happens. Lockout/tagout is proactive. Lockout/tagout prevents arc flash events from happening. If this proposal in any way encourages working on live equipment in lieu of lockout/tagout, this proposal will increase the frequency of arc flash events.

The following points are what need to be considered:

1.) Most switches are manually operated
2.) Many switches were never intended to be anything but manually operated
3.) Definitions mean everything
4.) Unlike switches, CB’s must be able to interrupt overcurrent
5.) Switches are much more affected by this proposal than CB’s were by NEC 240.87
6.) Bad practice to mix two products in the same proposal
7.) Switches are described elsewhere in the NEC
8.) Under-sizing fuses is a good practice
9.) Substantiation is not sound that similar requirements for CB’s is well established
10.) Switch manufacturers are addressing arc reduction by other methods
11.) Switches are designed around lockout/tagout
12.) Switches can be padlocked in the closed position
13.) Switches can have key interlocks
14.) The requirements of this proposal directly conflict with NEC 404.13(A)
15.) The term “fusible switch” is not defined, and is hard to define
16.) Switches have safety features that CB’s do not
17.) This proposal encourages working on energized equipment
18.) This proposal impacts products that do not have a risk problem
19.) This proposal could significantly add to the number of arc flash events
20.) Fuses are replaceable products
Point by Point Analysis:

Point No. 1. Most switches are manually operated

Boltswitch is a leading manufacturer of fusible switches rated 1200 amp and larger. Over the past ten years, three out of every four fusible switches rated 1200 amp and above that Boltswitch manufactured and sold were manually operated. Manually operated switches are important components in safe, electrical systems. This proposal could eliminate all manually operated fusible switches rated 1200 amp and above if fuses are unable to meet the fuse requirements (option 4) of this proposal.

Point No. 2. Many switches were never intended to be anything but manually operated

Fusible manual transfer switches, double throw switches and bypass isolation switches rated 1200 amp and above are standard products for specific applications such as optional standby systems. These switches were never intended to have anything other than a manual operating means. If fuse manufacturers are unable to develop fuses that open under arc fault conditions set forth in this proposal, these manually operated switch products will require a means to open automatically, which literally defy the name and/or definition of the product. I have been around automatic transfer switches that do not function with dependability. They require routine testing and maintenance. Simple, manually-operated switches are extremely dependable, which is exactly what people want and need in a power outage.

Point No. 3. The term “Fusible Switch” is not defined in the NEC

Since I began to participate in the IAEI some 3 to 4 decades ago, it has been drilled into me that definitions mean everything. There are five definitions used in the NEC and NFPA 70E that apply to switches rated 1200 amp and above. Each of the definitions would apply to fusible or non-fusible switches. The definitions are as follows:

1.) “Switching Device” is defined in the NEC and NFPA70E as “A device designed to close, open, or both, one or more electric circuits”.
2.) “Switch, Bypass Isolation” is defined in the NEC as “A manually operated device used in conjunction with a transfer switch to provide a means of directly connecting load conductors to a power source and of disconnecting the transfer switch”.
3.) “Switch, General-Use” is defined in the NEC as “A switch intended for use in general distribution and branch circuits. It is rated in amperes, and it is capable of interrupting its rated current at its rated voltage”.
4.) “Switch, Isolating” is defined in the NEC as “A switch intended for isolating an electrical circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means”.
5.) “Switch, Transfer” is defined in the NEC as “An automatic or non-automatic device for transferring one or more load conductor connections from one power source to another”.

By any of the definitions, a switch (fusible or non-fusible) is not an overcurrent protection device and it is not required to open a circuit automatically.

Four of the five definitions do not require the switch to be capable of opening under load. Only a “Switch, General-Use” is required to be capable of opening the circuit under load. But even with a General-Use Switch, the load current does not need to be greater than the rating of the switch. If this proposal is adopted, it should state specifically the types of switches rated 1200 amp and above that it applies to. The term “switch” is too vague. Per the definitions, a “Switch, General-Use” is the only type of switch that comes close to meeting the requirements.

Point No. 4. Unlike switches, CB’s must be able to interrupt overcurrent

A “Circuit Breaker” is defined in the NEC and in NFPA70E as “A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating”. This definition did not change due to the adoption of 240.87 in the NEC. Accordingly, unlike switches, circuit breakers have always been required to provide overcurrent protection and have always been required to open circuits automatically. Substantiation that switches should have the same requirements as circuit breakers is not sound.

Point No. 5. Switches are much more affected by this proposal than CB’s were by NEC 240.87

The requirements for arc reduction on circuit breakers had very little impact on the application of circuit breakers. After all, circuit breakers were already overcurrent devices and were already required to open automatically. The impact of this proposal on fusible switches is quite different, assuming fuses cannot meet the requirements of option (4) in most applications. Not only are 75% of the switches sold today manually operated, fusible switches can be hook stick operated or have a simple insulated handle on the crossbar. There is a purpose for these products, and they are used in safe schemes.

Point No. 6. Bad practice to mix two products in the same proposal

This proposal mixes requirements for “switches” and requirements for “fuses” as either/or methods for compliance. “Switches” and “fuses” are separate products, each designed around separate standards, and each with separate NRTL Listing marks. Since two products are involved, the first sentence in the proposal should use the term “fused” instead of “fusible”.

There is a big difference between a “fused” switch and a “fusible” switch. A fusible switch can have dummy fuses installed. Boltswitch sells dummy fuses rated 1200 amp and above on a regular basis specifically for the purpose of mounting in a fusible switch. If this term in this proposal is not changed from “fusible” to “fused”, then this proposal absolutely does not belong in “Article 240, Overcurrent
Protection since by any definition of a switch, a fusible switch with dummy fuses is not an overcurrent protective device. As a manufacturer of fusible switches, I have no control or knowledge regarding which brand of fuses or what size fuses (ampere rating) will be installed in the product, let alone whether the fuses selected will comply with the fuse method offered in the proposal. If the fuses selected can meet the proposal requirement, the fusible switch is not affected, even if the switch is manually operated. If the fuses selected do not meet the requirement, then the burden of compliance apparently shifts to the fusible switch, and the switch will need to be equipped with a means to detect an arc fault event, a means to open automatically, and be capable of interrupting a fault current. If this proposal is adopted and an installation does not comply, which product gets the red tag, the switch or the fuses? This illustrates why mixing two products in the same NEC requirement is a bad idea. If the switch is deemed in violation, which party will be held responsible to provide one of the arc energy reduction methods for compliance? Is it the responsibility of the switch manufacturer? Is it the responsibility of the switchboard manufacturer? Is it the responsibility of the installer? The installer is probably the only party that can install a remedy. This is because a truly functional arc reduction system may require sensors that extend downstream throughout the electrical system.

Point No. 7, Switches are described elsewhere in the NEC

Switches are presently addressed in Article 404 of the NEC. If adopted, some requirements for switches would be in Article 404 and some requirements would be in Article 240. NEC 404.1 provides the scope for switches in the NEC. It is very clear. Only switches rated above 1000 volt are to be covered elsewhere in the NEC. Does this mean this proposal only applies to fusible switches rated above 1000 volts?

Point No. 8, Under-sizing fuses is a good practice

The ability to use smaller rated fuses than the fusible switch rating is an important issue concerning this proposal. Suppose a 2000 amp switch has 1600 amp fuses installed, and the 1600 amp fuses comply with the arc reduction requirements, but 2000 amp fuses would not comply. Would the installation comply with the requirements of this proposal? The practice of under-sizing fuses is not only common, but it should be encouraged more often. It is an outstanding way to reduce arc energy and provide better short circuit protection. Class L fuses are uniquely designed around under-sizing. For example, a 4000 amp fuseholder can accept an 800 amp fuse without modification, or any size in-between. Class L fuses are also rated for use at 100% continuous. Most switches are de-rated (whether they are investigated for use at 100% or not) due to calculating the loads and adding 25%. Accordingly, most switches can have undersized fuses installed without the worry of a fuse opening under normal use. If a fault occurs, an undersized fuse offers better protection because it will react faster. Determining the best size fuse for a particular installation is one reason Boltswitch does not include fuses with the switches we sell. We have no idea what size fuse will be best for the installation.

Point No. 9, Substantiation is not sound that arc energy reduction for CB’s is well established

The substantiation provided in this proposal is that the benefits of arc energy reduction for circuit breakers have been well established. Is this true? Several years ago, OSHA began posting “Fatalities and Catastrophes” on their website, along with a brief description of each event. For the governmental Fiscal Year ending 10/1/2014 (FY14), there were 105 events classified as electrical. Of these events, 55 were identified as happening outdoors ahead of the service equipment. The remainder of 50 events is presumed to have occurred in NEC related equipment. For FY13, there were 74 electrical events. Of these events, 38 occurred outdoors ahead of the service equipment. The remainder of 36 events is presumed to have occurred in NEC related equipment. Accordingly, the number of serious NEC related events identified by OSHA increased from 36 in FY13 to 50 in FY14. Energy reduction for circuit breakers (Article 240.87) became effective in the 2011 NEC. If the benefits are well established, why did the number of serious electrical accidents rise by about 40%?

Point No. 10, Switch manufacturers are addressing arc reduction by other methods

Switch manufacturers are aware of the call for arc energy reduction and have been developing products to address the concerns. These methods are being used without a change in the NEC. Boltswitch believes a better approach than this proposal is to provide arc energy reduction closer to the anticipated arc flash hazards, similar to AFCI for circuit breakers. For example, it is unlikely that a very large fusible switch would directly feed a downstream control panel that requires maintenance or troubleshooting while energized. More likely a smaller safety switch or other disconnecting means is located near the downstream control panel. Fuses are available that reduce arc energy (semiconductor fuses), but they are generally available only in ratings of 1200 amp and smaller, not 1200 amp and larger as the proposal targets. Boltswitch offers methods to install fast-acting, semiconductor fuses in standard 400, 600, 800 and 1200 amp Boltswitch-brand fusible switches. They can be installed in new or existing switches that are either manual or shunt trip operated. (See www.boltswitch.com, Bulletin 148, for a description of the products). Not only should the nearest disconnecting means to where the work is to be performed respond the fastest and limit arc energy the best, consider the chaos that would result if a building main or feeder switch in a large facility suddenly opens due to an arc flash event in a small control panel. It may cause the “additional hazard or increased risk” that initially justified the permits to perform energized work. And the cost of a non- orderly shutdown would most likely exceed the cost of a planned outage.

Boltswitch also offers remote closing solenoids as an option to shunt trip operated switches. The remote closing solenoid is an inexpensive way to provide a means to close and open a switch remotely. This was developed for the chemical industry, where the environment may be more likely to cause an arc flash event.

General Electric, another manufacturer of fusible switches, has recently introduced what they call a “New Generation HPC Switch” with “a REAL arc Flash Hazard Mitigation Solution”. They boast minimizing arc flash exposure by offering fully remote operation for close and open with an internal operating motor, and by offering two modes of “switch (mechanical)” instantaneous protection to supplement the protection provided by the fuses.

The point is, switch manufacturers have already been responding to the request for arc energy reduction. Options are available today, and continue to be developed. However, there is such a variety of applications for fusible switches that no single method fits them all. It is also very important for users to understand that any arc reduction method is not to be construed as reasons to avoid the safest
procedure, which is to de-energize and follow lockout/tagout procedures.

Point No. 11, Switches are designed around lockout/tagout, circuit breakers are not

Switches differ from circuit breakers in that virtually every dead-front switch has padlocking provisions (dead-front means it can be operated by an external handle without opening the enclosure). Padlock provisions are a requirement in switch standards. Circuit breakers are not required to have padlock provisions. Thus, switches are truly designed around lockout/tagout procedures. Circuit breakers are not. Since circuit breakers are not required to have padlock provisions, it is understandable that circuit breakers need the requirements 240.87, and switches do not.

Point No. 12, Switches can be padlocked in the closed position

A very important feature on switches is that they can be padlocked in the ON position. Switches are often mounted outside. Most Firefighters prefer to have switches mounted outside. Some jurisdictions require the service disconnect to be located outside. It is not uncommon for switches to be located in alleyways or the backs & sides of buildings, all very accessible to the public. However, only manually operated switches can be padlocked in the ON position. Shunt trip operated switches or any circuit breaker cannot be padlocked in the ON position. This proposal will force many manually operated switches to become shunt trip operated, which means they can no longer be padlocked “ON”.

Point No. 13, Switches can have key interlocks

Switches can be equipped with key interlocks to lock in the OFF position, ON position, or both. Key interlock schemes are used between multiple products to ensure that each product in the system is in a prescribed position before another action can be taken. Key interlocks have auxiliary contacts and solenoid releases, and can be mounted in many ways, including on doors and panels of electrical equipment. Key interlock schemes can be used to prevent access to energized electrical components. The point is that key interlocks are used on switches in a proactive manner to prevent the occurrence of an arc flash event. Often the switches are manually operated and key interlocked in the ON position to prevent opening the switch under load. This proposal will adversely impact these proactive schemes. Shunt trip operated switches and circuit breakers cannot have key interlocks for locking in the ON position.

Point No. 14, The requirements of this proposal directly conflict with NEC 404.13(A)

NEC 404.13(A) states that isolating switches rated over 1200 amp shall not be opened under load. Isolation switches can be (and often are) fusible switches. This proposal would require these same switches to open a fault current automatically if fuses are not available to comply with option (4). Accordingly, the proposal directly conflicts with the requirements of NEC 404.13(A). The proposal must have an exception for isolating switches. I suppose one can argue that isolating switches need to be non-fusable. It would be a very weak argument. It would be saying that the circuit would be safer if it does not have a fuse in it.

Point No. 15, The term “fusible switch” is not defined, and is hard to define

Many “fusible switches” ultimately have copper bars installed in the fuse gap, commonly called dummy fuses. Boltswitch manufactures and sells dummy fuses as standard items. Would a “fusible switch” with dummy fuses installed be subject to the requirements of this proposal? I would think the answer is no, since the assembly would be the same as a non-fusible switch. But technically the switch itself is still a “fusible switch”. This further supports the need to change the term in the proposal from “fusible switch” to “fused switch”. 430.90 in the NEC is titled “Combination Fuseholder and Switch as Controller”. If a fuseholder (with fuses installed) and a non-fusible switch are combined, would the requirements of this proposal need to be enforced? Now there would be three separately listed products involved, and none of them would be a “fusible switch”. Changing the term “fusible switch” to “fused switch” would add clarity to this situation. I would think that most people would consider the combination to be a “fused switch”.

Point No. 16, Switches have safety features that CB’s do not have

Switches differ from circuit breakers in other ways besides padlock and key interlock provisions. Most commonly, switches usually have visible blades. Many switches have clear barriers as a standard feature or are available with clear barriers. Dead-front covers can be equipped with viewing windows to observe the switch blades without opening doors or exposing any live parts. NEC 404.6(C) requires the load terminals of a switch to be de-energized when the switch is in the open position unless marked with a permanent sign on the outside of the enclosure. Accordingly, a properly installed switch with a viewing window can be verified as being OFF without opening covers, unless a sign indicates otherwise. The importance of visible blades is further confirmed in NFPA 70E Article 120.1(3) when establishing an electrically safe work condition. As part of the procedure to establish a safe work condition, it states “Whenever possible, visually verify that all blades of the disconnecting devices are fully open or that drawout-type circuit breakers are withdrawn to the fully disconnected position”. This is a strong argument for using a switch with visible blades. Observing the switch blades through a viewing window is much safer than withdrawing a drawout-type circuit breaker. YouTube has numerous arc flash events involving drawout-type circuit breakers. Drawout-type circuit breakers may be the leading cause of NEC related arc flash events.

It should be noted that if switch blades are observed to be full open but the load conductors are unexpectedly confirmed to be energized, this is a violation NEC 406(C). If anyone comes across an installation where this is the case, they should insist that a permanent sign needs to be installed near the switch indicating the load conductors may remain energized by backfeed. Be proactive!

It will warn anyone working on this system in the future and may prevent an arc flash event.

Point No. 17, This proposal encourages working on energized equipment

Energy reduction for circuit breakers (NEC 240.87) allows an option of energy reducing maintenance switching. In theory, a maintenance mode may sound like a good feature, but if any worker thinks it is an alternative to de-energizing or allows for reduced
PPE requirements, then this feature is more harmful than good. With this feature activated, a worker can still be electrocuted if contact is made with electrical conductors. This feature provides a false sense of security. It may explain why the number of incidents increased in FY14 over FY13 (see Point No. 9).

Point No. 18, This proposal impacts products that do not have a risk problem

Thousands of manually-operated fused switches rated 1200 amp and above are used on 24 and 48 volt dc systems as battery disconnects. It is recognized throughout NFPA70E that there is little to no arc flash hazard at voltages below 50 volts. This proposal would put new requirements on these manually operated fusible switches. Clearly it would be a requirement that is not needed. The proposal should have an exception for applications below 50 volts.

Point No. 19, This proposal could significantly add to the number of arc flash events

Since 75% of the fusible switches 1200 amp and above are manually operated, these products will need to become shunt trip operated if fuses cannot be developed to comply with option (4) in the proposal. Manually operated switches are extremely reliable. They operate using an over-center spring which does not remain charged. A manual switch can be expected to operate decades after it is installed, with little to no maintenance. Shunt trip operator mechanisms have springs that remain charged when the switch is closed. Periodic exercise and proper lubrication is important, which means routine maintenance is important. Switch manufacturers typically recommend annual maintenance as a minimum on switches equipped with shunt trip mechanisms. Maintenance is an opportunity for an arc flash event because it requires opening doors or covers. The manual switch that performed reliably for 30 years without an arc flash hazard concern would evolve into thirty or more chances for an arc flash event if this proposal is adopted. Accordingly, this proposal has far-reaching effects that would dramatically increase the number of times a maintenance worker would be exposed to an arc flash hazard.

Point No. 20, Fuses are replaceable products

Fuses rated 1200 amp and above are non-renewable. If a fuse is called upon to function, it needs to be replaced. If a fusible switch has newer “arc reducing” fuses installed to meet the requirements of this proposal, and the fuses are called upon to function, what will insure that the replacement fuses will meet the arc reducing requirements? For Class L fuses, there are ten different types presently available from three major manufacturers. It could be that only a few of these types will be redesigned to meet the requirement of this proposal. If a facility needs to replace a fuse, they will likely be frantic to replace it as soon as possible. Remember, we are talking about 1200 amp & larger, so a big portion (if not all) of the facility will be down. They will use whatever fuses are in their storeroom, on the contractor’s truck, on the shelf at the nearest distributor, or whatever is available on eBay. Chances are the replacement fuse(s) will not be the same brand or type, and will not have the arc-reducing feature. Will newer “arc reducing” fuses need to incorporate rejection features to reject older fuses?

Point No. 21, Many types of fuses would be affected

While Class L fuses are the most popular for 1200 and above, there are many other fuses besides Class L. Boltswitch manufactures products that accept Class T fuses, semiconductor fuses, Form 101 fuses, BS88 fuses, and even older style Class M fuses. The Form 101 fuses are available in many dimensions (referred to as their “type” number) and in many voltages (500, 600, 700, 750, 1000 and 1500 volt), and usually mount in switches that are non-load-break by design. It is unlikely that many of these fuses (or the switches they mount in) can meet the new energy reducing requirements of this proposal. All of these different types of fuses are available and specified for a reason. Not all circuits are the same and need the same protection. Many of the switches accepting these switches are hook stick operated, and surely cannot be opened under load. This proposal is far too broad by including ALL fusible switches rated 1200 amp and larger.

Point No. 22, A proactive approach is better. This proposal is reactionary, not proactive.

If the electrical industry wants to get serious about reducing injuries caused by arc flash events, a pro-active approach would be to eliminate arc flash events from happening rather than trying to reduce the energy after an event happens. The first step should be to analyze electrical accidents. NEMA should form a committee to sit down with an OSHA representative for the purpose of reviewing electrical accidents. Problems cannot be solved unless they are understood. Proactive approaches should be developed to prevent accidents from happening, such as by increasing clearances between conductors or by adding barriers. This proposal cannot reduce the number of arc flash incidents because it is reactionary only. This proposal can influence a decision to work on energized equipment rather than shut it down and use lockout/tagout. If this proposal is adopted, the number of arc flash incidents can only be expected to increase. If someone is seriously hurt or electrocuted, a lawsuit will result. Anyone can be sued, the switch manufacturer, the fuse manufacturer, even the NFPA. If part of the claim is that the equipment had arc reducing features, defense of the lawsuit is quite different than defending a case where lockout/tagout procedures were violated. Circuit breaker manufacturers within NEMA wrote a white paper published in 2005 (and soon to be republished in 2015) titled Avoid Arc Flash Occurrences by Following Industry Standards. A complete paragraph from the document is as follows:

"The point is that the basic requirement, and it is a requirement, is to de-energize before working on equipment. The reason is that the hazard is removed by de-energizing. With careful planning, work can almost always be done with the equipment de-energized."

If this proposal goes forward, the proposal should include a warning, effectively saying "THE ENERGY REDUCING FEATURES ON THIS ASSEMBLY ARE NOT A SUBSTITUTE FOR FOLLOWING LOCKOUT/TAGOUT PROCEDURES. DO NOT WORK ON ENERGIZED EQUIPMENT". CMP 10 is taking a big chance with this proposal. As stated by circuit breaker manufacturers, work can almost always be done with the equipment de-energized. Lockout/tagout is a proactive approach that removes an electrical hazard. No action on the part of CMP 10 is better than taking the wrong action, which would be to adopt this proposal as is. Remember, the NEC is a minimum requirement. The minimum requirements for switches in the NEC (whether fusible or non-fusible) should be the ability to turn them off, lock them off, and verify they are off.
Point No. 23, The biggest problem . . . this protection does not belong on the service disconnect

You might think that I oppose this proposal as a switch manufacturer. Not true. The added components and shunt trip features will boost my sales. I oppose this proposal as a business owner. Let’s say a rooftop HVAC unit on my plant is not functioning. I’ll call the company that services our HVAC units. Each HVAC unit has a fused safety switch mounted at the unit. Each safety switch is fed from a CB in the building. Each CB is fed from the main switchboard, with a Boltswitch fusible service entrance switch. If troubleshooting on the HVAC unit is being done and an arc flash event happens, what product should clear the fault? My first choice is the fuses in the safety switch. My second choice is for the CB to clear the fault. That is what CB’s are designed to do. My absolute last choice is for a fuse in the service entrance switch to clear the fault. I have big problems if a main fuse functions. My entire plant will be down. If I am to follow NFPA70E, I first need to find and hire a qualified electrician. (Yes . . . even Boltswitch, the manufacturer of the service entrance switch, does not have a qualified electrician on staff to change a fuse under these conditions.) When the electrician arrives, I need to verify the electrician has appropriate PPE for any task he may need to perform. The electrician will need to assess the situation, repair and/or isolate any damage where the event happened, obtain & install new fuses in the service disconnect, verify the entire circuit is clear of faults, possibly schedule a shutdown with the utility so the contacts in the service disconnect can be inspected and dressed, and then follow a specific process before re-energizing, such as shutting down everything that was energized and re-energize as if the building was first being commissioned. Who knows how long it will be before my business is back up and running? There are many businesses and buildings similar to mine. If instead a fuse in the HVAC safety switch or the CB feeding it cleared the fault, I don’t have any of these problems. I merely have an HVAC unit that does not function and needs repair.

You do not want to be in a building if a fuse blows in the service disconnect. It does not matter if the service disconnect is a fused switch or fused circuit breaker. Every person in the building will have their day disrupted. It takes time to determine the problem and physically replace the fuse. If you are in a restaurant waiting for your meal, you may as well find another restaurant. If you are in a hotel room shaving, you will be shaving in the dark. If you are in a shopping mall, you may as well leave. The foremost purpose of fuses in the service disconnect is to clear a major fault such as closing into cables that are crossed. It does happen. Fuses in the service disconnect should not be the first line of response in an arc flash event. The service disconnect should not be required to open without any intentional delay. Article 230.95 understands this same concern in the event of a ground fault event. CMP 4 addresses the concern by allowing time delay and zone interlocking.

Boltswitch regularly sells 1200 amp fusible switches for use as the service disconnect on well-known restaurant chains nationwide. I am sure they do not have an electrical staff on duty that can deal with ANY situation concerning the service disconnect. The service disconnect is the only product in the building that cannot be completely de-energized by the occupants. Someone untrained and unfamiliar with electrical equipment will hastily take charge and will try to diagnose or rectify the problem. Most likely this person will not know what the letters PPE stand for. Service disconnects are often fed from the bottom. Changing fuses in a bottom-feed service disconnect requires work to be performed over live, unprotected incoming conductors. Most electrical contractors do not own the proper PPE for performing this work.

If this proposal is adopted, it should have an exception for fused switches used as the service disconnect. If someone thinks the features of this proposal would be good for the service disconnect, they should make a proposal for Article 230. Code Panel No. 4 should debate whether this is appropriate for service equipment. Hopefully they understand the hazards involved in changing fuses in the service disconnect, and realize the practice should be kept to a minimum.

As a switch manufacturer, I can attest with certainty that the service disconnect is the most ignored device in the building’s electrical system because it cannot be completely de-energized without a utility shutdown. Utilities request advance notice to schedule shutdowns, and typically charge fees. When this proposal was first being kicked around, I thought faster-acting fuses capable of responding quickly to arc flash events would be the perfect solution. I no longer think so. It is a bad situation for a fuse to open in a service disconnect, whether it is installed in a fusible switch or installed in a fusible circuit breaker. Changing a fuse (or fuses) in a service disconnect requires having replacement fuses on hand, it creates exposure to unprotected service conductors, it requires the use of tools within the energized cubicle, it requires handling bolts, washers & lock-washers while wearing PPE, and it takes time to physically perform the task. If the requirements of this proposal are enforced on service equipment, CMP 10 will be doing a disservice that will lead to serious injuries.

Conclusion

I realize that this proposal has enormous support. Everyone wants less injuries and safer workplaces. However, this proposal is not appropriate for all switches. Clearly, the requirements should not apply to systems below 50 volt, isolating switches, manual transfer switches and the like. It does not belong on many service disconnect switches. This proposal will not eliminate a single arc flash event because it is reactionary. It merely reduces arc energy. Lockout/tagout eliminates arc energy. Lockout/tagout should be an approved equivalent means because it is safer. This proposal is not appropriately placed in the code. Requirements for switches belong in Article 404 and the requirements for service disconnects belong in Article 230. If adopted, this proposal will create facility outages that should be handled by downstream devices, not the service disconnect. It will add maintenance needs to service equipment, which will only be neglected more-often than followed. Accordingly, as well intentioned as this proposal may be, it was not fully thought-out. It should be rejected.

If someone has to approach a switch to activate a “maintenance mode”, why can’t opening and locking off the same device be an approved equivalent means? A building owner has the right to prohibit working on energized equipment. A building owner can demand
the use of lockout/tagout procedures. If this proposal is adopted, Informational Note No. 4 should be added, stating the following:

Informational Note No. 4: An example of an approved equivalent means is a switch that has padlock provisions, visible blades, and is clearly marked “MANDATORY LOCKOUT/TAGOUT PROCEDURES REQUIRED IN ACCORDANCE WITH NFPA 70E”.

Adding this informational note hardly makes this proposal perfect, but it does make it more palatable. If added, I would accept this proposal.

Related Item
First Revision No. 2707-NFPA 70-2015 [New Section after 240.61]

Submitter Information Verification
Submitter Full Name: JAMES ERICKSON
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Submittal Date: Fri Sep 25 15:38:44 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The SR created on 240.67 changes the focus of arc energy reduction from switches to fuses. The text now clearly applies to overcurrent protection provided by fuses, falling under the scope of Article 240 and within the purview of CMP10. Switches are not the only devices that could be used to provide the arc energy reduction. For example, fiber optics with an overcurrent relay could be utilized on the secondary side of a transformer to sense an arcing fault. A signal could then be sent to a vacuum interrupter or pyrotechnic fuses on the primary side of the transformer to open. Under that scenario, the switch on the secondary of the transformer is not involved in the arc energy reduction. The fiber optics with overcurrent relay in combination with a vacuum interrupter or pyrotechnic fuses would be examples of “An approved equivalent means” in list item 4. The 240.67 text includes requirements for fuses that are 1200 amperes or greater, not switches that are 1200 amperes or greater. Arc energy reduction techniques are not required for fuses less than 1200 amperes, where incident energies may be lower. For example, 400 ampere fuses, which are associated with lower incident energies than 1200 ampere fuses, might be installed in a 1200 ampere switch, without the need for additional arc energy reduction techniques. 240.67 does not preclude the use of smaller fuses. Arc energy reduction is not just designed for arc-flash incidents within the service entrance switch or circuit breaker, but rather for arc-flash incidents within the service entrance switchboard/switchgear, or within downstream equipment, such as a MCC where it is fed by a CB or fuses rated 1200 amps or greater. Exempting service entrance equipment from the arc energy reduction requirements would significantly reduce safety. Arc energy reduction techniques, including energy reducing maintenance switches, when used as part of an electrical safety program within the guidelines of NFPA 70E, have a proven track record of increasing worker safety. The intent of 240.67 is to reduce the arc energy to which a worker could be exposed. It does not negate the requirements in NFPA 70E or OSHA, which prohibit energized work except for two specific situations that are recognized as justified energized work (1) where additional hazards or increased risk are created if the equipment is de-energized and (2) infeasibility, meaning that the task to be performed requires the equipment to be energized, for example, where voltage testing is required. When a worker, following NFPA 70E and OSHA, is working on energized equipment, this new section will provide for a safer working environment, through the reduction of arc energy, in a manner that is similar to 240.87, where arc energy reduction techniques are required for 1200 amperes and greater circuit breakers.
Public Comment No. 608-NFPA 70-2015 [Section No. 240.67]

240.67 Arc Energy Reduction.
Where the ampere rating of the fusible switch is 1200 A or higher, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

(A) Documentation.
Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the fusible switch(es).

(B) Method to Reduce Clearing Time.
One of the following shall be provided:

1. Differential relaying
2. Energy-reducing maintenance switching with local status indicator
3. Energy-reducing active arc flash mitigation system
4. A fuse that would open the circuit in 0.07-0.12 seconds or less, at or below the available arcing current
5. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the disconnect switch back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: IEEE 1584, IEEE Guide for performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment
I have suggested under separate public comment that this proposal should be rejected. If the code panel does not agree and chooses to adopt this proposal, then the opening time for fuses should be changed to an appropriate level for switches.

Most fusible switches rated 1200 amp and above are NRTL Listed as Fused Power-Circuit Devices per UL977. The standard requires either bolted pressure contacts or butt contacts. Of the four present manufacturers of Fused Power Circuit Devices, three use bolted pressure contacts and one uses butt contacts. The fastest opening time for a new Fused Power-Circuit Device (in perfect condition) with bolted pressure contacts is 6 to 7 cycles. Age and lack of maintenance will result in longer opening times. The opening process typically involves unbolting at each end of the switch blades; followed by moving the switch blades toward the open position; followed by the engagement of arcing contacts; and finally followed by separation of the arcing contacts. Butt contacts merely need to separate. While bolted pressure contacts have an advantage of running very cool (truly a “green” feature), butt contacts have an advantage of opening faster. Bolted pressure contacts can never be as fast as butt contacts.

This proposal offers three methods for arc energy reduction by means of the switch contacts or one method by means of the fuse(s). Any of the three methods for most switches to clear the fault will take a minimum of 6-7 cycles (0.10-0.12 seconds) plus the reaction time of the arc sensing components. A total of 0.12 seconds is as fast as can be expected. Accordingly, the fuse clearing time in option (4) should be equal to the total clearing time in options (1), (2) or (3). If this proposal is adopted, the duration for the fuse to open in method (4) should be changed from 0.07 seconds or less to 0.12 seconds or less, a value that is appropriate for most switches.

Related Item
First Revision No. 2707-NFPA 70-2015 [New Section after 240.61]

Submitter Information Verification

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Public Comment No. 610-NFPA 70-2015 [ Section No. 240.67 ]

240.67 Arc Energy Reduction.

Where the ampere rating of the fusible switch is 1200 A or higher, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

Exception 1: Not required on fused switches used as the service disconnect unless the device can be completely de-energized by the building occupants.

(A) Documentation.

Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the fusible switch(es).

(B) Method to Reduce Clearing Time.

One of the following shall be provided:

1. Differential relaying
2. Energy-reducing maintenance switching with local status indicator
3. Energy-reducing active arc flash mitigation system
4. A fuse that would open the circuit in 0.07 seconds or less, at or below the available arcing current
5. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the disconnect switch back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: IEEE 1584, IEEE Guide for performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment

I have suggested under separate public comment that this proposal should be rejected. If the code panel does not agree and chooses to adopt this proposal, fused switches rated 1200 amp and above will open more often, and will be opening under fault conditions. Fuses will also open more often if, as a result of this requirement, fuses are redesigned to respond to arc flash events. These are facts, since this proposal does nothing to prevent an arc flash event from happening in the first place. If after adoption of this proposal switches and/or fuses do not open more often, then adoption of this proposal will have served no useful purpose.

When a switch opens under fault conditions, maintenance is required before re-energizing. Unlike circuit breakers, switch standards allow for maintenance after each test operation under fault conditions. Accordingly, maintenance is expected any time after a switch opens under fault conditions. Proper maintenance is essential for properly functioning switches. Similarly, if a fuse opens, the fuse must be replaced. Replacing a fuse can only be done manually by humans with tools.

NFPA70E, 130.6 (M) addresses “Reclosing Circuits after Protective Device Operation”. It states “After a circuit is de-energized by the automatic operation of a circuit protective device, the circuit shall not be manually reenergized until it has been determined that the equipment and circuit can be safely energized. The repetitive manual reclosing of circuit breakers or reenergizing circuits through replaced fuses shall be prohibited.” This requirement substantiates the need for maintenance after an arc flash event results in a switch automatically opening.

If the switch happens to be is a service disconnect, this presents a unique problem. The contacts on a service disconnect cannot be serviced unless the building owners have a disconnect feeding the primary side of the transformer or a utility shutdown is arranged. Utility shutdowns require scheduling and a fee.

There are many causes of arc flash events. Human causes are the reason for this proposal. However, most arc flash events do not involve humans or human safety. Common causes are water entering equipment, windblown dust, rodents, loose wire connections, aging insulation, and voltage spikes. The consequences are generally not catastrophic. A downstream fuse or circuit breaker feeding the particular equipment usually opens. The rest of the building remains energized, which is usually desired.

In cases where a service disconnect switch cannot be completely de-energized by the building occupants, consideration should be given concerning the events for re-energizing the building. The service disconnect switch will need maintenance. Fuses in the service disconnect will need to be checked and may need to be replaced. A Utility shut-down usually puts humans (utility employees) in danger.
of an arc flash event. (If a utility worker is wearing PPE, you can bet he is wearing the PPE for a reason.) If the fuses need to be checked or replaced, a human may be asked to work with tools in an energized service disconnect compartment. A human is now in danger of an arc flash event near extremely dangerous service entrance conductors. If this proposal is adopted, this will be the result even when the initial arc flash event did not involve humans or human safety.

It should also be recognized that in new installations, fuses are often installed in service entrance equipment before the equipment ships to the jobsite, when there is no electrical hazard. If fuses in a service disconnect respond more frequently as a result of the new requirement, there should be serious concern about replacing these fuses, particularly if the service conductors are bottom fed (which is very common). Humans will be asked more often to work with tools over energized service conductors. This proposal creates opportunities for extremely serious arc flash events that never existed before. If adoption of this proposal results in human injuries that otherwise would not have happened, who is to blame?

In summary, any maintenance in the service entrance compartment poses unique hazards. Creating maintenance work in this compartment should be avoided, particularly if the building occupants cannot completely de-energize the incoming conductors. Recommended maintenance is usually ignored on service equipment as it is. Merely adding a shunt trip to what was a manual switch adds maintenance. If a service disconnect switch or its fuses function more frequently as a result of this proposal (which they will), more work in the service disconnect compartment will result. Arc energy reduction features should not be mandatory on a service disconnect switch that cannot be completely de-energized by the building occupants.

Related Item
First Revision No. 2707-NFPA 70-2015 [New Section after 240.61]

Submitter Information Verification

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Submittal Date: Fri Sep 11 16:14:24 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Arc energy reduction does not apply to only service entrance switches or circuit breakers, it also applies within the service entrance switchboard/switchgear, or within downstream equipment, such as a MCC where it is fed by a CB or fuses rated 1200 amps or greater. Exempting service entrance equipment from the arc energy reduction requirements would significantly reduce safety.
240.67 Arc Energy Reduction.

Where the ampere rating of the fusible switch is 1200 A or higher, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

(A) Documentation.

Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the fusible switch(es).

(B) Method to Reduce Clearing Time.

One of the following shall be provided:

1. Differential relaying
2. Energy-reducing maintenance switching with local status indicator
3. Energy-reducing active arc flash mitigation system
4. A fuse that would open the circuit in 0.07 seconds or less, at or below the available arcing current
5. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the disconnect switch back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: IEEE 1584, IEEE Guide for performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment

I have suggested under separate public comment that this proposal should be rejected. If the code panel does not agree and chooses to adopt this proposal, then the word “fusible” in the first sentence should be changed to “fused”.

There is a difference between a fusible switch and a fused switch. Boltswitch manufactures and sells “dummy fuses” for installations where overcurrent protection is not required. A fusible switch equipped with dummy fuses is the same as a non-fusible switch. This proposal is not intended to cover non-fusible switches. (If it is intended to cover non-fusible switches, then the proposal does not belong in Article 240.)

The products mostly affected by this proposal are called “Fused Power-Circuit Devices”, which coincides with the title of the UL standard (UL977). The standard is not called “Fusible Power-Circuit Devices”.

Committee Statement

Committee Action: Rejected
| Resolution: | See the Second Revision on 240.67. This SR changes the focus of arc energy reduction in this section from switches to fuses. |
240.67 Arc Energy Reduction.
Where the ampere rating of the fusible switch is 1200 A or higher, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

(A) Documentation.
Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the fusible switch(es).

(B) Method to Reduce Clearing Time.
One of the following shall be provided:

1. Differential relaying
2. Energy-reducing maintenance switching with local status indicator
3. Energy-reducing active arc flash mitigation system
4. A fuse that would open the circuit in 0.07 seconds or less, at or below the available arcing current
5. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the disconnect switch back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: IEEE 1584, IEEE Guide for performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment
I have suggested under separate public comment that this proposal should be rejected. If the code panel does not agree and chooses to adopt this proposal, then the term “or below” in Method (4) should be deleted.

The available arcing current is a calculated value for a given point in the electrical system. If a fuse is intended to operate within a prescribed period of time at a calculated current value, the fuse cannot be expected to operate within that prescribed time at a lesser current value. The term “or below” should not be part of the requirement.

Related Item
First Revision No. 2707-NFPA 70-2015 [New Section after 240.61]

Submitter Information Verification
Submitter Full Name: JAMES ERICKSON
Organization: BOLTSWITCH INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 11 16:22:20 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-2702-NFPA 70-2015
Statement: The focus of arc energy reduction is modified for clarity and references “fuses” not “switches,” removing all potential confusion about “fusible switches” versus “fused switches” or transfer switches.
This requirement addresses “arc energy reduction” and is properly located in Article 240 and under the purview of CMP 10.

The revised text now clearly applies to overcurrent protection provided by fuses. Similar requirements exist in 240.87 for “arc energy reduction” where the overcurrent devices are circuit breakers.
240.67.  Arc Energy Reduction.
Where the ampere rating of the fusible switch is 1200 A or higher, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

(A)  Documentation.
Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the fusible switch(es).

(B)  Method to Reduce Clearing Time.
One of the following shall be provided:

(1)  Differential relaying
(2)  Energy-reducing maintenance switching with local status indicator
(3)  Energy-reducing active arc flash mitigation system
(4)  A fuse that would open the circuit in 0.07 seconds or less, at or below the available arcing current
(5)  An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the disconnect switch back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: IEEE 1584, IEEE Guide for performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment
By adding a new Section 240.67 located under Part IV titled "Cartridge Fuses and Fuseholders" will lead to major confusion and enforcement will not be uniform. The requirements for fusible switches are appropriately covered in Article 404. Article 240 pertains to overcurrent and not the operation of switches. When it is intended to apply to service disconnects then additional language should appear in Article 230.

The change does not recognize that there are hundreds of manually operated fusible switches functioning every day safely. If this change continues to be accepted it will prevent the replacement of manually operated switches in existing facilities without major expensive design changes.

If the proponent's comment that "energy reduction incidents could also be utilized with fusible switches" is not sufficient substantiation for a change as major as this is.

If the proponent believes this proposed requirement should be placed on switches similar to circuit breakers then proper substantiation should be provided and the change should be submitted to Article 404 with added provisions for allowing the continued use of manually operated switches where appropriately designed.

Related Item
First Revision No. 2707-NFPA 70-2015 [New Section after 240.61]

Submitter Information Verification
Submitter Full Name: Richard Loyd
Organization: R & N Associates
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City:
State:
Zip:
Committee Statement

Resolution: The SR created on 240.67 changes the focus of arc energy reduction from switches to fuses. The text now clearly applies to overcurrent protection provided by fuses, falling under the scope of Article 240 and within the purview of CMP10. Switches are not the only devices that could be used to provide the arc energy reduction. For example, fiber optics with an overcurrent relay could be utilized on the secondary side of a transformer to sense an arcing fault. A signal could then be sent to a vacuum interrupter or pyrotechnic fuses on the primary side of the transformer to open. Under that scenario, the switch on the secondary of the transformer is not involved in the arc energy reduction. The fiber optics with overcurrent relay in combination with a vacuum interrupter or pyrotechnic fuses would be examples of “An approved equivalent means” in list item 4. The 240.67 text includes requirements for fuses that are 1200 amperes or greater, not switches that are 1200 amperes or greater. Arc energy reduction techniques are not required for fuses less than 1200 amperes, where incident energies may be lower. For example, 400 ampere fuses, which are associated with lower incident energies than 1200 ampere fuses, might be installed in a 1200 ampere switch, without the need for additional arc energy reduction techniques. 240.67 does not preclude the use of smaller fuses. Arc energy reduction is not just designed for arc-flash incidents within the service entrance switch or circuit breaker, but rather for arc-flash incidents within the service entrance switchboard/switchgear, or within downstream equipment, such as a MCC where it is fed by a CB or fuses rated 1200 amps or greater. Exempting service entrance equipment from the arc energy reduction requirements would significantly reduce safety. Arc energy reduction techniques, including energy reducing maintenance switches, when used as part of an electrical safety program within the guidelines of NFPA 70E, have a proven track record of increasing worker safety. The intent of 240.67 is to reduce the arc energy to which a worker could be exposed. It does not negate the requirements in NFPA 70E or OSHA, which prohibit energized work except for two specific situations that are recognized as justified energized work (1) where additional hazards or increased risk are created if the equipment is de-energized and (2) infeasibility, meaning that the task to be performed requires the equipment to be energized, for example, where voltage testing is required. When a worker, following NFPA 70E and OSHA, is working on energized equipment, this new section will provide for a safer working environment, through the reduction of arc energy, in a manner that is similar to 240.87, where arc energy reduction techniques are required for 1200 ampere and greater circuit breakers.
240.67 - Arc Energy Reduction.

Where the ampere rating of the fusible switch is 1200 A or higher, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

(A) - Documentation.

Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the fusible switch(es).

(B) - Method to Reduce Clearing Time.

One of the following shall be provided:

1. Differential relaying
2. Energy-reducing maintenance switching with local status indicator
3. Energy-reducing active arc flash mitigation system
4. A fuse that would open the circuit in 0.07 seconds or less, at or below the available arcing current
5. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the disconnect switch back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: IEEE 1584, IEEE Guide for performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment

Public Comment for First Revision No. 2707-NFPA 70-2015 [New Section 240.67]

Submitted by: Peter Walsh, Mersen, USA

This document is public comment for a proposal to add 240.67 "Arc Energy Reduction" to NFPA70-2017 (the NEC). The substantiation for the proposal is that the benefits of arc energy reduction requirements for circuit breakers in NEC 240.87 have been well established and thus should be added to the requirements for fusible switches. Mersen supports reducing arc flash energy. It is important that the proposal promotes safety and is appropriate for switches; is appropriately placed in the NEC; and does not conflict with other sections of the NEC.

The proposal is not appropriate for switches

Most switches are manually operated. Three out of every four fusible switches rated 1200 amp and above are manually operated. Manually operated switches are important components for safe, electrical systems. This proposal could eliminate all manually operated fusible switches rated 1200 amp and above if fuses are unable to meet the fuse requirements (option 4) of this proposal.

Many switches were never intended to be anything but manually operated. Fusible manual transfer switches, double throw switches and bypass isolation switches rated 1200 amp and above are commonly used in applications such as standby systems. These switches were never intended to have other than a manual operating means. If fuses that open under arc fault conditions set forth in this proposal are not properly selected, these manually operated switch products will require a means to open automatically, which goes against the product definition. Automatic transfer switches do not function without proper care. They require routine testing and maintenance. Manually-operated switches are extremely dependable.

The proposal requires changing the definition of a switch. There are five definitions used in the NEC and NFPA 70E that apply to switches rated 1200 amp and above. Each of the definitions applies to fusible or non-fusible switches. The definitions are as follows:

1.) “Switching Device” is defined in the NEC and NFPA70E as “A device designed to close, open, or both, one or more electric circuits”.
2.) “Switch, Bypass Isolation” is defined in the NEC as “A manually operated device used in conjunction with a transfer switch to provide a means of directly connecting load conductors to a power source and of disconnecting the transfer switch”.
3.) “Switch, General-Use” is defined in the NEC as “A switch intended for use in general distribution and branch circuits. It is rated in amperes, and it is capable of interrupting its rated current at its rated voltage”.
4.) “Switch, Isolating” is defined in the NEC as “A switch intended for isolating an electrical circuit from the
source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means.

5) “Switch, Transfer” is defined in the NEC as “An automatic or non-automatic device for transferring one or more load conductor connections from one power source to another.

By any of the definitions, a switch (fusible or non-fusible) is not an overcurrent protection device and it is not required to open a circuit automatically.

Four of the five definitions do not require the switch to be capable of opening under load. Only a “Switch, General-Use” is required to be capable of opening the circuit under load. If this proposal is adopted, all five of these types of switches rated 1200 amp and above will be required to be load break and also be capable of interrupting a fault current.

Thousands of manually-operated fused switches rated 1200 amp and above are used on 24 and 48 volt dc systems as battery disconnects. It is recognized throughout NFPA70E that there is little to no arc flash hazard at voltages below 50 volts. This proposal would put new requirements on these manually operated fusible switches. The proposal should have an exception for applications below 50 volts.

The proposal is in the wrong location, switches are described elsewhere in the NEC

Switches are presently addressed in Article 404 of the NEC. If adopted, some requirements for switches would be in Article 404 and some requirements would be in Article 240. NEC 404.1 provides the scope for switches in the NEC. It is very clear. Only switches rated above 1000 volt are to be covered elsewhere in the NEC. This is not the case with the proposal and would require changes in Section 404.1.

The requirements conflict with other parts of the NEC

NEC 404.13(A) states isolating switches rated over 1200 amp shall not be opened under load. Isolation switches can be and often are fusible switches. This proposal would require these same switches to open a fault current automatically if fuses are not installed to comply with option (4). Accordingly, the proposal directly conflicts with the requirements of NEC 404.13(A).

The term “fusible switch” is not defined. Many “fusible switches” have copper bars installed in the fuse gap, commonly called dummy fuses. Would a “fusible switch” with dummy fuses installed be subject to the requirements of this proposal? I would think the answer is no, since the assembly would be the same as a non-fusible switch. But technically the switch itself is still a “fusible switch”.

430.90 in the NEC is titled “Combination Fuseholder and Switch as Controller”. If a fuseholder (with fuses installed) and a non-fusible switch are combined, would the requirements of this proposal apply? There would be three separately listed products involved, and none of them would be a “fusible switch”. Changing the term “fusible switch” to “fused switch” may add clarity to this situation. Most people would consider the combination to be a “fused switch”.

Safety

An important safety feature on switches is that they can be padlocked in the ON position. Switches are often mounted outside. Most Firefighters prefer to have switches mounted outside. Some jurisdictions even require the service disconnect to be located outside however only manually operated switches can be padlocked in the ON position. Shunt trip operated switches or any circuit breaker cannot be padlocked in the ON position. This proposal will force many manually operated switches to become shunt trip operated, which means they can no longer be padlocked “ON”.

Switches can be equipped with key interlocks to lock in the OFF position, ON position, or both. Key interlock schemes are used to ensure that each product in the system is in a prescribed position before another action can be taken. Key interlocks may have auxiliary contacts and solenoid releases, and can be mounted in many ways, including on doors and panels of electrical equipment. Key interlock schemes can be used to prevent access to energized electrical components. The point is that key interlocks are used on switches in a proactive manner to prevent the occurrence of an arc flash event. Often the switches are manually operated and key interlocked in the ON position to prevent opening the switch under load. This proposal will adversely impact these proactive schemes. Shunt trip operated switches and circuit breakers cannot have key interlocks for locking in the ON position.

Needed Exceptions

This proposal lacks key exceptions. The first is an exception for applications with the working distance having not over 8 Cal/cm2. Under this level the hazard is compatible with normal Category 2 arc rated PPE.

The second needed exception is in industrial processes. Sometimes they need selective coordination but this proposal would cause additional hazards such as considered in 240.12.

The third exception is for a switch with ampere ratings below 1200 amps. Frequently 1200 amp switch is required for shunt trip or other functionality independent of the service entrance rating. Fuses can be sized at 400A, 600A, 800A, and 1000A and still fit into the 1200 amp fused switch. A 400 amp switch does not have the same communications and trips available as a 1200 amp.

Conclusion

As the reader can see, the proposal does not promote safety, it is not appropriate for switches or fuses, it conflicts with other sections of the NEC, and it is in the wrong place. It is not good code and should be rejected
Submitter Information Verification

Submitter Full Name: Peter Walsh  
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City:  
State:  
Zip:  
Submittal Date: Mon Sep 21 12:39:14 EDT 2015

Committee Statement

Committee Action: Rejected

Resolution: The SR created on 240.67 changes the focus of arc energy reduction from switches to fuses. The text now clearly applies to overcurrent protection provided by fuses, falling under the scope of Article 240 and within the purview of CMP10. Switches are not the only devices that could be used to provide the arc energy reduction. For example, fiber optics with an overcurrent relay could be utilized on the secondary side of a transformer to sense an arcing fault. A signal could then be sent to a vacuum interrupter or pyrotechnic fuses on the primary side of the transformer to open. Under that scenario, the switch on the secondary of the transformer is not involved in the arc energy reduction. The fiber optics with overcurrent relay in combination with a vacuum interrupter or pyrotechnic fuses would be examples of “An approved equivalent means” in list item 4. The 240.67 text includes requirements for fuses that are 1200 amperes or greater, not switches that are 1200 amperes or greater. Arc energy reduction techniques are not required for fuses less than 1200 amperes, where incident energies may be lower. For example, 400 ampere fuses, which are associated with lower incident energies than 1200 ampere fuses, might be installed in a 1200 ampere switch, without the need for additional arc energy reduction techniques. 240.67 does not preclude the use of smaller fuses. Arc energy reduction is not just designed for arc-flash incidents within the service entrance switch or circuit breaker, but rather for arc-flash incidents within the service entrance switchboard-switchgear, or within downstream equipment, such as a MCC where it is fed by a CB or fuses rated 1200 amps or greater. Exempting service entrance equipment from the arc energy reduction requirements would significantly reduce safety. Arc energy reduction techniques, including energy reducing maintenance switches, when used as part of an electrical safety program within the guidelines of NFPA 70E, have a proven track record of increasing worker safety. The intent of 240.67 is to reduce the arc energy to which a worker could be exposed. It does not negate the requirements in NFPA 70E or OSHA, which prohibit energized work except for two specific situations that are recognized as justified energized work (1) where additional hazards or increased risk are created if the equipment is de-energized and (2) infeasibility, meaning that the task to be performed requires the equipment to be energized, for example, where voltage testing is required. When a worker, following NFPA 70E and OSHA, is working on energized equipment, this new section will provide for a safer working environment, through the reduction of arc energy, in a manner that is similar to 240.87, where arc energy reduction techniques are required for 1200 ampere and greater circuit breakers.
Public Comment No. 1365-NFPA 70-2015 [Section No. 240.67 [Excluding any Sub-Sections]]

Where the ampere rating of the fusible switch is 1200 A or higher, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

Exception: The requirements of 240.67(A) and (B) do not apply to fusible transfer switches rated at 1200 A or higher.

Statement of Problem and Substantiation for Public Comment

Incident energy reduction techniques will generally already be utilized upstream of the transfer switch.

Related Item

First Revision No. 2707-NFPA 70-2015 [New Section after 240.61]

Submitter Information Verification

Submitter Full Name: Vincent Saporita
Organization: Eaton
Affiliation: Eaton
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 00:03:33 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2702-NFPA 70-2015
Statement: The focus of arc energy reduction is modified for clarity and references “fuses” not “switches,” removing all potential confusion about “fusible switches” versus “fused switches” or transfer switches.

This requirement addresses “arc energy reduction” and is properly located in Article 240 and under the purview of CMP 10.

The revised text now clearly applies to overcurrent protection provided by fuses. Similar requirements exist in 240.87 for “arc energy reduction” where the overcurrent devices are circuit breakers.
Where the ampere rating of the fusible fused switch capable of opening automatically is 1200 A or higher, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

Statement of Problem and Substantiation for Public Comment

Some switches by definition are not capable or allowed to open automatically such as an isolating switch or a knife switch.

Related Item
First Revision No. 2707-NFPA 70-2015 [New Section after 240.61]

Submitter Information Verification

Submitter Full Name: ERIC MAIER
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State: 
Zip: 
Submittal Date: Thu Jul 23 16:35:41 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: See the Second Revision on 240.67. This SR changes the focus of arc energy reduction in this section from switches to fuses.
Where the ampere rating of the fusible switch is 1200 A or higher, 240.67(A) and (B) shall apply. This requirement shall become effective January 1, 2020.

Statement of Problem and Substantiation for Public Comment

Solutions are available today to reduce the arc flash hazard in 1200 amp or higher overcurrent protective device installations. There is no need for electrical workers to have to wait until 2020.

Related Item
First Revision No. 2707-NFPA 70-2015 [New Section after 240.61]

Submitter Information Verification

Submitter Full Name: Ed Larsen
Organization: Schneider Electric USA
Affiliation: Schneider Electric USA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 14:42:39 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The extended effective date is necessary to allow for equipment design and manufacturing changes. The NEC currently allows for the installation of these arc reduction techniques.
(B) Method to Reduce Clearing Time.

One. Unless downstream incident energy at the working distance is documented to be 8 cal/cm² or lower, one of the following shall be provided:

1. Differential relaying
2. Energy-reducing maintenance switching with local status indicator
3. Energy-reducing active arc flash mitigation system
4. A fuse that would open the circuit in 0.07 seconds or less, at or below the available arcing current
5. An approved equivalent means

The requirements of 240.67(B) shall not be required to apply to fusible switches serving continuous industrial processes where a lack of protective device coordination will introduce greater or other hazards.

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the disconnect switch back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: IEEE 1584, IEEE Guide for Performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment

First as proposed in PI 1704 for 240.87 in the first draft stage, methods to reduce clearing time should not be required by the NEC for installations where the calculated incident energy at the working distance is 8 cal/cm² or less. Required PPE for this energy level is consistent with the reduced PPE level that will be required after 240.67-approved methods to reduce clearing time are applied to some installations, and consistent with what is needed for some installations that would not fall under 240.67. It is common in many workplaces to provide 8 cal/cm² clothing as daily wear. Second as proposed in PI 1764 in the first draft stage for 240.87, there should be an exception to these requirements where the fusible switch serves continuous industrial processes where a lack of protective device coordination will introduce greater or other hazards. All of the measures that could be cost-effectively provided for loads served by an outgoing fusible switch would introduce some level of protective device miscoordination. Qualified industrial users should be allowed to appropriately manage the full spectrum of hazards, which they could do via the proposed exception.

Related Item

Public Input No. 1704-NFPA 70-2014 [Section No. 240.87(B)]
Public Input No. 1764-NFPA 70-2014 [Section No. 240.87(B)]

Submitter Information Verification

Submitter Full Name: Carl Fredericks
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Affiliation: American Chemistry Council
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City:
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Zip:
Submittal Date: Fri Sep 04 15:33:46 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: No technical justification has been provided for a permitted exposure threshold of an incident energy equal to 8 cal/cm² when the arc energy reduction techniques may be able to reduce the arc energy to a much lower value. An exemption for industrial processes is unnecessary because arc energy reduction techniques are available. CMP 10 requests that the
NFPA Research Foundation initiate a study to determine what, if any, incident energy level would be an acceptable exposure level in the installation code, NFPA 70.
Public Comment No. 575-NFPA 70-2015 [Section No. 240.67(B)]

(B) Method to Reduce Clearing Time.
One of the following shall be provided:

1. Differential relaying
2. Energy-reducing maintenance switching with local status indicator
3. Energy-reducing active arc flash mitigation system
4. A fuse that would open the circuit in 0.07 seconds or less, at or below, the available arcing current
5. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the disconnect switch back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: IEEE 1584, IEEE Guide for performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment

In the past several months I have heard from a number of people that text, as written, could be confusing because of the phrase "or below". The phrase "or below" can actually be removed without changing the intent of the requirement. By removing "or below", the requirement is clarified.

Related Item
First Revision No. 2707-NFPA 70-2015 [New Section after 240.61]

Submitter Information Verification

Submitter Full Name: Vincent Saporita
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Affiliation: Eaton Bussmann Division
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City:
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Zip:
Submittal Date: Tue Sep 08 15:08:11 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2702-NFPA 70-2015
Statement: The focus of arc energy reduction is modified for clarity and references "fuses" not "switches," removing all potential confusion about "fusible switches" versus "fused switches" or transfer switches.

This requirement addresses "arc energy reduction" and is properly located in Article 240 and under the purview of CMP 10.

The revised text now clearly applies to overcurrent protection provided by fuses. Similar requirements exist in 240.87 for "arc energy reduction" where the overcurrent devices are circuit breakers.
Section 240.83(A)

Durable and Visible.

Circuit breakers shall be marked with their ampere rating in a manner that will be durable and visible after installation. Such marking shall be permitted to be made visible by removal of a trim or cover.

Statement of Problem and Substantiation for Public Comment

The circuit breaker label is vital in determining both code compliance and trip characteristics. For purposes of determining arc flash incident energy levels, the exact circuit breaker manufacturer and model must be determined, and the engineer or inspector should not be burdened or subjected to unsafe tasks such as removing trim cover on energized systems. Rejecting this proposed code change on the basis of not having enough room or added cost should be classified as criminal neglect should a person be harmed.

Related Item

Public Input No. 1896-NFPA 70-2014 [Section No. 240.83(A)]

Submitter Information Verification

Submitter Full Name: BARRY CALLOWAY
Organization: CENTURY 3
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 22 16:43:10 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter has not substantiated a problem with existing code requirements. It is not practical to require that these and other markings be provided in an unobstructed location that can be easily and safely read by an individual making a survey of energized equipment. Individuals performing an incident energy analysis on an existing system must follow all applicable OSHA regulations and the industry standard for electrical safety in the workplace, NFPA 70E.
(B) Method to Reduce Clearing Time.

One of the following means shall be provided:

(1) Zone-selective interlocking
(2) Differential relaying
(3) Energy-reducing maintenance switching with local status indicator
(4) Energy-reducing active arc flash mitigation system
(5) An instantaneous trip setting that is less than the available arcing current greater than the maximum instantaneous trip setting, if adjustable
(6) An instantaneous override that is less than the available arcing current
(7) An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to “no intentional delay” to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the trip unit back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the circuit breaker or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: An instantaneous trip is a function that causes a circuit breaker to trip with no intentional delay when currents exceed the instantaneous trip setting or current level. If arcing currents are above the instantaneous trip level, the circuit breaker will trip in the minimum possible time.

Informational Note No. 4: IEEE 1584–2002, IEEE Guide forPerforming Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment

As accepted by FR 2706, someone could avoid using one of the incident energy reduction methods by turning down the instantaneous trip, then after final inspection, turning up the instantaneous trip to achieve selective coordination. If accepted, this public comment would assure that the intent of incident energy reduction is not circumvented.

Related Public Comments for This Document

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Submitter Information Verification

Submitter Full Name: Vincent Saporita
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Submittal Date: Thu Sep 24 22:47:54 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The adjustment of a circuit breaker’s instantaneous trip to a setting below the arcing current is a proven method to reduce clearing time and therefore incident energy. No substantiation has been provided to indicate that injuries have occurred because an instantaneous trip was adjusted to a setting that was higher than the arcing current.
Public Comment No. 1359-NFPA 70-2015 [Section No. 240.87(B)]

(B) Method to Reduce Clearing Time.

One of the following means shall be provided:

1. Zone-selective interlocking
2. Differential relaying
3. Energy-reducing maintenance switching with local status indicator
4. Energy-reducing active arc flash mitigation system
5. An instantaneous trip setting that is less than the available arcing current
6. An instantaneous override available arcing current that is less, greater than the available arcing current instantaneous override
7. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to “no intentional delay” to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the trip unit back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the circuit breaker or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: An instantaneous trip is a function that causes a circuit breaker to trip with no intentional delay when currents exceed the instantaneous trip setting or current level. If arcing currents are above the instantaneous trip level, the circuit breaker will trip in the minimum possible time.

Informational Note No. 4: IEEE 1584–2002, IEEE Guide for Performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment

This is an editorial change to correlate with Public Comment 1357. There is no change to the requirements shown in FR 2706.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 1357-NFPA 70-2015 [Section No. 240.87(B)]</td>
<td></td>
</tr>
<tr>
<td>First Revision No. 2706-NFPA 70-2015 [Section No. 240.87(B)]</td>
<td></td>
</tr>
</tbody>
</table>

Submitter Information Verification

Submitter Full Name: Vincent Saporita
Organization: Eaton
Affiliation: Eaton
Street Address: Eaton
City: 
State: 
Zip:
Submittal Date: Thu Sep 24 23:01:09 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The adjustment of a circuit breaker’s instantaneous trip to a setting below the arcing current is a proven method to reduce clearing time and therefore incident energy. No substantiation has been provided to indicate that injuries have occurred because an instantaneous trip was adjusted to a setting that was higher than the arcing current.
Method to Reduce Clearing Time.

One of the following means shall be provided:

1. Zone-selective interlocking
2. Differential relaying
3. Energy-reducing maintenance switching with local status indicator
4. Energy-reducing active arc flash mitigation system
5. An instantaneous trip setting that is less than the available arcing current or an adjustable instantaneous trip setting that is set to minimum and is not changed
6. An instantaneous override that is less than the available arcing current
7. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to "no intentional delay" to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the trip unit back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the circuit breaker or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: An instantaneous trip is a function that causes a circuit breaker to trip with no intentional delay when currents exceed the instantaneous trip setting or current level. If arcing currents are above the instantaneous trip level, the circuit breaker will trip in the minimum possible time.

Informational Note No. 4: IEEE 1584–2002, IEEE Guide for Performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment

Items (5) and (6) are effective ways reduce arc flash energy as stated by the committee and are a valuable addition to 240.87. The committee does an excellent job identifying that instantaneous trips may be as fast or faster as the other means stated. The committee is also correct in identifying that the trip setting must be below the arcing current. When the trip setting is low the instantaneous trip will operate and provide better protection.

Maintenance switches remove intentional delays from instantaneous trips and may also reduce the trip settings. The end result is that the circuit breaker with the maintenance switch activated acts identically to any circuit breaker that has an instantaneous trip that is already set to minimum. This proposed change recognizes that either a circuit breaker with a maintenance switch or one with an instantaneous trip set to minimum provides equivalent arc flash protection. This also provides a way to apply an effective protection means without performing an arc flash study. None of the other means require an arc flash study in order to be implemented; this proposal aligns the use of an instantaneous trip with the other allowed means.

Related Item

Public Input No. 1384-NFPA 70-2014 [Section No. 240.87(B)]
Public Input No. 2243-NFPA 70-2014 [Section No. 240.87(B)]

Submitter Information Verification

Submitter Full Name: THOMAS PAPALLO
Organization: SIEMENS
Affiliation: Siemens Industry
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 10:33:08 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>When the available arcing current is greater than the instantaneous trip, no further action is required.</td>
</tr>
</tbody>
</table>
(B) Method to Reduce Clearing Time.

One, unless downstream incident energy at the working distance is documented to be 8 cal/cm² or lower, one of the following means shall be provided:

1. Zone-selective interlocking
2. Differential relaying
3. Energy-reducing maintenance switching with local status indicator
4. Energy-reducing active arc flash mitigation system
5. An instantaneous trip setting that is less than the available arcing current
6. An instantaneous override that is less than the available arcing current
7. An approved equivalent means

The requirements of 240.87(B) shall not be required to apply to circuit breakers serving continuous industrial processes where a lack of protective device coordination will introduce greater or other hazards

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to "no intentional delay" to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then to set the trip unit back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the circuit breaker or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: An instantaneous trip is a function that causes a circuit breaker to trip with no intentional delay when currents exceed the instantaneous trip setting or current level. If arcing currents are above the instantaneous trip level, the circuit breaker will trip in the minimum possible time.

Informational Note No. 4: IEEE 1584-2002, IEEE Guide for Performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.

Statement of Problem and Substantiation for Public Comment

First as proposed in PI 1704 in the first draft stage, methods to reduce clearing time should not be required by the NEC for installations where the calculated incident energy at the working distance is 8 cal/cm² or less. Required PPE for this energy level is consistent with the reduced PPE level that will be required after 240.87-approved methods to reduce clearing time are applied to some installations, and consistent with what is needed for some installations that do not fall under 240.87. It is common in many workplaces to provide 8 cal/cm² clothing as daily wear. Second as proposed in PI 1764 in the first draft stage, there should be an exception to these requirements where the breaker serves continuous industrial processes where a lack of protective device coordination will introduce greater or other hazards. All of the measures that could be cost-effectively provided for loads served by an outgoing breaker would introduce some level of protective device miscoordination. Qualified industrial users should be allowed to appropriately manage the full spectrum of hazards, which they could do via the proposed exception.

Related Item

Public Input No. 1704-NFPA 70-2014 [Section No. 240.87(B)]
Public Input No. 1764-NFPA 70-2014 [Section No. 240.87(B)]

Submitter Information Verification

Submitter Full Name: Carl Fredericks
Organization: The Dow Chemical Company
Affiliation: American Chemistry Council
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 04 15:21:30 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>No technical justification has been provided for a permitted exposure threshold of an incident energy equal to 8 cal/cm² when the arc energy reduction techniques may be able to reduce the arc energy to a much lower value. An exemption for industrial processes is unnecessary because arc energy reduction techniques are available. CMP 10 requests that the NFPA Research Foundation initiate a study to determine what, if any, incident energy level would be an acceptable exposure level in the installation code, NFPA 70.</td>
</tr>
</tbody>
</table>
Public Comment No. 1766-NFPA 70-2015 [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.

Informational Note No. 2: See NFPA 780-2017, Standard for the Installation of Lightning Protection Systems, for information on lightning protection system grounding.

Statement of Problem and Substantiation for Public Comment

the Correlating Committee directs that the panel give further consideration to the comments expressed in voting on FR 1203.

Related Item
First Revision No. 1203-NFPA 70-2015 [Section No. 250.4(A)(1)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:18:27 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1201-NFPA 70-2015
Statement: The NEC is not a lightning protection document. Adding the reference to NFPA 780 will provide additional information for lightning protection systems.
(1) Grounding Electrical Equipment.

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

Informational Note No. 1: See NFPA 780-2017, Standard for the Installation of Lightning Protection Systems, for information on lightning protection grounding.

Statement of Problem and Substantiation for Public Comment

Due to transcription errors the information note was omitted from the ballot as noted in the ballot comments of Charles Mello. This note is to be the same as in 250.4(A)(1)

Related Item

First Revision No. 1203-NFPA 70-2015 [Section No. 250.4(A)(1)]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 14:00:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1201-NFPA 70-2015
Statement: The NEC is not a lightning protection document. Adding the reference to NFPA 780 will provide additional information for lightning protection systems.
Exception

When objectional ground fault current may be imposed on communication cables.
The installation must comply with 250.6 (A) & (B)

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trough_Bonding.JPG</td>
<td>The pic shows a trough with the panel feed, control wiring and an Ethernet communications cable to support a valve control panel. The several conduits would not physically fit in the panel. The trough intercepted the associated conduits and condensed them to (3) sealights going to the control panel. The completed installation had the communication wiring was separated by 2&quot; from power &amp; control wiring. The communication conduit did not have a ground wire as required by 514.8 ex 2 last sentence. The grounding and bonding was achieved by other approved means. This proposed amendment to 514.8 ex 2 would clarify that it is acceptable to ground and bond by other means.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

In underground situations where rigid steel conduit transitions to PVC underground and emerges as rigid conduit on both ends. A ground wire is included to bond both ends of the raceway. When there are several conduits in the same enclosure and all are Rigid steel / PVC and some are for communications, the conduit can be bonded to ground without running a ground wire in the conduit with communication cables. If a ground wire was run in with communication cables, the ground fault currents of other circuits could be imposed on the communication cables and damage equipment. The exception to 250.6 (C) would enable the grounding conductor to be removed from the communication conduit. A note should be added that it comply with 250.6 (A) & (B) This would also go along with a proposed change for 514.8 exception 2 to eliminate the requirement of a grounding conductor if it was for a communication cable and the conduit could be bonded by other approved means.

Related Item

First Revision No. 1205-NFPA 70-2015 [Section No. 250.6(B)]

Submitter Information Verification

Submitter Full Name: GERALD DALEY
Organization: Daley Electric Company
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Aug 11 22:03:44 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: It appears the submitter is intending to add an exception but it is incomplete as it is not a complete sentence as required in the NEC Style Manual. In addition, fault current is not considered “objectionable current”. The installation example is inconsistent with 300.3(C) and 800.133(a), because communications conductors are being installed in raceways and enclosures with power conductors.
TITLE OF NEW CONTENT
NEC Code Change Proposal
09/21/15

The upper end of the electrode shall be flush with or below ground level unless the aboveground end and the electrode conductor attachment are protected against physical damage as specified in 250.10.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017_NEC_Change_Proposal.pdf</td>
<td>2017 proposal</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

Submitted by:
Dan Tharp
Owner and Master Electrician of Big "D" Electric
PO Box 414
Longville, MN. 56655

As a Master electrician for over 30 years, I have witnessed and dealt with the effects of poor grounding. A large part of this stems from the connection point of the GEC to the Grounding Electrode. Section 110.14 of the NEC Handbook describes this issue, yet does not address it completely. Dissimilar metal connections are used frequently in the electrical industry. copper to galvanized ground rods, copper to steel rebar, aluminum to copper ground rods.

Even with "listed" connectors the industry does not address the facts that to dissimilar metals create a battery of such to sacrifices the anode to the cathode. (see attached article)

This is creating a loose and unstable connection point that can lead to a great hazard to both life and property.

The industry also has been led to believe by the creators of exothermic welding that their connections are 100% free from galvanic corrosion. This is proving not to be the case, thus companies such as Century Link, civil engineering firms in St. Louis, Mo and US Dept. of the Interior – Mining and others are requiring a sealant over their exothermic welding connections which are then either buried deep beneath the soil or in concrete. Many companies such as Enbridge and Monsanto require annual inspections of these connections to check that the connection is still sound.

Since the grounding system is dormant a large part of it’s life we as electricians tend to over look it till it’s too late. Once the grounding
system is needed do to a fault or lightning strike occurs we want to have the peace of mind knowing our grounding system is working properly.

Studies show that nearly 86% of all electrical problems stem from poor grounding. While proper installation of grounding equipment is closely regulated, post installation inspection has been largely overlooked. Recent growth spurts in the electrical industry have been bringing attention to these issues, with safety being the utmost concern.

All electrical systems rely on a good ground connection to ensure safe and reliable operation. Making sure there is minimal resistance at the grounding point ensures that any potential hazards are avoided.

The safest and simplest way to achieve these goals are by encapsulating the connection point. As read in the attached paper “Galvanic Corrosion in the Electrical Industry” put together by John Langholtz EE/PE graduate of South Dakota State University.

Related Item
Public Input No. 4181-NFPA 70-2014 [Section No. 250.10]

Submitter Information Verification

Submitter Full Name: dan tharp
Organization: Big D Electric
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 08:52:24 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: For 250.10: The methods of providing protection against physical damage are not provided. For 250.53(G): The proposed change does not add clarity. For 250.62: The Comment does not propose a change in wording. For 110.14: This Code Panel does not have jurisdiction over 110.14.
250.22  Circuits Not to Be Grounded.
The following circuits shall not be grounded:

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

Statement of Problem and Substantiation for Public Comment

The text is revised to reflect that actual text in 393.60(B)

Committee State ment

Committee Action: Rejected but see related SR
Resolution: SR-1203-NFPA 70-2015
Statement: The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.


**Public Comment No. 1767-NFPA 70-2015 [Section No. 250.22]**

250.22 Circuits Not to Be Grounded.

The following circuits shall not be grounded:

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

**Statement of Problem and Substantiation for Public Comment**

the Correlating Committee directs that the panel give further consideration to the comments expressed in voting on FR 1208.

**Related Item**

First Revision No. 1208-NFPA 70-2015 [Section No. 250.22]

**Submitter Information Verification**

**Submitter Full Name:** CC on NEC-AAC  
**Organization:** NFPA

**Committee Statement**

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-1203-NFPA 70-2015  
**Statement:** The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.
(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. For the purpose of this section, connection of the grounding electrode conductor in an enclosure that will be sealed or locked by the utility provider shall not be considered accessible, unless such connection is required by the utility provider.

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

Statement of Problem and Substantiation for Public Comment

If the grounding electrode conductor terminates inside a meterbase, C. T. enclosure, service gutter or similar enclosure that is sealed by the utility company, it is no longer accessible for inspection and maintenance by the electrical inspector or electrical professional. This seal or lock prevents the inspector or electrical personnel from close approach to verify this connection when a modification or repair is done to service equipment. The utility companies seal and sometimes lock all enclosures containing access to conductors on the line side of the metering equipment to prevent tampering and theft of electricity. Over the last 50 years as electricity has become more costly, the problem of theft of service has been an increasing concern to the utility companies.

As inspectors, we are not authorized to break a utility company seal and may have to wait days in order to schedule a utility person to meet on site to remove and re-seal the enclosures, just to insure the grounding electrode connection. This creates a hardship and waists valuable time for the inspector, the utility provider and the electrical personnel who need to get approval from the AHJ to energize the equipment. A connection inside a sealed enclosure is no longer accessible as defined in Article 100. Additional language has been added to the original proposal to exempt this requirement where the connection inside the metering enclosure is required by the utility provider.

Related Item

Public Input No. 4313-NFPA 70-2014 [Section No. 250.24(A)(1)]

Submitter Information Verification

Submitter Full Name: Rodney Jones
Organization: Clackamas County, Oregon
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 18:09:25 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed language would limit the ability of the authority having jurisdiction to interpret the NEC to comply with local regulations or practices as provided in 90.4.
Where an ac system operating at 2000 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.

**Statement of Problem and Substantiation for Public Comment**

The voltage level should remain at 1000 volts. Making the change to 2000 volts may allow additional items to comply with low voltage
requirements without substantiation and may create safety issues. Although the change in voltage does not directly impact the
grounding requirements in Article 250, it creates inconsistency with other Articles throughout the code, as other CMP's did not accept
these Public Inputs.

**Related Public Comments for This Document**

<table>
<thead>
<tr>
<th>Related Comment</th>
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<tbody>
<tr>
<td>Public Comment No. 407-NFPA 70-2015 [Section No. 250.36 [Excluding any Sub-Sections]]</td>
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<tr>
<td>Public Comment No. 408-NFPA 70-2015 [Section No. 280.1]</td>
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</table>

**Submitter Information Verification**

**Submitter Full Name:** MIKE OMEARA  
**Organization:** Edison Electric Institute  
**Affiliation:** EEI Electric Light & Power NEC Task Force  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Thu Aug 13 13:32:22 EDT 2015

**Committee Statement**

**Committee Action:** Accepted  
**Resolution:** SR-1204-NFPA 70-2015  
**Statement:** The voltage level should remain at 1000 volts. Making this change to 2000 volts creates inconsistency within Article 250, as 250.180 and 250.188 were not changed and remain at 1000 volts. Services over 1000 volts are covered in 250.186.
(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 labeled 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.

Statement of Problem and Substantiation for Public Comment

The term "and labeled" is required to provide the identification the equipment is Suitable for Use as Service Equipment. List along does not provide sufficient information to the installer, inspector or user that the equipment has this rating.

Related Item
First Revision No. 1219-NFPA 70-2015 [Section No. 250.30(A)(4)]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:20:07 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1210-NFPA 70-2015
Statement: The text "and identified" was added to be consistent with 250.30(A)(6).
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 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.
(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 No.1: If a separately derived system originates in equipment that is listed 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.

Exception No.2: If a separately derived system is part of mobile system the equipment grounding conductor from the service 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.

Statement of Problem and Substantiation for Public Comment

In my facility we have numerous test stands that are moved throughout the various labs. These are connected to 480V 3 phase receptacles. On many of the test stands we have a small (generally less than 5 kVA) transformers installed that are used to create 120/240V for a computer, monitor, lab power supply, etc. that are connected to receptacles installed in the bench. To date we have taken a dedicated grounding electrode conductor from the grounded conductor in the derived system to a clamp to building steel to serve as the grounding electrode for the separately derived system.

I have two concerns with this; one due to the portable nature of the test stands it is possible for the dedicated grounding electrode conductor to NOT be connected to building steel as an operator may forget or assume that the equipment grounding conductor in the receptacle does accomplish this and/or the building steel is poorly bonded and does not serve as “good” a grounding electrode as one would hope.

I would like to require only the equipment grounding conductor that supplies the entire receptacle (and therefore the bench) as the grounding electrode to ensure that any time the bench is connected to the 3 phase 480V receptacle the grounded conductors of the separately derived system are connected to a suitable equipment grounding conductor.

Related Item
Public Input No. 443-NFPA 70-2014 [Section No. 210.64]

Submitter Information Verification

Submitter Full Name: Cullen Hall
Organization: Donaldson Company Inc.
City:
State:
Zip:
Submital Date: Thu Aug 27 14:49:16 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed new exception is not clear as to the intended application and as such would not be enforceable.
(5) Grounding Electrode Conductor, Single Separately Derived System.

A grounding electrode conductor for a single separately derived system shall be sized in accordance with 250.66 for the derived ungrounded conductors. It shall be used to connect the grounded conductor of the derived system to the grounding electrode in accordance with 250.30(A)(4), or as permitted in 250.68(C)(1) and (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.

Statement of Problem and Substantiation for Public Comment

Editorial correction to put space between the terms "bus" and "if".

Related Item
First Revision No. 1214-NFPA 70-2015 [Section No. 250.30(A)(5)]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:30:43 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1205-NFPA 70-2015
Statement: This revision is an editorial correction to put space between the terms "bus" and "if in Exception No. 1.
(5) Grounding Electrode Conductor, Single Separately Derived System.

A grounding electrode conductor for a single separately derived system shall be sized in accordance with 250.66 for the derived ungrounded conductors. It shall be used to connect the grounded conductor of the derived system to the grounding electrode in accordance with 250.30(A)(4), or as permitted in 250.68(C)(1) and (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.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that the panel give further consideration to the comments expressed in voting on FR 1214

Related Item
First Revision No. 1214-NFPA 70-2015 [Section No. 250.30(A)(5)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:21:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1205-NFPA 70-2015
Statement: This revision is an editorial correction to put space between the terms "bus" and "if" in Exception No. 1.
(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)(2) or is connected to the metal structural frame of the building or structure that complies with 250.68(C)(2) or connected or the metal structural frame of the building or structure that complies with 250.68(C)(2) or connected to the grounding electrode system by a conductor that shall not be smaller than 3/0 AWG copper or 250 kcmil aluminum

(d) 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.

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

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

(7) 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).

(8) 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 Comment

Due to transcription errors in the draft the text is revised to reflect CMP-5 action as reflected in the ballot comment by Charles Mello.

Related Item

First Revision No. 1218-NFPA 70-2015 [Section No. 250.30(A)(6)]
### Submitter Information Verification

**Submitter Full Name:** Charles Mello  
**Organization:** UL LLC  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Fri Sep 25 14:35:20 EDT 2015

### Committee Statement

<table>
<thead>
<tr>
<th>Committee Action</th>
<th>Resolution</th>
<th>Statement</th>
</tr>
</thead>
</table>
| Rejected but see related SR | SR-1206-NFPA 70-2015 | The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.  
The work “also” was added in 250.30(A)(6)(c)(2) for clarity.  
The words “thick” and “wide” were added to the busbar description for consistency. |
(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:

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

(2) A metal water pipe that complies with 250.68(C)(2) or is connected to the grounding electrode system by a conductor that shall not be smaller than 3/0 AWG copper or 250 kcmil aluminum

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

Exception: If the source of a separately derived system is located within equipment listed and identified as suitable for use as service equipment, the grounding electrode conductor from the service or feeder equipment to the grounding electrode shall be permitted as the grounding electrode conductor for the separately derived system, if the grounding electrode conductor is of sufficient size for the separately derived system. If the equipment grounding bus internal to the equipment is not smaller than the required grounding electrode conductor for the separately derived system, the grounding electrode connection for the separately derived system shall be permitted to be made to the bus.

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

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

(2) Listed connections to aluminum or copper busbars not smaller than 6 mm × 50 mm (¼ in. × 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 comply with 250.64(A).

(3) The exothermic welding process.

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

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1218.

Related Item

First Revision No. 1218-NFPA 70-2015 [Section No. 250.30(A)(6)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
<table>
<thead>
<tr>
<th>Committee Statement</th>
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<tr>
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<td><strong>Statement:</strong></td>
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</table>
(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

A metal

(1) The metal frame of the building or structure, or a continuous metal water pipe that complies with 250.68(C)(2) or is connected to the grounding electrode system by a conductor that shall not be smaller than 3/0 AWG copper or 250 kcmil aluminum

(c) 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.

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

(5) A connector listed as grounding and bonding equipment

(6) Listed connections to aluminum or copper busbars not smaller than 6 mm × 50 mm (1/4 in. × 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 comply with 250.64(A).

(7) 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 Comment

This is a revision to 250.30 (A) (6) (a) (2) to add back the metal from of the building or structure and to assure the metal water pipe is continuous. As it appears from the Committee Statement that metal frame of the building was not intended to be omitted from this section. In addition, the added words continuous related to the metal water pipe is a requirement that 250.68(C)(2) explains how to accomplish.

Related Item

First Revision No. 1218-NFPA 70-2015 [Section No. 250.30(A)(6)]

Submitter Information Verification
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1206-NFPA 70-2015
Statement: The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.

The work “also” was added in 250.30(A)(6)(c)(2) for clarity.

The words “thick” and “wide” were added to the busbar description for consistency.
(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)(2) or is connected to the grounding electrode system by a conductor that shall not be smaller than 3/0 AWG copper or 250 kcmil aluminum

(d) 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.

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

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

(7) Listed connections to aluminum or copper busbars not smaller than 6 mm × 50 mm (\(\frac{1}{4}\) in. × 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 comply with 250.64(A).

(8) 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 Comment

New rule references 250.68(C)(2), I'm sure this is not the reference the Panel intended, since 68(C)(2) addresses metal structure frame.

Related Item
First Revision No. 1218-NFPA 70-2015 [Section No. 250.30(A)(6)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.

The work “also” was added in 250.30(A)(6)(c)(2) for clarity.

The words “thick” and “wide” were added to the busbar description for consistency.
(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)(2)

2

(1) or is connected to the grounding electrode system by a conductor that shall not be smaller than 3/0 AWG copper or 250 kcmil aluminum

(d) 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.

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

(6) A connector listed as grounding and bonding equipment,

(7) Listed connections to aluminum or copper busbars not smaller than 6 mm × 50 mm (1/4 in. × 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 comply with 250.64(A),

(8) 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 Comment

250.30(A)(6)(a)(2) proposes to permit the common grounding electrode conductor to be a metal water pipe that complies with 250.68(C)(2). This referenced section [250.68(C)(2)] describes the proper connection of a grounding electrode conductor or bonding jumper to a metal structural frame of a building (not a connection to a metal water pipe). In the 2014 NEC, 250.30(A)(6)(a)(2) did reference the metal frame of a building and compliance to 250.52(A)(2). However, this was proposed to be changed to a metal water pipe with FR 1218. May I suggest that the correct reference in this text be changed to 250.68(C)(1) rather than 250.68(C)(2).
250.68(C)(1) is more appropriate for the proposed text and references connection to a metal water pipe.

**Related Item**

First Revision No. 1218-NFPA 70-2015 [Section No. 250.30(A)(6)]

**Submitter Information Verification**

- **Submitter Full Name:** L. Keith Lofland
- **Organization:** International Association of Electrical Inspectors (IAEI)
- **Affiliation:** None
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Fri Sep 18 15:06:36 EDT 2015

**Committee Statement**

- **Committee Action:** Rejected but see related SR
- **Resolution:** SR-1206-NFPA 70-2015
- **Statement:**
  The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.

  The work “also” was added in 250.30(A)(6)(c)(2) for clarity.

  The words “thick” and “wide” were added to the busbar description for consistency.
Public Comment No. 741-NFPA 70-2015 [ Section No. 250.35(B) ]

(B) Nonseparately Derived System.

1. When a 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.

2. A non-separately derived generator shall not supply more than one transfer switch (TS) under the following conditions:

   1. One TS supplying a Service disconnect and one TS supplying feeder conductors that are supplied from other service entrance conductors.
   2. Two or more feeders supplied from different sets of service entrance conductors, with a TS supplying each feeder.
   3. Two or more feeders that are each individually supplied from two different separately derived sources, with a TS supplying each feeder.

Additional Proposed Changes

<table>
<thead>
<tr>
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<th>Description</th>
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<td>Parallel path</td>
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<td>img045.jpg</td>
<td>Ground to neutral connection</td>
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<td>img046.jpg</td>
<td>neutral hazard and overload</td>
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<td>img047.jpg</td>
<td>Kirchhoff's Law</td>
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Statement of Problem and Substantiation for Public Comment

This was originally submitted in 702.10 (PI 2813) However I believe the panel did not understand the parallel path and objective current issues, and assume the performance base directive in 250.6 would be a sufficient deterrent. Please review this issue to see if has merit to be included as a requirement. I have attached four illustrations.

250.35 (B) speaks to when not if

250.35 (B) (2) A non-separately derived generator supplying any downstream feeder panels supplied from different main service disconnects will see the neutral to ground connection (main bonding connection) from the main service disconnect of the other main service disconnect creating a parallel path and a violation of 250.6, even folks that understand section 250.6 do not realize the other service main bonding jumper creates a neutral to ground connection downstream in a feeder panel when supplied from a non-separately derived generator connection. Section 250.24 (A) (5) address the load side of a main service disconnect neutral to bond connection. This is not a load side connection but one from another main service panel. Connecting the generator non-separately derived will create a parallel path and if one of the panels lost a neutral the other service neutral would be overloaded. Another hazard would occur when working on one panels circuit neutrals when a potential from the other panels branch circuit is energized.

This section will NOT preclude more than two main services panels supplied from a common service from being supplied by a non-separately derived generator. This new section will make it clear this type of installation is not permitted.

see Kirchhoff's first Law.

Thank you for this consideration.

Related Item

Public Input No. 2813-NFPA 70-2014 [New Section after 702.10]
Public Input No. 2159-NFPA 70-2014 [Section No. 250.35(B)]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 18 16:04:04 EDT 2015
<table>
<thead>
<tr>
<th>Committee Statement</th>
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<tr>
<td><strong>Committee Action:</strong> Rejected</td>
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<tr>
<td><strong>Resolution:</strong> The provisions in 250.6 are adequate to address objectionable current.</td>
</tr>
</tbody>
</table>
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 2000 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).

Statement of Problem and Substantiation for Public Comment

The voltage level should remain at 1000 volts. Making the change to 2000 volts may allow additional items to comply with low voltage requirements without substantiation and may create safety issues. Although the change in voltage does not directly impact the grounding requirements in Article 250, it creates inconsistency with other Articles throughout the code, as other CMP's did not accept these Public Inputs.

Related Public Comments for This Document

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<tr>
<td>Public Comment No. 404-NFPA 70-2015 [Section No. 250.24(C) [Excluding any Sub-Sections]</td>
<td></td>
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<tr>
<td>Public Comment No. 408-NFPA 70-2015 [Section No. 280.1]</td>
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<tr>
<td>First Revision No. 1233-NFPA 70-2015 [Section No. 250.36 [Excluding any Sub-Sections]]</td>
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<td>First Revision No. 1232-NFPA 70-2015 [Section No. 250.24(C) [Excluding any Sub-Sections]]</td>
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<tr>
<td>First Revision No. 1244-NFPA 70-2015 [Section No. 280.1]</td>
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Submitter Information Verification

Submitter Full Name: MIKE OMEARA
Organization: Edison Electric Institute
Affiliation: EEI Electric Light & Power NEC Task Force
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 13 13:51:38 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-1207-NFPA 70-2015
Statement: The voltage level is reverted to 1000 volts, because voltages above 1000 volts are already covered in 250.187.
(1) Metal Underground Water Pipe.

A. If the power source feeding the building or structure is a dedicated source only to that building or structure, 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 Comment

Some neighborhoods have metal water pipes throughout. Many of these homes have transformers feeding more than one home. When more than one structure is served by these transformers and each building bonds their first means of disconnect and then the grounding electrodes utilized are the water pipes, the neutral current imbalance can follow the water pipes into the other structures back to the neutral of the source. This would be a violation of article 250.6. This practice causes objectionable current on the grounding systems and should be only used when the transformers are dedicated for one structure.

Related Item
Public Input No. 2173-NFPA 70-2014 [Section No. 250.6]

Submitter Information Verification
Submitter Full Name: James Lyon
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 22:44:41 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The submitter’s reference to PI 2173 is misleading. That PI wished to exchange the terms “equipment grounding conductors” for “equipment bonding conductor”. The submitter has not provided documentation of a problem with this commonly provided metal water pipe distribution scheme which includes countless installations for decades.
Public Comment No. 212-NFPA 70-2015 [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 (\(\frac{1}{2}\) 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 1: 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.

Informational Note 2: Copper, the metal usually used for grounding, is a noble metal and can have serious corrosive effects on underground structures made of iron or steel that are electrically connected to the copper.

Statement of Problem and Substantiation for Public Comment

PI No. 1412 Addressed this proposal and was rejected. I'm proposing it again for reconsideration. The Committee statement is not entirely correct. IEEE 144-2007 does indeed state: “It should be noted that steel rebar, when encased in concrete, has approximately the same potential as copper and thus will not corrode.” This is a true statement only when the steel rebar and the copper are not connected together to form a corrosion cell. If the concrete encased steel rebar is used solely as the grounding electrode and doesn't have an electrical connection to copper, other than through the earth, then it will be perfectly fine. There will be very little to no corrosion.

The problem arises when one connects large amounts of copper to large amounts of concrete encased steel. In these situations, the steel rebar becomes an anode and will sacrifice itself to the copper. Instead of relying on one sentence in IEEE 144 that is seemingly being taken out of context, please consider basic chemical principles and add this note to alert users and inspectors of the potential corrosion problem. Most users and inspection authorities are unaware of this issue since it's not an electrical safety issue. Even though this isn't an electrical safety issue if foundation rebar or structural steel corrodes there could be a structural safety issue.

Related Item

Public Input No. 1412-NFPA 70-2014 [New Section after 250.52(A)(3)]

Submitter Information Verification

Submitter Full Name: PAUL GUIDRY
Organization: FLUOR ENTERPRISES INC
Affiliation: Associated Builders and Contractors, Inc.
Street Address:
City: 
State: 
Zip: 
Submittal Date: Mon Jul 13 13:46:02 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: No new information has been provided on this subject. The Panel statement as provided for Public Input 1412 is applicable. The submitter has not provided documentation indicating that use of concrete-encased steel in accordance with the provisions of section 250.52(A)(3) will cause significant deterioration of the structural reinforcing steel. As stated in the resolve of PI 1412, which references IEEE 144 - 2007 4.4.5, pg. 181, “It should be noted that steel rebar, when encased in concrete, has approximately the same potential as copper and thus will not corrode.”
Other Local Metal Underground Systems or Structures.

Other local metal underground systems or structures such as piping systems, underground tanks, and underground metal well casings that are not bonded to a metal water pipe. The structures and structural reinforcing steel described at 680.26(B)(1) and (B)(2) shall not be considered as a grounding electrode described by this section.
Public Comment No. 1738-NFPA 70-2015 [Section No. 250.52(A)(8)]

(8) Other Local Metal Underground Systems or Structures.

Other local metal underground systems or structures such as piping systems, underground tanks, and underground metal well casings that are not bonded to a metal water pipe. The structures and structural reinforcing steel described at 680.26(B)(1) and (B)(2) shall not be considered as a grounding electrode described by this section.

Statement of Problem and Substantiation for Public Comment

Delete the last sentence added during the first revision. The language in 680.26(B) refers to "remote" panelboards, service equipment or electrodes and does not apply to all situations.

Related Item
First Revision No. 1220-NFPA 70-2015 [Section No. 250.52(A)(8)]

Submitter Information Verification

Submitter Full Name: Paul Dobrowsky
Organization: Innovative Technology Services
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 11:17:42 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1208-NFPA 70-2015
Statement: The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.
Other Local Metal Underground Systems or Structures.

Other local metal underground systems or structures such as piping systems, underground tanks, and underground metal well casings that are not bonded to a metal water pipe. The structures and structural reinforcing steel described at 680.26(B)(1) and (B)(2) shall not be considered as a grounding electrode described by this section.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1220.

Related Item

First Revision No. 1220-NFPA 70-2015 [Section No. 250.52(A)(8)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:23:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1208-NFPA 70-2015
Statement: The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.
Public Comment No. 1587-NFPA 70-2015 [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 at 680.26(B)(1) and (B)(2)

Informational Note: See 250.104(B) for bonding requirements of gas piping.

Statement of Problem and Substantiation for Public Comment

Due to transcription errors this text was incorrectly placed in 250.52(A)(8) and this comment reflects the panel action. See ballot comment from Charles Mello

Related Item
First Revision No. 1220-NFPA 70-2015 [Section No. 250.52(A)(8)]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:47:31 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1209-NFPA 70-2015
Statement: The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.
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.

Additional Proposed Changes

File Name Description Approved
2017_NECChangeProposal.pdf

Statement of Problem and Substantiation for Public Comment

As a Master electrician for over 30 years, I have witnessed and dealt with the effects of poor grounding. A large part of this stems from the connection point of the GEC to the Grounding Electrode. Section 110.14 of the NEC Handbook describes this issue, yet does not address it completely. Dissimilar metal connections are used frequently in the electrical industry. Copper to galvanized ground rods, copper to steel rebar, aluminum to copper ground rods.

Even with "listed" connectors the industry does not address the facts that to dissimilar metals create a battery of such to sacrifices the anode to the cathode.
(see attached article)

This is creating a loose and unstable connection point that can lead to a great hazard to both life and property.

The industry also has been led to believe by the creators of exothermic welding that their connections are 100% free from galvanic corrosion. This is proving not to be the case, thus companies such as Century Link, civil engineering firms in St. Louis, Mo and US Dept. of the Interior – Mining and others are requiring a sealant over their exothermic welding connections which are then either buried deep beneath the soil or in concrete. Many companies such as Enbridge and Monsanto require annual inspections of these connections to check that the connection is still sound.

Since the grounding system is dormant a large part of it's life we as electricians tend to over look it till it's too late. Once the grounding system is needed do to a fault or lightning strike occurs we want to have the peace of mind knowing our grounding system is working properly.

Studies show that nearly 86% of all electrical problems stem from poor grounding. While proper installation of grounding equipment is closely regulated, post installation inspection has been largely overlooked. Recent growth spurt in the electrical industry have been bringing attention to these issues, with safety being the utmost concern.

All electrical systems rely on a good ground connection to ensure safe and reliable operation. Making sure there is minimal resistance at the grounding point ensures that any potential hazards are avoided.

The safest and simplest way to achieve these goals are by encapsulating the connection point. As read in the attached paper “Galvanic Corrosion in the Electrical Industry” put together by John Langholtz EE/PE graduate of South Dakota State University.

Related Public Comments for This Document

Related Comment Relationship
Public Comment No. 1532-NFPA 70-2015 [Section No. 250.53(G)]

Related Item
Public Input No. 4181-NFPA 70-2014 [Section No. 250.10]

Submitter Information Verification

Submitter Full Name: dan tharp
Organization: Big D Electric
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:37:57 EDT 2015
Committee Statement

Committee Action: Rejected

Resolution: The proposed change does not add clarity. Connectors listed for Grounding and Bonding under UL 467 have been tested for corrosion protection. Additional physical protection for every installation is not warranted.
(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 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 shall be protected against physical damage as specified in 250.10.

Additional Proposed Changes

File Name Description Approved
2017_NEC_Change_Proposal.pdf

Statement of Problem and Substantiation for Public Comment

As a Master electrician for over 30 years, I have witnessed and dealt with the effects of poor grounding. A large part of this stems from the connection point of the GEC to the Grounding Electrode. Section 110.14 of the NEC Handbook describes this issue, yet does not address it completely. Dissimilar metal connections are used frequently in the electrical industry. Copper to galvanized ground rods, copper to steel rebar, aluminum to copper ground rods. Even with "listed" connectors the industry does not address the facts that to dissimilar metals create a battery of such to sacrifices the anode to the cathode.

(see attached article)

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The industry also has been led to believe by the creators of exothermic welding that their connections are 100% free from galvanic corrosion. This is proving not to be the case, thus companies such as Enbridge and Monsanto require annual inspections of these connections to check that the connection is still sound.

Since the grounding system is dormant a large part of it’s life we as electricians tend to over look it till it’s too late. Once the grounding system is needed do to a fault or lightning strike occurs we want to have the peace of mind knowing our grounding system is working properly.

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All electrical systems rely on a good ground connection to ensure safe and reliable operation. Making sure there is minimal resistance at the grounding point ensures that any potential hazards are avoided.

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Related Public Comments for This Document

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Submitter Information Verification

Submitter Full Name: dan tharp
Organization: Big D Electric
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:49:10 EDT 2015
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**Public Comment No. 1541-NFPA 70-2015 [ 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. Where two or more buildings or structures with individual services are present on the same premise and have common electrical or communications systems, the grounding electrodes serving the buildings or structures shall be bonded together.

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

**Statement of Problem and Substantiation for Public Comment**

In PI 1465, the submitter requested that the grounding electrodes of multiple buildings on the same property be bonded together. The panel responded that the submitter did not provide adequate substantiation to require all cases of multiple buildings or structures on one property to have the grounding electrodes of the buildings connected together. In the submitter's example, the separate buildings each had a service, but shared common lighting, fire alarm and communications systems. In this specific case, it would be prudent to bond the grounding electrodes together.

**Related Item**

Public Input No. 1465-NFPA 70-2014 [Section No. 250.58]

**Submitter Information Verification**

Submitter Full Name: Christel Hunter  
Organization: General Cable

**Committee Statement**

Committee Action: Rejected

Resolution: Adding this as a requirement could create a path for objectionable current. Adequate substantiation has not been provided to require all buildings and structures to have their grounding electrode systems connected together. The buildings or structures described in the proposed language could be a considerable distance apart.
Public Comment No. 1772-NFPA 70-2015 [Section No. 250.60]

250.60 Use of Strike Termination Devices.
Conductors and driven pipes, rods, or plate electrodes used for grounding strike termination devices shall not be used in lieu of the grounding electrodes required by 250.50 for grounding wiring systems and equipment. This provision shall not prohibit the required bonding together of grounding electrodes of different systems.

Informational Note No. 1: See 250.106 for spacing from lightning protection system components. See 800.100(D), 810.21(J), and 820.100(D) for bonding of electrodes.

Informational Note No. 2: Bonding together of all separate grounding electrodes will limit voltage differences between them and between their associated wiring systems.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 7510.

Related Item
First Revision No. 7510-NFPA 70-2015 [Section No. 250.60]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:24:28 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Panel 5 has reviewed the voting comments to FR 7510 and has determined that they are not applicable.
250.60 Use of Strike Termination Devices.

Conductors and driven pipes, rods, or plate electrodes used for grounding strike termination devices shall not be used in lieu of the grounding electrodes required by 250.50 for grounding wiring systems and equipment. This provision shall not prohibit the required bonding together of grounding electrodes of different systems.

Informational Note No. 1: See 250.106 for spacing from the bonding requirement of the lightning protection system components. See 800.100(D) - 810.21(J) and 820.100(D) for bonding of electrodes, electrode to the building or structure grounding electrode system.

Informational Note No. 2: Bonding together of all separate grounding electrodes will limit voltage differences between them and between their associated wiring systems.

Statement of Problem and Substantiation for Public Comment

Note No. 1 was always wrong, 250.106 has nothing to do with spacing of lighting protection systems, it has to do with bonding of LPS electrode to the building/structure electrode. Also deleting the references to Chapter 8 rules removes references that have nothing to do the LPS electrodes, that is covered in 250.106.

Related Item
First Revision No. 7510-NFPA 70-2015 [Section No. 250.60]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 16:24:35 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1211-NFPA 70-2015
Statement: Informational Note 1 has been corrected to address proper correlation with the lightning protection system.
Public Comment No. 1538-NFPA 70-2015 [Section No. 250.62]

250.62  Grounding Electrode Conductor Material.

The grounding electrode conductor shall be of copper, aluminum, copper-clad aluminum, or the items as permitted in 250.68(C). The material selected shall be resistant to any corrosive condition existing at the installation or installation and shall be protected against corrosion. Conductors of the wire type shall be solid or stranded, insulated, covered, or bare.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

As a Master electrician for over 30 years, I have witnessed and dealt with the effects of poor grounding. A large part of this stems from the connection point of the GEC to the Grounding Electrode. Section 110.14 of the NEC Handbook describes this issue, yet does not address it completely. Dissimilar metal connections are used frequently in the electrical industry, copper to galvanized ground rods, copper to steel rebar, aluminum to copper ground rods.

Even with “listed” connectors the industry does not address the facts that to dissimilar metals create a battery of such to sacrifices the anode to the cathode.

(see attached article)

This is creating a loose and unstable connection point that can lead to a great hazard to both life and property.

The industry also has been led to believe by the creators of exothermic welding that their connections are 100% free from galvanic corrosion. This is proving not to be the case, thus companies such as Century Link, civil engineering firms in St. Louis, Mo and US Dept. of the Interior – Mining and others are requiring a sealant over their exothermic welding connections which are then either buried deep beneath the soil or in concrete. Many companies such as Enbridge and Monsanto require annual inspections of these connections to check that the connection is still sound.

Since the grounding system is dormant a large part of its life we as electricians tend to over look it till it’s too late. Once the grounding system is needed do to a fault or lightning strike occurs we want to have the peace of mind knowing our grounding system is working properly.

Studies show that nearly 86% of all electrical problems stem from poor grounding. While proper installation of grounding equipment is closely regulated, post installation inspection has been largely overlooked. Recent growth spurts in the electrical industry have been bringing attention to these issues, with safety being the utmost concern.

All electrical systems rely on a good ground connection to ensure safe and reliable operation. Making sure there is minimal resistance at the grounding point ensures that any potential hazards are avoided.

The safest and simplest way to achieve these goals are by encapsulating the connection point. As read in the attached paper “Galvanic Corrosion in the Electrical Industry” put together by John Langholtz EE/PE graduate of South Dakota State University.

Related Item

Public Input No. 4189-NFPA 70-2014 [Section No. 250.62]
Public Input No. 4181-NFPA 70-2014 [Section No. 250.10]

Submitter Information Verification

Submitter Full Name: dan tharp
Organization: Big D Eletric
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:54:20 EDT 2015

Committee Statement

Committee Action: Rejected
| Resolution: | If the grounding electrode conductor is corrosion resistant for the environment, additional corrosion protection is not necessary. |
(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. Where installed outside of a building or enclosure, aluminum or copper-clad aluminum grounding electrode conductors shall not be terminated within 450 mm (18 in.) of the earth unless the termination method is listed as a sealed wire-connector system. 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 Comment
The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1222 and FR 1223.

Related Item
First Revision No. 1222-NFPA 70-2015 [Section No. 250.64(A)]
First Revision No. 1223-NFPA 70-2015 [Section No. 250.64(B)]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:25:46 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1213-NFPA 70-2015
Statement: Type -XW was added to RTRC, and the raceways types for protection of smaller than 6 AWG conductors was added to correct transcription errors.
Public Comment No. 677-NFPA 70-2015 [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. Where installed outside of a building or enclosure, aluminum or copper-clad aluminum grounding electrode conductors shall not be terminated within 450 mm (18 in.) of the earth, unless the termination method is listed as a sealed wire-connector system. Terminations made within listed enclosures suitable for outdoor use shall be permitted within 450 mm (18 in.) of the earth. The term "suitable" is not a recognized term, and not defined.

Additional Proposed Changes

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</table>

Statement of Problem and Substantiation for Public Comment

There is no reason to approve the change to the language of the 2014 NEC. The device is not listed for exterior exposure and would present a safety issue if corrosion of an aluminum conductor occurred, as is likely within 18 inches of the earth. The term "suitable" is not a recognized term and is not defined.

Related Item

First Revision No. 1222-NFPA 70-2015 [Section No. 250.64(A)]

Submitter Information Verification

Submitter Full Name: David Brender
Organization: Copper Development Association
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Sep 16 16:37:44 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed last sentence is unclear, unenforceable, and does not contain mandatory language.
Public Comment No. 789-NFPA 70-2015 [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. Where installed outside of a building or enclosure, aluminum or copper-clad aluminum grounding electrode conductors shall not be terminated within 450 mm (18 in.) of the earth, unless the termination method is listed as a sealed wire-connector system. 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 Comment

Listed sealed wire-connector systems have not been evaluated for sealing of bare or uninsulated conductors. The following information is from the UL White Book in ZMWQ:

This category covers sealed wire-connector systems intended for wet or damp locations and other installations, such as direct burial, below grade, or above grade where protected from direct exposure to sunlight. These systems may also be used indoors or in dry locations.

Sealed wire-connector systems are intended for use in installations covered by ANSI/NFPA 70, "National Electrical Code."

Sealed wire-connector systems have not been investigated for direct exposure to sunlight. Additional performance considerations to show equivalency to the connected conductors should be considered for UV exposure.

Sealed wire-connector systems have not been investigated for direct exposure to salt or seawater.

This category covers a complete system or insulating caps, covers, resins, tubing and tapes that are part of the system for use with specific wire connectors where the seal is made at the conductor. Pressure wire connectors may or may not be provided with the system.

In addition, the phrase in the last sentence relative to the use of the term "suitable" is inappropriate and not defined in the NEC. This substantiates the deletion of the last sentence.

Related Item

First Revision No. 1222-NFPA 70-2015 [Section No. 250.64(A)]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 16:59:24 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1212-NFPA 70-2015
Statement: This subdivision was revised into a list format to improve usability. The word "covered" was added to be consistent with other sections of the NEC. The phrase "or where subject to corrosive conditions" was added to list item 1 to correct a transcription error. List item 3 was revised to replace "suitable" with "identified" as it is a defined term. The phrase "listed as grounding and bonding equipment" was added to ensure the connectors are evaluated for fault current and to allow a product to be made available.
Public Comment No. 1592-NFPA 70-2015 [Section No. 250.64(B)]

| (B) | Securing and Protection Against Physical Damage.  
Where exposed, a grounding electrode conductor or its enclosure shall be securely fastened to the surface on which it is carried. Grounding electrode conductors shall be permitted to be installed on or through framing members. 300.5. |
|---|---|
| (1) | Not Exposed to Physical Damage.  
A 6 AWG or larger copper or aluminum grounding electrode conductor not exposed to physical damage shall be permitted to be run along the surface of the building construction without metal covering or protection. |
| (2) | Exposed to Physical Damage.  
A 6 AWG or larger copper 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 (PVC) XW-type, reinforced thermosetting resin conduit (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, PVC XW-type, RTRC-XW, EMT, or cable armor. |
| (4) | In Contact with the Earth.  
Grounding electrode conductors and grounding electrode bonding jumpers in contact with the earth shall not be required to comply with 300.5, but shall be buried or otherwise protected if subject to physical damage. |

Statement of Problem and Substantiation for Public Comment

Due to transcription errors the Draft test was not reflected from the Panel actions. See ballot comment from Charles Mello. In list item 3, the "XW-type" was added to be consistent with the requirements in list item 2.

Related Item
First Revision No. 1223-NFPA 70-2015 [Section No. 250.64(B)]

Submitter Information Verification

Submitter Full Name: Charles Mello  
Organization: UL LLC  
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 14:57:21 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR  
Resolution: SR-1213-NFPA 70-2015  
Statement: Type -XW was added to RTRC, and the raceway types for protection of smaller than 6 AWG conductors was added to correct transcription errors.
Public Comment No. 335-NFPA 70-2015 [Section No. 250.64(B)(3)]

(3) Smaller Than 6 AWG.

Grounding electrode conductors smaller than 6 AWG shall be protected.

Statement of Problem and Substantiation for Public Comment

You either have to eliminate the word "in" or tell us what the GEC smaller than #6 needs to be protected in.

Related Item

First Revision No. 1223-NFPA 70-2015 [Section No. 250.64(B)]

Submitter Information Verification

Submitter Full Name: DON GANIERE
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 31 19:40:34 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1213-NFPA 70-2015
Statement: Type -XW was added to RTRC, and the raceways types for protection of smaller than 6 AWG conductors was added to correct transcription errors.
(1) General.
Ferrous metal raceways and enclosures 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 and enclosures 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 and enclosures shall not be required to be electrically continuous.

Statement of Problem and Substantiation for Public Comment

I think adding the word 'electrically' would be a good idea...

Related Item
First Revision No. 1225-NFPA 70-2015 [Section No. 250.64(E)(1)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 16:33:13 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1214-NFPA 70-2015
Statement: The words "an electrically" were added to be consistent with how that phrase is typically used to improve clarity.
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 250.66, except as permitted in 250.66(A) through (C).

Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

<table>
<thead>
<tr>
<th>Size of Largest Ungrounded Service-Entrance Conductor or Equivalent Area for Parallel Conductors</th>
<th>Copper</th>
<th>Aluminum or Copper-Clad Aluminum</th>
<th>Copper</th>
<th>Aluminum or Copper-Clad Aluminum</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 or smaller</td>
<td>1/0 or smaller</td>
<td>8</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1 or 1/0</td>
<td>2/0 or 3/0</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2/0 or 3/0</td>
<td>4/0 or 250</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Over 3/0 through 350</td>
<td>Over 250 through 500</td>
<td>2</td>
<td>1/0</td>
<td></td>
</tr>
<tr>
<td>Over 350 through 600</td>
<td>Over 500 through 900</td>
<td>1/0</td>
<td>3/0</td>
<td></td>
</tr>
<tr>
<td>Over 600 through 1100</td>
<td>Over 900 through 1750</td>
<td>2/0</td>
<td>4/0</td>
<td></td>
</tr>
<tr>
<td>Over 1100</td>
<td>Over 1750</td>
<td>3/0</td>
<td>250</td>
<td></td>
</tr>
</tbody>
</table>

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.

aThis table also applies to the derived conductors of separately derived ac systems.

bSee installation restrictions in 250.64(A).

(A) Connections to a Rod, Pipe, or Plate Electrode(s).

Where the grounding electrode conductor or bonding jumper connected to a single or multiple rod, pipe, or plate electrode(s), or any combination thereof, as permitted in 250.52(A)(5) or (A)(7), does not extend on to other types of electrodes, 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.

Where the grounding electrode conductor or bonding jumper connected to a single or multiple concrete-encased electrode(s), as permitted in 250.52(A)(3), 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 4 AWG copper wire.

(C) Connections to Ground Rings.

Where the grounding electrode conductor or bonding jumper connected to a ground ring, as permitted in 250.52(A)(4), 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 the conductor used for the ground ring.

Statement of Problem and Substantiation for Public Comment

Due to transcription errors the Draft text did not reflect the panel action. See ballot comments of Charles Mello.

Related Item
First Revision No. 1227-NFPA 70-2015 [Sections 250.66(A), 250.66(B), 250.66(C)]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address: City: State:
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected but see related SR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>SR-1215-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement:</td>
<td>The phrase &quot;or bonding jumper&quot; was added to each subdivision to correct a transcription error in the first draft. The phrase &quot;that require a larger size conductor&quot; was added to (A) to be consistent with the other subdivisions. The term &quot;permitted&quot; was changed to &quot;described&quot; for accuracy.</td>
</tr>
</tbody>
</table>
**Public Comment No. 1774-NFPA 70-2015 [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 250.66, except as permitted in 250.66(A) through (C).

Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

<table>
<thead>
<tr>
<th>Size of Largest Ungrounded Service-Entrance Conductor or Equivalent Area for Parallel Conductors&lt;sup&gt;a&lt;/sup&gt; (AWG/kcmil)</th>
<th>Size of Grounding Electrode Conductor (AWG/kcmil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>Aluminum or Copper-Clad Aluminum</td>
</tr>
<tr>
<td>2 or smaller</td>
<td>1/0 or smaller</td>
</tr>
<tr>
<td>1 or 1/0</td>
<td>2/0 or 3/0</td>
</tr>
<tr>
<td>2/0 or 3/0</td>
<td>4/0 or 250</td>
</tr>
<tr>
<td>Over 3/0 through 350</td>
<td>Over 250 through 500</td>
</tr>
<tr>
<td>Over 350 through 600</td>
<td>Over 500 through 900</td>
</tr>
<tr>
<td>Over 600 through 1100</td>
<td>Over 900 through 1750</td>
</tr>
<tr>
<td>Over 1100</td>
<td>Over 1750</td>
</tr>
</tbody>
</table>

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.

<sup>a</sup>This table also applies to the derived conductors of separately derived ac systems.

<sup>b</sup>See installation restrictions in 250.64(A).

(A) Connections to a Rod, Pipe, or Plate Electrode(s).

Where the grounding electrode conductor connected to a single or multiple rod, pipe, or plate electrode(s), or any combination thereof, as permitted in 250.52(A)(5) or (A)(7), does not extend on to other types of electrodes, 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.

Where the grounding electrode conductor connected to a single or multiple concrete-encased electrode(s), as permitted 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.

Where the grounding electrode conductor connected to a ground ring, as permitted 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.

**Statement of Problem and Substantiation for Public Comment**

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1227.

**Related Item**

First Revision No. 1227-NFPA 70-2015 [Sections 250.66(A), 250.66(B), 250.66(C)]

**Submitter Information Verification**

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
<table>
<thead>
<tr>
<th>Zip:</th>
<th>Submittal Date: Mon Sep 28 15:30:11 EDT 2015</th>
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</thead>
<tbody>
<tr>
<td>Committee Statement</td>
<td></td>
</tr>
<tr>
<td><strong>Committee Action:</strong></td>
<td>Rejected but see related SR</td>
</tr>
<tr>
<td><strong>Resolution:</strong></td>
<td><strong>SR-1215-NFPA 70-2015</strong></td>
</tr>
<tr>
<td><strong>Statement:</strong></td>
<td>The phrase &quot;or bonding jumper&quot; was added to each subdivision to correct a transcription error in the first draft. The phrase &quot;that require a larger size conductor&quot; was added to (A) to be consistent with the other subdivisions. The term &quot;permitted&quot; was changed to &quot;described&quot; for accuracy.</td>
</tr>
</tbody>
</table>
Public Comment No. 489-NFPA 70-2015 [Sections 250.66(A), 250.66(B), 250.66(C)]

Sections 250.66(A), 250.66(B), 250.66(C)

(A) Connections to a Rod, Pipe, or Plate Electrode(s).
Where if the grounding electrode conductor connected to a single or multiple rod, pipe, or plate electrode(s) — or any combination thereof — as permitted in 250.52(A)(5) or (A)(7) — does not extend on to other types of electrodes that require a larger size of conductor then 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.
Where if the grounding electrode conductor connected to a single or multiple concrete-encased electrode(s) — as permitted in 250.52(A)(3) — does not extend on to other types of electrodes that require a larger size of conductor then the grounding electrode conductor shall not be required to be larger than 4 AWG copper wire.

(C) Connections to Ground Rings.
Where if the grounding electrode conductor connected to a ground ring — as permitted in 250.52(A)(4) — does not extend on to other types of electrodes that require a larger size of conductor then the grounding electrode conductor shall not be required to be larger than the conductor used for the ground ring.

Statement of Problem and Substantiation for Public Comment

The term "that require a larger size of conductor" was included in B and C but not A. There is no indication in the proposal or the CMP statement that would lead to the conclusion that this term was not supposed to be in all 3 sections and was just inadvertently left off of A.

Removed a number of commas and changed "Where" to "If" to make the sentences a little more readable.

Related Item
First Revision No. 1227-NFPA 70-2015 [Sections 250.66(A), 250.66(B), 250.66(C)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip:
Submittal Date: Tue Sep 01 17:57:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1215-NFPA 70-2015
Statement: The phrase "or bonding jumper" was added to each subdivision to correct a transcription error in the first draft. The phrase "that require a larger size conductor" was added to (A) to be consistent with the other subdivisions. The term "permitted" was changed to "described" for accuracy.
(C) Grounding Electrode 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 Connection to interior metal water piping shall be located not more than 1.52 m (5 ft) from the point of entrance to the building.
   
   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 the grounding electrode conductor. The rebar extension shall not be exposed to contact with the earth without corrosion protection.

Statement of Problem and Substantiation for Public Comment

Edited text in the Draft was not from the committee action and result was incorrect requirement. Revised text provided to meet editorial requirements and clarify this item.

Related Item
First Revision No. 1228-NFPA 70-2015 [Section No. 250.68(C)]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 15:12:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1216-NFPA 70-2015
Statement:

The word "conductor" was added to the title of 250.68(C) to more accurately reflect the application of the section.

The phrase "that is continuous with a metal underground water pipe electrode and is" was added to 250.68(C)(1) to be clear that the interior water piping connection is only permitted if the piping is continuous to the underground portion.

The phrase "shall be" was deleted to correct a transcription error in the first draft.

The second sentence of 250.68(C)(1) was added to provide clear language to not allow water piping beyond 5 ft from being used as a connection point unless the exception applies.

The term "bonding jumpers" was added to 250.68(C)(3) to be consistent with the title of 250.68.
(C) Grounding Electrode 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 shall be located not more than 1.52 m (5 ft) from the point of entrance to the building. 

*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 the grounding electrode conductor. The rebar extension shall not be exposed to contact with the earth without corrosion protection.

**Statement of Problem and Substantiation for Public Comment**

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1228.

**Related Item**

First Revision No. 1228-NFPA 70-2015 [Section No. 250.68(C)]

**Submitter Information Verification**

**Submitter Full Name:** CC on NEC-AAC  
**Organization:** NFPA  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Mon Sep 28 15:31:00 EDT 2015

**Committee Statement**

**Committee Action:** Rejected but see related SR

**Resolution:** SR-1216-NFPA 70-2015

**Statement:** The word "conductor" was added to the title of 250.68(C) to more accurately reflect the application of the section.

The phrase "that is continuous with a metal underground water pipe electrode and is" was added to 250.68(C)(1) to be clear that the interior water piping connection is only permitted if the piping is continuous to the underground portion.

The phrase "shall be" was deleted to correct a transcription error in the first draft.

The second sentence of 250.68(C)(1) was added to provide clear language to not allow water piping beyond 5 ft from being used as a connection point unless the exception applies.

The term "bonding jumpers" was added to 250.68(C)(3) to be consistent with the title of 250.68.
Public Comment No. 301-NFPA 70-2015 [Section No. 250.68(C)]

(C) Other Than Grounding Electrode 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 shall be continuous with a metal underground water pipe electrode, located not more than 1.52 m (5 ft) from the point of entrance to the building.

   *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 the grounding electrode conductor 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 Comment

The title modification clarifies these connections are "other than" direct to a grounding electrode as permitted under 250.64(F).

Revised text in (1) clarifies the interior metal water piping must be continuous with a qualifying metal underground water pipe electrode.

Revised text in (3) allows connection of bonding jumpers to this location.

Changed "extention" to the proper spelling: "extension".

Related Item
First Revision No. 1228-NFPA 70-2015 [Section No. 250.68(C)]

Submitter Information Verification

Submitter Full Name: JOSEPH HREN
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 27 08:59:29 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1216-NFPA 70-2015
Statement: The word "conductor" was added to the title of 250.68(C) to more accurately reflect the application of the section.

The phrase "that is continuous with a metal underground water pipe electrode and is" was added to 250.68(C)(1) to be clear that the interior water piping connection is only permitted if the piping is continuous to the underground portion.

The phrase "shall be" was deleted to correct a transcription error in the first draft.
The second sentence of 250.68(C)(1) was added to provide clear language to not allow water piping beyond 5 ft from being used as a connection point unless the exception applies.

The term "bonding jumpers" was added to 250.68(C)(3) to be consistent with the title of 250.68.
(C) Grounding Electrode 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 shall be located not more than 1.52 m (5 ft) from the point of entrance to the building. The pipe shall not be used as part of the grounding electrode system or as a conductor used 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 the grounding electrode conductor. The rebar extension shall not be exposed to contact with the earth without corrosion protection.

Statement of Problem and Substantiation for Public Comment

The language in this PI was not adapted correctly from the submitted original proposal in the PI first draft. The current language as shown is confusing and inaccurate. Corrections have been made to clarify the language and the original intent of the submitter. In general, the first 5-feet of a utility water pipe allowed for use as a grounding electrode in 250.52(A)(1), measured from the point where the pipe enters the building, has in previous editions of the code been permitted to be used as a grounding electrode and interconnection point for grounding electrode conductors. Metal piping beyond 5-feet from the entrance to the building must be bonded in compliance with 250.104 but is not allowed to be used as a grounding electrode or an interconnecting point for a grounding electrode conductor. The language currently shown in 250.68(C)(1) (2014 edition) provides permissive language and suggests code users can use metal piping further than 5-feet as a grounding electrode and/or interconnection point for grounding electrode conductors. Proper language of this section needs revision to provide clarity for code users and to ensure proper installation techniques for safe installations. The danger of allowing metal piping further than 5-feet from the point of entry into a building as a grounding electrode or an interconnection point for grounding electrode conductors may be present if sections of the metal water pipe are removed and replace with plastic piping products, thus eliminating the metallic pathway to the earth ground.

Related Item

Public Input No. 2768-NFPA 70-2014 [Section No. 250.68(C)]

Submitter Information Verification

Submitter Full Name: GARY BECKSTRAND
Organization: UTAH ELECTRICAL JATC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 30 08:47:27 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1216-NFPA 70-2015
<table>
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<th><strong>Statement:</strong></th>
<th>The word &quot;conductor&quot; was added to the title of 250.68(C) to more accurately reflect the application of the section.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The phrase &quot;that is continuous with a metal underground water pipe electrode and is&quot; was added to 250.68(C)(1) to be clear that the interior water piping connection is only permitted if the piping is continuous to the underground portion.</td>
</tr>
<tr>
<td></td>
<td>The phrase &quot;shall be&quot; was deleted to correct a transcription error in the first draft.</td>
</tr>
<tr>
<td></td>
<td>The second sentence of 250.68(C)(1) was added to provide clear language to not allow water piping beyond 5 ft from being used as a connection point unless the exception applies.</td>
</tr>
<tr>
<td></td>
<td>The term &quot;bonding jumpers&quot; was added to 250.68(C)(3) to be consistent with the title of 250.68.</td>
</tr>
</tbody>
</table>
250.80  Service Raceways and Enclosures.

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

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

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1206.

Related Item
First Revision No. 1206-NFPA 70-2015 [Section No. 250.80]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:31:44 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1217-NFPA 70-2015
Statement: The phrase "metal components" was added to each subdivision to correct a transcription error in the first draft. Isolated sections of metal conduit that meet the requirements of this section are considered to be metal components.

The exception was converted to a list to improve usability.
250.86  Other Conductor Enclosures and Raceways.
Except as permitted by 250.112(I), metal enclosures and raceways for other than service conductors shall be connected to the equipment grounding conductor.

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

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

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

Exception No. 3: A metal elbow. Metal components shall not be required to be connected to the equipment grounding conductor or supply side bonding jumper where it is installed in a run of nonmetallic raceway and is (s) and are isolated from possible contact by a minimum cover of 450 mm (18 in.) to any part of the elbow or is, metal components or are, encased in not less than 50 mm (2 in.) of concrete.

Statement of Problem and Substantiation for Public Comment

Due to transcription errors the panel change in this section to mirror the same changes in 250.80 were missed. See ballot comments from Charles Mello

Related Item
First Revision No. 1206-NFPA 70-2015 [Section No. 250.80]

Submitter Information Verification
Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:31:25 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1217-NFPA 70-2015
Statement: The phrase "metal components" was added to each subdivision to correct a transcription error in the first draft. Isolated sections of metal conduit that meet the requirements of this section are considered to be metal components.

The exception was converted to a list to improve usability.
250.86 Other Conductor Enclosures and Raceways.

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

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

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

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

Exception No. 3: A metal elbow or sections of metal conduit shall not be required to be connected to the equipment grounding conductor where it is installed in a run of nonmetallic raceway and is isolated from possible contact by a minimum cover of 450 mm (18 in.) to any part of the elbow or conduit or is encased in not less than 50 mm (2 in.) of concrete.

Statement of Problem and Substantiation for Public Comment

I have seen requirements in contract notes on more than one occasion to provide Rigid Metal Conduit (under driveways only) along a street lighting PVC run spanning a block or more. Although I believe that PVC buried more than 18" (in this case 24") would not be a physical protection issue under a driveway, the engineer is requiring short sections of RMC under each driveway. Section 250.86 Exception #3 states "elbows" are not required to be grounded. I would like to see this exception include "short sections of RMC conduit" added. As grounding these sections causes unnecessary additional costs and effective grounding issues.

Related Item

Public Input No. 2165-NFPA 70-2014 [Section No. 250.86]

Submitter Information Verification

Submitter Full Name: Michael Brinster
Organization: Brinster Electric LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 16:38:47 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1217-NFPA 70-2015
Statement: The phrase "metal components" was added to each subdivision to correct a transcription error in the first draft. Isolated sections of metal conduit that meet the requirements of this section are considered to be metal components.

The exception was converted to a list to improve usability.
Public Comment No. 704-NFPA 70-2015 [ Section No. 250.94 ]

**250.94. Bonding for Non-Communication Systems.**

**Communications system bonding.** For non-communications systems (such as gas piping), the bonding terminations shall be connected in accordance with (A) or (B).

(A). The Intersystem Bonding Termination Device.

The following:

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 (% 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 Comment

Substantiation: The rejection of the original PI (3837 and 3838) by CMP-5 was based on the revised definition and limitation of the Intersystem Bonding Termination (IBT) to communication systems only. However, the 2011 NEC acknowledged the possibility of additional bonding requirements for gas piping in an Informational Note located in Section 250.104(B). With the change in 2009 NFPA 54 Code requiring the additional bonding of CSST gas piping systems to the grounding electrode system, an IBT for non-communication systems provides a viable and appropriate connection for this purpose. Over six million existing homes have CSST installed without this additional bonding conductor. The National Association of State Fire Marshals has been actively promoting a public safety 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 an 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. The requirement for extra bonding of CSST systems has been reconfirmed by the NFPA 54 Technical Committee in both the 2012 and 2015 editions. Allowing an additional IBT will not interfere with the functioning of the communications only IBT, and will it improve electrical safety for the gas piping system.

<table>
<thead>
<tr>
<th>Related Item</th>
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<tbody>
<tr>
<td>Public Input No. 3837-NFPA 70-2014 [Section No. 250.94]</td>
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### Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name</th>
<th>ROBERT TORBIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>CUTTING EDGE SOLUTIONS LLC</td>
</tr>
<tr>
<td>Affiliation</td>
<td>Omega Flex, Inc</td>
</tr>
<tr>
<td>Street Address</td>
<td></td>
</tr>
<tr>
<td>City</td>
<td></td>
</tr>
<tr>
<td>State</td>
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<tr>
<td>Submittal Date</td>
<td>Thu Sep 17 18:26:54 EDT 2015</td>
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### Committee Statement

<table>
<thead>
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<tbody>
<tr>
<td>Resolution</td>
<td>The intersystem bonding termination, by definition, is limited to communications conductors. Other listed means are available. This section is not needed as the means for bonding other metal piping is already covered in 250.104(B).</td>
</tr>
</tbody>
</table>
Communications system bonding terminations shall be connected in accordance with (A) or (B).

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1215.

Related Item
First Revision No. 1215-NFPA 70-2015 [Section No. 250.94]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 28 15:33:31 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There are no changes needed, based on the ballot comments.
(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, and listed for the environment in which they are installed.

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 Comment

Since the Code Panel made reference to an Exception, there must be confusion as to what this change would be. Googling these intersystem bonding terminals on the internet one can see just how many are offered. The concern is finding one listed but not for a wet location and having questionable terminals as to that environment. It would seem only a reminder for the wet location listing or identifying, where the entire Code provides for that in many areas already. Is the Code Making Panel suggesting there is no need for this testing as a part of the listing?

And what Exception would this interfere with?

Related Item
Public Input No. 2734-NFPA 70-2014 [Section No. 250.94]

Submitter Information Verification

Submitter Full Name: Ron Chilton
Organization: North Carolina Code Clearing Committee
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 10:37:13 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
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</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>Sections 110.3(B) and 110.11 already address this concern. ANSI/UL 467 requires that devices listed for grounding and bonding shall be protected against corrosion.</td>
</tr>
</tbody>
</table>
Public Comment No. 368-NFPA 70-2015 [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 Comment

I'm sure none of the Panel 5 members could actually draw out a circuit to demonstrate how an ITBT could reduce noise on communications' systems. In addition, I'm sure if the Panel actually took some time, they would not be able to come up with the definition of electrical noise. As a matter of fact, the ITBT would actually add to the issue of 'noise' if there were multiple neutral-to-ground connections in a premises. How about we just not add information to the NEC that is not true or a fact.

Related Item
First Revision No. 1215-NFPA 70-2015 [Section No. 250.94]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Aug 04 16:44:36 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: No technical substantiation was provided for this change.
Public Comment No. 1778-NFPA 70-2015 [Section No. 250.102(A)]

(A) Material.
Bonding jumpers shall be of copper, aluminum, copper-clad aluminum, or other corrosion-resistant material. A bonding jumper shall be a wire, bus, screw, or similar suitable conductor.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 7509.

Related Item
First Revision No. 7509-NFPA 70-2015 [Section No. 250.102]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:35:57 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1219-NFPA 70-2015
Statement: Further consideration was given to the comments expressed in voting on FR 7509 in accordance with the direction of the Correlating Committee. It was determined that the intended revisions to Table 250.102(C)(1) were not shown in FR 7509. In addition, the second informational note in 250.102(C)(2) was incorrectly relocated in FR 7509. The proposed second revision corrects these transcription errors.
Public Comment No. 1634-NFPA 70-2015 [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: 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.

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

<table>
<thead>
<tr>
<th>Size of Largest Ungrounded Conductor or Equivalent Area for Parallel Conductors (AWG/kcmil)</th>
<th>Size of Grounded Conductor or Bonding Jumper* (AWG/kcmil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>Aluminum or Copper-Clad Aluminum</td>
</tr>
<tr>
<td>2 or smaller</td>
<td>1/0 or smaller</td>
</tr>
<tr>
<td>1 or 1/0</td>
<td>2/0 or 3/0</td>
</tr>
<tr>
<td>2/0 or 3/0</td>
<td>4/0 or 250</td>
</tr>
<tr>
<td>Over 3/0 through 350</td>
<td>Over 250 through 500</td>
</tr>
<tr>
<td>Over 350 through 800</td>
<td>Over 500 through 900</td>
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<td>Over 600 through 1100</td>
<td>Over 900 through 1750</td>
</tr>
<tr>
<td>Over 1100</td>
<td>Over 1750</td>
</tr>
</tbody>
</table>

Notes:

1. 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.

2. 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.

3. 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 1/2 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.

4. 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.

5. 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.

6. 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.

Informational Note: See Chapter 9, Table 8, for the circular mil area of conductors 18 AWG through 4/0 AWG.

Statement of Problem and Substantiation for Public Comment

Due to transcription errors the rearrangement and changes to the notes to Table 250.102(C)(1) did not reflect the panel action. See ballot comments from Charles Mello.

Related Item

First Revision No. 7509-NFPA 70-2015 [Section No. 250.102]

Submitter Information Verification
<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Committee Action:</strong></td>
</tr>
<tr>
<td><strong>Resolution:</strong></td>
</tr>
<tr>
<td><strong>Statement:</strong></td>
</tr>
</tbody>
</table>
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 where 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 sized 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 250.66 except as permitted in 250.104(A)(2) and 250.104(A)(3).

(B) 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 equipment bonding jumper shall be sized in accordance with 250.102(D).

(C) 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:

(a) Building or structure disconnecting means enclosure where located at the building or structure
(b) Equipment grounding conductor run with the supply conductors
(c) One or more grounding electrodes used

The bonding jumper(s) shall be sized in accordance with Table 250.66, 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.

(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 250.122 using 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 54-2012, National Fuel Gas Code.
(C) Structural Metal.

Structural metal that 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 250.66, and shall be installed in accordance with 250.64(A), (B), and (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 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 250.66 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 where 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 where 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 250.66 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 where 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 where 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.


Where a common grounding electrode conductor is installed for multiple separately derived systems as permitted by 250.30(A)(6), and structural metal 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 where 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 Comment

Due to transcription errors the Draft text did not reflect the panel action. See ballot comments from Charles Mello.

Related Item

First Revision No. 1216-NFPA 70-2015 [Section No. 250.104]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address:
City:
State:
<table>
<thead>
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<td><strong>Resolution:</strong></td>
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<td><strong>Statement:</strong></td>
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</table>
Public Comment No. 1779-NFPA 70-2015 [Section No. 250.104(A) [Excluding any Sub-Sections]]

The metal water piping system shall be bonded as required in (A)(1), (A)(2), or (A)(3) of this section.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1216.

Related Item

First Revision No. 1216-NFPA 70-2015 [Section No. 250.104]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:40:48 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1220-NFPA 70-2015
Statement: Further consideration was given to the comments expressed in voting on FR 1216 in accordance with the direction of the Correlating Committee. It was determined that the intended Panel 5 revisions to 250.104 were not shown correctly in FR 1216. The proposed second revision corrects these transcription errors. The reference to NFPA 54 in Informational Note No. 2 in 250.104(B) was also updated. Also note that references to Table 250.66 were changed to Table 250.102(C)(1) in several locations as these conductors are bonding jumpers, not grounding electrode conductors.

In several locations, the word "where" was appropriately changed to "if".
Public Comment No. 165-NFPA 70-2015 [Section No. 250.104(B)]

(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 250.122 using 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 54-2012 [2015], National Fuel Gas Code.

Statement of Problem and Substantiation for Public Comment

In informational note, referenced current edition of NFPA 54.

Related Item
First Revision No. 1216-NFPA 70-2015 [Section No. 250.104]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address: [Not Specified]
City: [Not Specified]
State: [Not Specified]
Zip: [Not Specified]
Submittal Date: Mon Jul 06 23:41:55 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1220-NFPA 70-2015
Statement: Further consideration was given to the comments expressed in voting on FR 1216 in accordance with the direction of the Correlating Committee. It was determined that the intended Panel 5 revisions to 250.104 were not shown correctly in FR 1216. The proposed second revision corrects these transcription errors. The reference to NFPA 54 in Informational Note No. 2 in 250.104(B) was also updated. Also note that references to Table 250.68 were changed to Table 250.102(C)(1) in several locations as these conductors are bonding jumpers, not grounding electrode conductors.

In several locations, the word "where" was appropriately changed to "if".
Public Comment No. 336-NFPA 70-2015 [Section No. 250.104(C)]

(C) Structural Metal.

Structural metal that is interconnected to form a building frame and that 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 250.66 and installed in accordance with 250.64(A), (B), and (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 Comment

The deletion of the requirement that the structural metal be interconnected to form a frame results in a major expansion of this section without any substantiation. Without those words a single steel beam in a dwelling unit basement or the metal bar joists in a commercial block wall building will require a bonding connections.

Related Public Comments for This Document

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<td>Public Comment No. 337-NFPA 70-2015 [Section No. 250.104(D) [Excluding any Sub-Sections]]</td>
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Submitter Information Verification

Submitter Full Name: DON GANIERE
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 31 20:12:20 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1220-NFPA 70-2015
Statement: Further consideration was given to the comments expressed in voting on FR 1216 in accordance with the direction of the Correlating Committee. It was determined that the intended Panel 5 revisions to 250.104 were not shown correctly in FR 1216. The proposed second revision corrects these transcription errors. The reference to NFPA 54 in Informational Note No. 2 in 250.104(B) was also updated. Also note that references to Table 250.66 were changed to Table 250.102(C)(1) in several locations as these conductors are bonding jumpers, not grounding electrode conductors.

In several locations, the word "where" was appropriately changed to "if".
Public Comment No. 369-NFPA 70-2015 [Section No. 250.104(C)]

(C) Structural Metal.

Structural metal that 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 250.66 and installed in accordance with 250.64(A), (B), and (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 Comment

Structural steel that is ‘grounded’ is not going to clear a ground-fault (you guys know that), and adding if bonded to the rule just adds confusion. How about we follow the same rule for all of 250.104 parts like we did in (A) and (B). Let’s keep it safe, let’s not go back to 2005 language (when grounding was considered safe from a ground fault).

Related Item
First Revision No. 1216-NFPA 70-2015 [Section No. 250.104]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 16:52:16 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Structural metal likely to become energized is required to be bonded. This section further clarifies that if the structural metal has already been grounded or bonded, it is not required to be bonded again.
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).

Statement of Problem and Substantiation for Public Comment

The proposed wording is a major expansion of the bonding requirements that was made without any substantiation. The new wording requires any structural metal, such as a single bean or things like bar joist to be bonded. This same change also needs to be made in 250.104(D)(2).

Related Public Comments for This Document

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</tr>
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Submitter Information Verification

Submitter Full Name: DON GANIERE
Organization: [ Not Specified ]
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Fri Jul 31 20:21:52 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1220-NFPA 70-2015
Statement: Further consideration was given to the comments expressed in voting on FR 1216 in accordance with the direction of the Correlating Committee. It was determined that the intended Panel 5 revisions to 250.104 were not shown correctly in FR 1216. The proposed second revision corrects these transcription errors. The reference to NFPA 54 in Informational Note No. 2 in 250.104(B) was also updated. Also note that references to Table 250.66 were changed to Table 250.102(C)(1) in several locations as these conductors are bonding jumpers, not grounding electrode conductors.

In several locations, the word "where" was appropriately changed to "if".
(B) Multiconductor Cable.

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

Removal of the requirements for conditions of maintenance and supervision by qualified persons is a reduction of safety for re-identification of the most important safety conductor in a multiconductor cable. The panel statement cites consistency with 200.7(C) which permits the grounded conductor to be re-identified as an ungrounded conductor, however, it is not consistent with the more important requirement of 200.6(E) which in general requires the grounded conductor to be a continuous white or gray outer finish in a multiconductor cable. Additionally, the exception in 200.6(E) remains, as it should, permitting re-identification only in locations where conditions of maintenance and supervision ensure only qualified persons service the installation. 250.119(B) needs to be consistent with 200.6(E) and not 200.7(C). Re-identifying conductors, whether for equipment grounding conductors, grounded conductors, or as permitted in 200.7(C) for ungrounded conductors in multiconductor cables is often missed and violated especially by installers who are other than qualified. Manufactures make and have readily available the correct multiconductor cable for installations with properly identified equipment grounding conductors which should be used in place of an incorrect cable being used for an application it was not originally manufactured.

Related Item

First Revision No. 1230-NFPA 70-2015 [Section No. 250.119(B)]

Submitter Information Verification

Submitter Full Name: Derrick Atkins
Organization: Minneapolis Electrical JATC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 12:34:58 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1221-NFPA 70-2015
Statement: The text is revised to establish that, except where only qualified staff are doing work, the equipment grounding conductor in multiconductor cables shall have a continuous insulation color of green or green with yellow stripes. Returning this portion of the text to previous edition will maintain consistency with 200.6(E).
(B) Multiconductor Cable.

One or more insulated conductors in a multiconductor cable, at the time of installation, shall be permitted to be permanently identified as equipment grounding conductors at each end and at every point where the conductors are accessible by one of the following means:

1. Stripping the insulation from the entire exposed length
2. Coloring the exposed insulation green
3. Marking the exposed insulation with green tape or green adhesive labels. Identification shall encircle the conductor.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1230.

Related Item
First Revision No. 1230-NFPA 70-2015 [Section No. 250.119(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:41:43 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1221-NFPA 70-2015
Statement: The text is revised to establish that, except where only qualified staff are doing work, the equipment grounding conductor in multiconductor cables shall have a continuous insulation color of green or green with yellow stripes. Returning this portion of the text to previous edition will maintain consistency with 200.6(E).
Delete the changes as edited in FR 1230 and revert to the existing 2014 language as follows:

(B) Multiconductor Cable.

One

Where the conditions of maintenance and supervision ensure that only qualified persons service the installation, 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 Comment

The panel action on this PI should have been a resolve. The edit made to sub-part (B) of this section removes the limited application (originally an exception) of identifying those colors that are traditionally associated with ungrounded conductors to the color green. This now provides unrestricted re-identification of said colored conductors (black blue etc.) in all multi-wire cables in all locations as an equipment grounding conductor. Field makings are a moving target. This expanded permissive language for conductors 6 AWG and smaller, can create a problem over time which will be exponentially increased, especially in locations where premises maintenance is not limited to those who are familiar with local marking procedures (such as an industrial location). One argument expressed during panel discussion included a reference to the language found in section 200.7 regarding re-identification and use of a white (or gray) conductor as an ungrounded conductor. This is understandable, but in reality if a re-identified white conductor was inadvertently connected to a grounded terminal or an energized terminal the failure would be limited to one branch circuit or feeder. A mistake with a conductor that is intentionally connected to the system or structures non-current carrying metal parts is life threatening and may raise the potential on the entire structure presenting a shock hazard (or worse). This hazard might migrate to other systems (such as chapter 8 wiring) that are permitted to be terminated to the structures intersystem bond terminals as mentioned in 250.94. Once this permissive rule is extended to residential and commercial occupancies where the lion share of the work is performed by pedestrian installers having no stake in the continued and safe operation of the facility or dwelling the monitoring of that installation and its future.

Related Item

First Revision No. 1230-NFPA 70-2015 [Section No. 250.119(B)]

Submitter Information Verification

Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSPI
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 12:56:02 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1221-NFPA 70-2015
Statement: The text is revised to establish that, except where only qualified staff are doing work, the equipment grounding conductor in multiconductor cables shall have a continuous insulation color of green or green with yellow stripes. Returning this portion of the text to previous edition will maintain consistency with 200.6(E).
(B) Aluminum and Copper-Clad Aluminum Conductors.

Equipment grounding conductors of bare or insulated aluminum or copper-clad aluminum shall be permitted. Bare conductors, covered or insulated 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, unless the termination method is listed as a sealed wire-connector system. Terminations made within listed enclosures suitable for outdoor use shall be permitted within 18 in. of the earth.

Statement of Problem and Substantiation for Public Comment

Due to transcription errors the Draft did not reflect the panel action. Please see ballot comments from Charles Mello

Related Item
First Revision No. 1235-NFPA 70-2015 [Section No. 250.120(B)]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:00:31 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1222-NFPA 70-2015
Statement: Revisions were made to add covered conductors to provide requirements for their use. The revisions clarify the use of sealed wire connector systems and outdoor enclosures. The text is rewritten in list format to improve clarity.
(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, unless the termination method is listed as a sealed wire-connector system. Terminations made within listed enclosures suitable for outdoor use shall be permitted within 18 in. of the earth.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1235.

Related Item
First Revision No. 1235-NFPA 70-2015 [Section No. 250.120(B)]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:42:32 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1222-NFPA 70-2015
Statement: Revisions were made to add covered conductors to provide requirements for their use. The revisions clarify the use of sealed wire connector systems and outdoor enclosures. The text is rewritten in list format to improve clarity.
Public Comment No. 679-NFPA 70-2015 [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 unless the termination method is listed as a sealed wire connector system. Terminations made within listed enclosures suitable for outdoor use shall be permitted within 18 in. of the earth.

Additional Proposed Changes

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<td>Section 250.120(B) Public Input</td>
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Statement of Problem and Substantiation for Public Comment

Sealed wire connection systems are not listed for outdoor exposure and does not protect conductor material. The sealed system is not listed for UV exposure. Such use would violate the UL listing. The term "suitable" is not recognized or defined. The submitter has not provided any substantiating evidence that the change is allowable or warranted. There is no reason to change the Code.

See Public Input on Section 250.64(A)

Related Item

First Revision No. 1235-NFPA 70-2015 [Section No. 250.120(B)]

Submitter Information Verification

Submitter Full Name: David Brender
Organization: Copper Development Association
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 16 17:11:13 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1222-NFPA 70-2015
Statement: Revisions were made to add covered conductors to provide requirements for their use. The revisions clarify the use of sealed wire connector systems and outdoor enclosures. The text is rewritten in list format to improve clarity.
Public Comment No. 791-NFPA 70-2015 [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, unless the termination method is listed as a sealed wire-connector system. Terminations made within listed enclosures suitable for outdoor use shall be permitted within 18 in. of the earth.

Statement of Problem and Substantiation for Public Comment

This section permits bare aluminum equipment grounding conductors. Listed sealed wire connection systems have not been evaluated for sealing of bare or uninsulated conductors. The following information is from the UL White Book in ZMWQ:

This category covers sealed wire-connector systems intended for wet or damp locations and other installations, such as direct burial, below grade, or above grade where protected from direct exposure to sunlight. These systems may also be used indoors or in dry locations.

Sealed wire-connector systems are intended for use in installations covered by ANSI/NFPA 70, "National Electrical Code."

Sealed wire-connector systems have not been investigated for direct exposure to sunlight. Additional performance considerations to show equivalency to the connected conductors should be considered for UV exposure.

Sealed wire-connector systems have not been investigated for direct exposure to salt or seawater.

This category covers a complete system or insulating caps, covers, resins, tubing and tapes that are part of the system for use with specific wire connectors where the seal is made at the conductor. Pressure wire connectors may or may not be provided with the system.

In addition, the phrase in the last sentence relative to the use of the term "suitable" is inappropriate and not defined in the NEC. This substantiates the deletion of the last sentence.

Related Item

First Revision No. 1235-NFPA 70-2015 [Section No. 250.120(B)]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 17:18:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1222-NFPA 70-2015
Statement: Revisions were made to add covered conductors to provide requirements for their use. The revisions clarify the use of sealed wire connector systems and outdoor enclosures. The text is rewritten in list format to improve clarity.
(B) Increased in Size.

If ungrounded conductors are increased in size for any reason from the minimum size that has sufficient ampacity for the intended installation before the application of any adjustment or correction factor(s), required wire-type equipment grounding conductors shall be increased in size. The increase in size shall be in the same proportion as the proportionate to the increase in the size of the ungrounded conductors using their circular mil area conductor(s), calculated using circular mil areas or AWG size changes.

Statement of Problem and Substantiation for Public Comment

Adding the word "required" takes into consideration metallic wiring methods which qualify as an equipment grounding conductor without the addition of a wire-type EGC. Such systems employing a "redundant" wire-type EGC have already been upsized. Direct upsizing to non-metallic wiring methods where upsizing is necessary.

Also, when economics are a major design consideration, specifiers may opt to just not include a wire-type EGC in EGC-qualifying metallic wiring methods rather than upsize. Better to install a minimum-sized wire-type EGC than none at all.

Also added that proportionate sizing can be determined by AWG size changes, i.e. a change of 4 AWG sizes is proportional no matter what two sizes you start with. See Public Comment No. 81 and related Input.

Related Item
Public Input No. 3230-NFPA 70-2014 [Section No. 250.122(B)]

Submitter Information Verification

Submitter Full Name: JOSEPH HREN
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Sun Jul 05 15:32:38 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1223-NFPA 70-2015
Statement: Increase of the equipment grounding conductor size due to adjustment or correction factors is not necessary because of the short duration of a fault.

This revision was suggested by a ballot comment in the First Draft.
Increased in Size.

If ungrounded conductors are increased in size for any reason from the minimum size that has sufficient ampacity for the intended installation before the application of any adjustment or correction factor(s), wire-type equipment grounding conductors shall be increased in size. The increase in size shall be in the same proportion as the increase in the size of the ungrounded conductors using their circular mil area.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1236. The text of FR 1236 as written is run-on and confusing.

Related Item
First Revision No. 1236-NFPA 70-2015 [Section No. 250.122(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 28 15:43:19 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1223-NFPA 70-2015
Statement: Increase of the equipment grounding conductor size due to adjustment or correction factors is not necessary because of the short duration of a fault.

This revision was suggested by a ballot comment in the First Draft.
Public Comment No. 338-NFPA 70-2015 [Section No. 250.122(B)]

(B) Increased in Size.

If ungrounded conductors are increased in size for any reason from the minimum size that has sufficient ampacity for the intended installation before the application of any adjustment or correction factor(s), wire-type equipment grounding conductors shall be increased in size. The minimum size of the ungrounded conductors shall be the allowable ampacity per the Tables in 310.15(B). The increase in size shall be in the same proportion as the increase in the size of the ungrounded conductors using their circular mil area.

Statement of Problem and Substantiation for Public Comment

It appears to me that the basis for the increase in size of the EGC is the allowable ampacities as found in the 310.15(B) tables. This change make that clear.

Related Item
First Revision No. 1236-NFPA 70-2015 [Section No. 250.122(B)]

Submitter Information Verification

Submitter Full Name: DON GANIERE
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 31 20:54:08 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1223-NFPA 70-2015
Statement: Increase of the equipment grounding conductor size due to adjustment or correction factors is not necessary because of the short duration of a fault.

This revision was suggested by a ballot comment in the First Draft.
(B) Increased in Size.
If ungrounded conductors are increased in size for any reason from the minimum size that has sufficient ampacity for the intended installation before the application of any adjustment or correction factor(s), wire-type equipment grounding conductors shall be increased in size. The increase in size shall be in the same proportion as, to, or greater than, the increase in the size of the ungrounded conductors using their circular mil area.

Statement of Problem and Substantiation for Public Comment
It's probably not going to be possible to get an exact match to the proportional increase of the current carrying conductors in the EGC. The EGC should be equal to, or greater than, the proportional increase.

Related Item
First Revision No. 1236-NFPA 70-2015 [Section No. 250.122(B)]

Submitter Information Verification
Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 01 18:21:14 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1223-NFPA 70-2015
Statement: Increase of the equipment grounding conductor size due to adjustment or correction factors is not necessary because of the short duration of a fault.

This revision was suggested by a ballot comment in the First Draft.
(B) Increased in Size.

If ungrounded conductors are increased in size for any reason from the minimum size that has sufficient ampacity for the intended installation before other than an increase due to the application of any adjustment or correction factor(s), wire-type equipment grounding conductors shall be increased in size. The increase in size shall be at least in the same proportion as the increase in the size of the ungrounded conductors using their circular mil area.

Statement of Problem and Substantiation for Public Comment

The proposed text does not change the intent of this section. The proposed text is submitted to improve clarity.

Related Item

First Revision No. 1236-NFPA 70-2015 [Section No. 250.122(B)]

Submitter Information Verification

Submitter Full Name: G. Scott Harding
Organization: F. B. Harding, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 19 14:12:19 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1223-NFPA 70-2015
Statement: Increase of the equipment grounding conductor size due to adjustment or correction factors is not necessary because of the short duration of a fault.

This revision was suggested by a ballot comment in the First Draft.
(B) Increased in Size.

If ungrounded conductors are increased in size for any reason larger than the minimum size that has sufficient ampacity for the intended installation before, without the application of any adjustment or correction factor(s), wire-type equipment grounding conductors shall be increased in size. The increase in size shall be in the same proportion as the increase in the size of the ungrounded conductors using their circular mil area.

Statement of Problem and Substantiation for Public Comment

The revised language submitted is clearer and more precise than the First Revision, and meets the intention of the submitter.

Related Item

First Revision No. 1236-NFPA 70-2015 [Section No. 250.122(B)]

Submitter Information Verification

Submitter Full Name: David Brender
Organization: Copper Development Association
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 18:06:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1223-NFPA 70-2015
Statement: Increase of the equipment grounding conductor size due to adjustment or correction factors is not necessary because of the short duration of a fault.

This revision was suggested by a ballot comment in the First Draft.
(B) Increased in Size.

If ungrounded conductors are increased in size for any reason from the minimum size that has sufficient ampacity for the intended installation before the application of any adjustment or correction factor(s), wire-type equipment grounding conductors shall be increased in size. The increase in size shall be in the same proportion as the increase in the size of the ungrounded conductors using their circular mil area.

Informational Note: Circular mil areas of AWG sized conductors are rounded to four significant figures per ASTM B258 Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors. Proportion calculation should adhere to ASTM E29 Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications, specifically §7.4.1.2 which states, "The rule when multiplying or dividing is that the result shall contain no more significant digits than the value with the smaller number of significant digits." As such, an equal change in AWG number satisfies the proportion requirement. For example, an ungrounded conductor increased from 3AWG to 2/0AWG (a change of 4) is the same increase in circular mil area proportion as an equipment grounding conductor increased from 8AWG to 4AWG (also a change of 4).

Statement of Problem and Substantiation for Public Comment

Resolution to Public Input No. 1111 states, "The informational note is misleading for some conditions and does not provide clarity for correctly sizing the EGC necessary to carry fault current." Without additional comment, there is no way for me to determine in what way and how my proposed Informational Note is misleading in some conditions and lacks clarity for correctly sizing the EGC. The proposed Informational Note is about calculating proportion, nothing else. I therefore submit full blown text for the Informational Note to provide more clarity. I cannot fathom any condition for which this Informational Note would be misleading. Please be more specific in any and all committee statements in this regard.

I do not have copyright permission to include ASTM B258 or ASTM E29 herewith as supporting documents.

Related Item

Public Input No. 1111-NFPA 70-2014 [Section No. 250.122(B)]

Submitter Information Verification

Submitter Full Name: JOSEPH HREN
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jun 26 20:22:22 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The informational note suggested did not add clarity and does not include stranding types other than round.
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). The equipment grounding conductor shall not be required to be larger than the largest ungrounded conductor within the raceway or cable.

(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 trays 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. Wire type 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.

(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. 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.

(2) Multiconductor Cables

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

(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. 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.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1236. The text of FR 1236 as written is run-on and confusing.

Related Item
First Revision No. 1246-NFPA 70-2015 [Section No. 250.122(F)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:45:40 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1224-NFPA 70-2015
Statement: The panel has reviewed the Correlating Committee comment and has split 250.122(F)(2) into (2)(a), (b), (c), and (d) to make the text easier to understand.
For circuits of parallel conductors as permitted in 310.10(H), the equipment grounding conductor shall be installed in accordance with (1) or (2). The equipment grounding conductor shall not be required to be larger than the largest ungrounded conductor within the raceway or cable.

Statement of Problem and Substantiation for Public Comment

The sentence "The equipment grounding conductor shall not be required to be larger than the largest ungrounded conductor within the raceway or cable." should be deleted. The implication is that this is a clarification of the requirement in 250.122(A) that states "... but in no case shall they be required to be larger than the circuit conductors supplying the equipment." The proposed new sentence in 250.122(F) conflicts with 250.122(A) and adds confusion in applying the provisions of this section. This was proposed for the 2014 Edition of the NEC and was held for the next Edition. There were statements that no documentation or substantiation was submitted to justify this change, and none was offered for the 2017 Edition. The Panel 5 Task Group assigned this PI recommended resolve.

In some cases, compliance with the proposed new sentence could result in an electrically hazardous situation: Since 1/0 AL conductors are allowed to be paralleled, several could be installed in parallel to give an ampacity of 960 amperes. Some overcurrent device equal to or less than 960 amperes could be used to protect the conductors. According to several sources, and per calculations, 1/0 AL conductors are suitable for fault currents up to approximately 36kA for one cycle and approximately 57kA for a half cycle. Many electrical systems are capable of delivering fault currents in excess of these values, and under some conditions, a portion of a single grounding conductor may be subjected to the entire fault energy, introducing the possibility of cable failure before the overcurrent device operates, resulting in dangerous voltages being imposed on exposed metallic components of the electrical system.

Related Item

First Revision No. 1246-NFPA 70-2015 [Section No. 250.122(F)]

Submitter Information Verification

Submitter Full Name: JOSEPH ANDERSON
Organization: STEEL TUBE INSTITUTE
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 18:56:20 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1225-NFPA 70-2015
Statement: There was insufficient technical justification to insert the deleted sentence in the First Draft.
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 trays 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. Wire type 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.

(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. 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. Where metallic raceways are used and are equipment grounding conductors per 250.118, an equipment grounding conductor of the wire type installed within each raceway shall not be required to be larger than what would be required for the largest overcurrent protective device that would be permitted to protect the conductors in the raceways.

Statement of Problem and Substantiation for Public Comment

The currently accepted version of this rule will result in designers and installers deleting an EGC of the wire type where the circuits are installed in metallic raceways. My change would also put raceways on a more equal footing with the change made for cables in 250.122(F)(2)(b).

Related Item
First Revision No. 1246-NFPA 70-2015 [Section No. 250.122(F)]

Submitter Information Verification

Submitter Full Name: DON GANIERE
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 09 07:38:56 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: A wire type equipment grounding conductor, if used, shall comply with all requirements in Article 250, including being sized based on the feeder or branch circuit overcurrent device, as stated in 250.122.
Public Comment No. 1667-NFPA 70-2015 [Section No. 250.148 [Excluding any Sub-Sections]]

Where 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 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.

Statement of Problem and Substantiation for Public Comment

Due to transcription errors the Draft did not reflect the panel action. See ballot comments from Charles Mello

Related Item
First Revision No. 1237-NFPA 70-2015 [Section No. 250.148 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:03:54 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1227-NFPA 70-2015
Statement: The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.
Where 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 within the box or to the box with devices suitable for the use in accordance with 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 Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1327.

Related Item

First Revision No. 1237-NFPA 70-2015 [Section No. 250.148 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:46:44 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1227-NFPA 70-2015
Statement: The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.
Public Comment No. 245-NFPA 70-2015 [Section No. 250.148 [Excluding any Sub-Sections]]

Where circuit conductors are spliced within a contained within an otherwise unbonded metal box, or spliced within 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, and/or bonded to the box if metal, 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 Comment

Eliminates the ambiguity equipment grounding conductors being being associated certain circuit conductors. It is obviously associated with one or more circuit conductors, but if all [normal] EGC’s are to be connected together, the circuit to which an EGC is associated is irrelevant.

Also clarifies where a box is otherwise unbonded, it shall be bonded with the EGC’s, which should include the largest. Under the former text, one could have multiple sets of 500kcmil conductor running through a metal box unspliced, and yet have one #12 circuit spliced... and only a #12 bonding jumper would be required to the otherwise unbonded box. The alternative would be running a separate bonding jumper, but that does not adhere to the concept of grounding continuity.

Related Item
First Revision No. 1237-NFPA 70-2015 [Section No. 250.148 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: JOSEPH HREN
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 14 20:57:41 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel reaffirms the previous decision that, where all the conductors of a circuit pass through the box or enclosure without splice or termination, the associated equipment grounding conductor(s) is not required to be spliced or connected to the other equipment grounding conductors or to the box or enclosure.
250.186. Grounding Service-Supplied Alternating-Current Systems of over 1000 Volts

(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 conductor at the service point, a grounded conductor(s) shall be installed and routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means grounded conductor(s) terminal or bus. A main bonding jumper shall connect the grounded conductor(s) to each service disconnecting means's enclosure. The grounded conductor(s) shall be installed in accordance with 250.186(A)(1) through (A)(4). The size of the solidly grounded circuit conductor(s) shall be the larger of that determined by 250.184 or 250.186(A)(1) or (A)(2).

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

(1) Sizing for a Single Raceway or Overhead Conductor.

The grounded conductor shall not be smaller than the required grounding electrode conductor specified in Table 250.102(C)(1) but shall not be required to be larger than the largest ungrounded service-entrance conductor(s).

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

If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or as overhead parallel conductors, the grounded conductors shall also be installed in parallel. The size of the grounded conductor in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

Informational Note: See 310.10(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 shall be installed and routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means equipment grounding conductor terminal or bus. The supply-side bonding jumper shall be installed in accordance with 250.186(B)(1) through (B)(3).

Exception: Where two or more service disconnecting means are located in a single assembly listed for use as service equipment, it shall be permitted to connect the supply-side bonding jumper to the assembly common equipment grounding terminal or bus.

(1) Sizing for a Single Raceway or Overhead Conductor.

The supply-side bonding jumper shall not be smaller than the required grounding electrode conductor specified in Table 250.102(C)(1) but shall not be required to be larger than the largest ungrounded service-entrance conductor(s).

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

If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or overhead conductors, the supply-side bonding jumper shall also be installed in parallel. The size of the supply-side bonding jumper in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

(3) Impedance Grounded Neutral Systems.

Impedance grounded neutral systems shall be installed in accordance with 250.187.

Statement of Problem and Substantiation for Public Comment

Due to transcription errors the Draft did not reflect the panel action. See ballot comments from Charles Mello.

Related Item

First Revision No. 1239-NFPA 70-2015 [Section No. 250.186]

Submitter Information Verification
### Committee Statement

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<td>Statement:</td>
<td>The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.</td>
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250.186  Grounding Service-Supplied Alternating-Current Systems of over 1000 Volts

(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 conductor at the service point, a grounded conductor(s) shall be installed and routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means grounded conductor(s) terminal or bus. A main bonding jumper shall connect the grounded conductor(s) to each service disconnecting means's enclosure. The grounded conductor(s) shall be installed in accordance with 250.186(A)(1) through (A)(4). The size of the solidly grounded circuit conductor(s) shall be the larger of that determined by 250.184 or 250.186(A)(1) or (A)(2).

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

(1) Sizing for a Single Raceway or Overhead Conductor.

The grounded conductor shall not be smaller than the required grounding electrode conductor specified in Table 250.102(C)(1) but shall not be required to be larger than the largest ungrounded service-entrance conductor(s).

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

If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or as overhead parallel conductors, the grounded conductors shall also be installed in parallel. The size of the grounded conductor in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

Informational Note: See 310.10(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 shall be installed and routed with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means equipment grounding conductor terminal or bus. The supply-side bonding jumper shall be installed in accordance with 250.186(B)(1) through (B)(3).

Exception: Where two or more service disconnecting means are located in a single assembly listed for use as service equipment, it shall be permitted to connect the supply-side bonding jumper to the assembly common equipment grounding terminal or bus.

(1) Sizing for a Single Raceway or Overhead Conductor.

The supply-side bonding jumper shall not be smaller than the required grounding electrode conductor specified in Table 250.102(C)(1) but shall not be required to be larger than the largest ungrounded service-entrance conductor(s).

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

If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or overhead conductors, the supply-side bonding jumper shall also be installed in parallel. The size of the supply-side bonding jumper in each raceway or overhead shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or overhead, as indicated in 250.186(A)(1), but not smaller than 1/0 AWG.

(3) Impedance Grounded Neutral Systems.

Impedance grounded neutral systems shall be installed in accordance with 250.187.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1239.

Related Item

First Revision No. 1239-NFPA 70-2015 [Section No. 250.186]

Submitter Information Verification
<table>
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<tr>
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<td>Organization</td>
<td>NFPA</td>
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Committee Statement

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<td>Statement</td>
<td>The text is revised to correct transcription errors in the First Revision and to reflect the panel action in the First Revision meeting.</td>
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Public Comment No. 1404-NFPA 70-2015 [ Section No. 250.187(B) ]

(B) Identified and Insulated.

The neutral conductor of an impedance grounded neutral system shall be identified. For high resistance grounded systems, as well as fully insulated for the maximum, the neutral shall have the same insulation rating as the phase conductors. For other systems, the neutral shall be permitted to have insulation rating of not less than the maximum line to neutral voltage.

Statement of Problem and Substantiation for Public Comment

In doing research on reducing the insulation rating on the neutral for the impedance grounded systems over 1000 volts, I found two articles, EC&M (Electrical Construction & Maintenance) April 1, 2007 "From the Ground Up" written by Tony Locker, P.E., I-Gard and "Resistance Grounding System Basics" written by Michael D. Seal, P.E., G.E. Senior Specifications Engineer, containing similar viewpoints on the requirements for the insulation rating of the neutral. To paraphrase, both effectively state that in a ground-fault event with one phase faulted, the system operates with the un-faulted phases being raised from earth potential to the full phase-to-phase voltage for an extended period. Therefore the insulation system needs to be rated for phase-to-phase voltage. In the first article cited, the author applies this thought to the high resistance grounded systems which he also cites as being typically used in less than 5 kV applications. Additionally, in both PI-1798 and FR-7525 reference is made to the neutral voltage being 57.7% of the system voltage. This is true strictly for a three-phase wye system. If it is also possible to have a three-phase delta system operated with an impedance grounded neutral system, then the 57.7% would be inaccurate and the reason for clarifying in the Code the maximum line to neutral voltage for other systems such as low resistance grounded systems and resonance grounded systems.

Related Item
First Revision No. 7525-NFPA 70-2015 [Section No. 250.187(B)]

Submitter Information Verification

Submitter Full Name: Derrick Atkins
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 10:14:53 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1229-NFPA 70-2015 The phase to neutral voltage, as provided in the FR, would only apply to three phase wye systems. It is technically infeasible for the neutral to ground voltage to exceed the 57.7 percent of the phase-to-phase voltage. There is no need to repeat the application for impedance grounded system, as the section is for this type of system only.
Statement: The formatting revisions improve clarity. By establishing the list items, this provides enforcement clearer statement for defining any corrections required.

An informational note was added to clarify the magnitude of the neutral voltage.
250.191  Grounding System at Alternating-Current Substations.
For ac substations, the grounding system shall be in accordance with Part III of Article 250.


### Statement of Problem and Substantiation for Public Comment


### Related Public Comments for This Document

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### Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name:</th>
<th>Aaron Adamczyk</th>
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<tbody>
<tr>
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<td>[ Not Specified ]</td>
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### Committee Statement

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<td>SR-1230-NFPA 70-2015</td>
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<tr>
<td>Statement:</td>
<td>This revision updates the reference in the informational note to the latest published edition of the standard and deletes the reference to “ANSI”.</td>
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</table>
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.


(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 Comment


Related Public Comments for This Document

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<td>Public Input No. 2729-NFPA 70-2014 [Section No. 250.194]</td>
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Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 24 00:01:20 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1231-NFPA 70-2015
Statement: The revision updates the reference in the informational note to the current edition of the standard.
280.1 Scope.
This article covers general requirements, installation requirements, and connection requirements for surge arresters installed on premises wiring systems over 2000 over 1000 volts.

Statement of Problem and Substantiation for Public Comment
The voltage level should remain at 1000 volts. Making the change to 2000 volts may allow additional items to comply with low voltage requirements without substantiation and may create safety issues. Although the change in voltage does not directly impact the grounding requirements in Article 250, it creates inconsistency with other Articles throughout the code, as other CMP’s did not accept these Public Inputs.

Related Public Comments for This Document

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<td>Public Comment No. 407-NFPA 70-2015 [Section No. 250.36 [Excluding any Sub-Sections]]</td>
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<td>First Revision No. 1232-NFPA 70-2015 [Section No. 250.24(C) [Excluding any Sub-Sections]]</td>
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<tr>
<td>First Revision No. 1233-NFPA 70-2015 [Section No. 250.36 [Excluding any Sub-Sections]]</td>
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Submitter Information Verification
Submitter Full Name: MIKE OMEARA
Organization: Edison Electric Institute
Affiliation: EEI Electric Light & Power NEC Task Force
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 13 14:03:11 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1232-NFPA 70-2015
Statement: There is inadequate technical substantiation to increase this to 2000 volts at this time.
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.

(2) Solidly Grounded Systems.
The maximum continuous operating voltage shall be the phase-to-ground voltage of the system.

(3) Impedance or Ungrounded System.
The maximum continuous operating voltage shall be the phase-to-phase voltage of the system.

(D) 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. 2: The selection of a properly rated metal oxide arrester is based on considerations of maximum continuous operating voltage and the magnitude and duration of overvoltages at the arrester location as affected by phase-to-ground faults, system grounding techniques, switching surges, and other causes. See the manufacturer's application rules for selection of the specific arrester to be used at a particular location.

Statement of Problem and Substantiation for Public Comment


Related Item
First Revision No. 1242-NFPA 70-2015 [Section No. 280.3]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Jul 24 00:10:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1233-NFPA 70-2015
Statement: This revision corrects numbering errors. The reference in Informational Note No. 1 was updated to the latest published standard.
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 power frequency voltage available at the point of application.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that the Panel clarify “phase-to-ground power frequency voltage.”

Related Item
First Revision No. 1247-NFPA 70-2015 [Section No. 280.2]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:51:34 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1234-NFPA 70-2015
Statement: The panel reviewed the text as directed by the Correlating Committee. The revised text clarifies the intent of the panel.
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 metallic 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 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.

Statement of Problem and Substantiation for Public Comment

Due to transcription errors the text under 280.24(A) we deleted which was not the panel action. See ballot comments from Charles Mello

Related Item
First Revision No. 1241-NFPA 70-2015 [Section No. 280.24(A)]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 16:18:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1235-NFPA 70-2015
Statement: The list items (1) and (2) were incorrectly omitted in the First Draft and are now reinstated as in the previous edition.
(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:

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1241.

Related Item
First Revision No. 1241-NFPA 70-2015 [Section No. 280.24(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 28 15:52:25 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1235-NFPA 70-2015
Statement: The list items (1) and (2) were incorrectly omitted in the First Draft and are now reinstated as in the previous edition.
(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:

Statement of Problem and Substantiation for Public Comment

Section A had a 2 item list under it that was deleted in the first revision. Without the list A refers to nothing. Looks like there was some kind of editing mistake here.

Related Item
First Revision No. 1241-NFPA 70-2015 [Section No. 280.24(A)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 01 19:16:20 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1235-NFPA 70-2015
Statement: The list items (1) and (2) were incorrectly omitted in the First Draft and are now reinstated as in the previous edition.
Scope.

This article covers general requirements, installation requirements, and connection requirements for surge-protective devices (SPDs) permanently installed on premises wiring systems of 2000 volts or less. 

Informational Note: Surge arresters 2000 volts or less are also known as Type 1 SPDs.

Statement of Problem and Substantiation for Public Comment

NEMA does not support this expansion of the NEC to 2000 volts. It raises some safety concerns that are not addressed in any current standard.

Related Item

First Revision No. 1245-NFPA 70-2015 [Sections 285.1, 285.3]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 10:00:22 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1236-NFPA 70-2015
Statement: There is inadequate technical substantiation to increase this to 2000 volts at this time.
Public Comment No. 9-NFPA 70-2015 [Section No. 285.1]

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 2000-1000 volts or less.

Informational Note: Surge arresters 2000-1000 volts or less are also known as Type 1 SPDs.

Statement of Problem and Substantiation for Public Comment

The problem is that the existing ANSI/UL 1449-2014 standard only covers surge protective devices (SPD) up to 1000 Vac in its scope. So, there is no technical standard that can "list" an SPD beyond 1000 Vac. Allowing voltages beyond 1000 without a possible "listing" violates section 285.5 requiring a "listed" device.

As a working group member of UL 1449 and the IEEE PES Surge Protective Device (3.6) committees, there is no technical nor product-safety direction yet established by these standards committees. Therefore, I have even greater reluctance toward the NEC including voltages beyond 1000 Vac. Without a solid product-safety standard to address SPDs between 1000 and 2000 Vac, the NFPA should not change the 285.1

In reality, the ANSI C84 standard does not recognize any low-voltage electrical system beyond 600 volts. We do know that Wind Turbines deliver a 690Y/400 V system - this is unique to these systems. Therefore, even stating "up to 1000 V" is more than what is covered in other standards.

The fact that the C84.1-2011 standard remains nebulous between 600 and 2400 volts should also cause the NFPA pause as well.

Keeping the maximum voltage at 1000 volts maintains code consistency with the change to up the low voltage range from 600 to 1000 volts.

Related Public Comments for This Document

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<tr>
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<tr>
<td>Public Comment No. 11-NFPA 70-2015 [Section No. 285.3]</td>
<td>Related Item</td>
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<td>First Revision No. 1245-NFPA 70-2015 [Sections 285.1, 285.3]</td>
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Submitter Information Verification

Submitter Full Name: FRANK BASCIANO
Organization: SURGE SUPPRESSION INCORPORATED
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jun 22 15:06:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1236-NFPA 70-2015
Statement: There is inadequate technical substantiation to increase this to 2000 volts at this time.
285.3 Uses Not Permitted.
An SPD device shall not be installed in the following:

1. Circuits over **2000 - 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 power frequency voltage available at the point of application

Statement of Problem and Substantiation for Public Comment

This also relates to comments made to 285.1.

The problem is that the existing ANSI/UL 1449-2014 standard only covers surge protective devices (SPD) up to 1000 Vac in its scope. So, there is no technical standard that can "list" an SPD beyond 1000 Vac. Allowing voltages beyond 1000 without a possible "listing" violates section 285.5 requiring a "listed" device.

As a working group member of UL 1449 and the IEEE PES Surge Protective Device (3.6) committees, there is no technical nor product-safety direction yet established by these standards committees. Therefore, I have even greater reluctance toward the NEC including voltages beyond 1000 Vac. Without a solid product-safety standard to address SPDs between 1000 and 2000 Vac, the NFPA should not change the 285.1

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The fact that the C84.1-2011 standard remains nebulous between 600 and 2400 volts should also cause the NFPA pause as well.

Keeping the maximum voltage at 1000 volts maintains code consistency with the change to up the low voltage range from 600 to 1000 volts.

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<td>Public Comment No. 13-NFPA 70-2015 [Section No. 285.13]</td>
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Committee Statement

| Committee Action: | Rejected but see related SR |
| Resolution:       | SR-1238-NFPA 70-2015 |
| Statement:        | There is inadequate technical substantiation to increase this to 2000 volts at this time. |

Item 3 was revised for consistency with 280.12.
Public Comment No. 987-NFPA 70-2015 [Section No. 285.5]

285.5 Listing.
An SPD shall be a listed and labeled device.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item

Public Input No. 863-NFPA 70-2014 [Section No. 285.5]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
City:
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1237-NFPA 70-2015
Statement: The section numbers were revised to correct the transcription error made in the First Revision draft.

The words "and labeled" were added to indicate that SPDs in the field are listed.
Sections 285.5, 285.6

285.5.6 Listing.
An SPD shall be a listed device.

285.6.7 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.

Statement of Problem and Substantiation for Public Comment

The panel acted to renumber the listing requirement to 285.6 to conform with the Style Manual. This was not reflected in the Draft. See ballot comment from Charles Mello

Related Item
First Revision No. 1243-NFPA 70-2015 [Section No. 285.5]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:30:17 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1237-NFPA 70-2015
Statement: The section numbers were revised to correct the transcription error made in the First Revision draft.

The words "and labeled" were added to indicate that SPDs in the field are listed.
Public Comment No. 13-NFPA 70-2015 [Section No. 285.13]

### Statement of Problem and Substantiation for Public Comment

ANSI/UL1449-2014 includes other "component assemblies" - these should be listed in this section because of confusion in the field over what is meant by "other component types".

### Related Public Comments for This Document

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### Related Item

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### Submitter Information Verification

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<th>FRANK BASCIANO</th>
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### Committee Statement

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<tbody>
<tr>
<td>Resolution:</td>
<td>The various types of surge-protective devices (SPD) are defined in Article 100. Type 4 is defined as a component assembly, which is not suitable for field installation. If the SPD is not listed but is a recognized component, then it is to only be installed by a manufacturer or as a replacement in a listed product.</td>
</tr>
</tbody>
</table>
Paralleled Installations.

AC and DC Conductors shall be permitted to be run in parallel in accordance with the provisions of 310.10(H). The requirement to run all circuit conductors within the same raceway, auxiliary gutter, cable tray, trench, cable, or cord shall apply separately to each portion of the paralleled installation, and the equipment grounding conductors shall comply with the provisions of 250.122. Parallel runs in cable tray shall comply with the provisions of 392.20(C).

Exception: DC Conductors shall be permitted to be arranged as isolated polarity, neutral, and grounded conductor installations and the raceways, auxiliary gutter, cable tray, trench, cable, or cord shall be installed in close proximity.

Exception: AC Conductors installed in nonmetallic raceways run underground shall be permitted to be arranged as isolated phase, neutral, and grounded conductor installations. The raceways shall be installed in close proximity, and the isolated phase, neutral, and grounded conductors shall comply with the provisions of 300.20(B).

Statement of Problem and Substantiation for Public Comment

the panel is right in saying induction is not an issue with DC, however without a reference to allow isolated parallel polarity one can think it is not allowed, 300.3 (B) applies to AC and DC systems. and if induction is not an issue this type of install should also be allowed for DC.

Related Item

Public Input No. 3271-NFPA 70-2014 [Section No. 300.3(B)(1)]
First Revision No. 601-NFPA 70-2015 [Section No. 300.3(B)(1)]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: master
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 04 15:43:58 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Inserting the phrase “AC and DC” at the beginning paragraph in (B)(1) is unnecessary since the requirement in 300.3(B)(1) for compliance with 310.10(H) already accomplishes the submitter’s request since 310.10(H) clearly covers both ac and dc parallel conductor installations. The existing Exception in 300.3(B)(1) applies to ac conductors installed in nonmetallic raceways in underground installations only. Public Input 3271 limited the installation to nonmetallic conduit in underground installations only. The proposed text in Comment 555 permits dc conductors of any type to be installed as isolated polarities in any installation with any type wiring method, cord, or cable, above ground or below ground, without consideration of any dc source, even those that may be interrupted at a rate of 10 Hz to 200 Hz (pulsating dc). The unlimited installations of dc conductors without regard to the source cannot be done without technical substantiation of the effects on insulation and conductor resistance for power sources with pulsating dc.
300.4 Protection Against Physical Damage.

Where subject to physical damage, conductors, raceways, and cables shall be protected.

(A) Cables and Raceways Through Wood Members.

(1) Bored Holes.

In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed through bored holes in joists, rafters, or wood members, holes shall be bored so that the edge of the hole is not less than 32 mm (1 \(\frac{1}{4}\) in.) from the nearest edge of the wood member. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by screws or nails by a listed and marked steel plate(s) or bushing(s) at least 1.6 mm (\(\frac{1}{16}\) in.) thick and of appropriate length and width installed to cover the area of the wiring.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (\(\frac{1}{16}\) in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Informational Note: ANSI/UL 2239 defines requirements for listed steel bushings.

(2) Notches in Wood.

Where there is no objection because of weakening the building structure, in both exposed and concealed locations, cables or raceways shall be permitted to be laid in notches in wood studs, joists, rafters, or other wood members where the cable or raceway at those points is protected against nails or screws by a listed and marked steel plate at least 1.6 mm (\(\frac{1}{16}\) in.) thick and of appropriate length and width, installed to cover the area of the wiring. The steel plate shall be installed before the building finish is applied.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (\(\frac{1}{16}\) in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(B) Nonmetallic-Sheathed Cables and Electrical Nonmetallic Tubing Through Metal Framing Members.

(1) Nonmetallic-Sheathed Cable.

In both exposed and concealed locations where nonmetallic-sheathed cables pass through either factory- or field-punched, cut, or drilled slots or holes in metal members, the cable shall be protected by listed bushings or listed grommets covering all metal edges that are securely fastened in the opening prior to installation of the cable.

Exception: A listed and marked steel plate less than 1.6 mm (\(\frac{1}{16}\) in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(2) Nonmetallic-Sheathed Cable and Electrical Nonmetallic Tubing.

Where nails or screws are likely to penetrate nonmetallic-sheathed cable or electrical nonmetallic tubing, a listed and marked steel sleeve, steel plate, or steel clip not less than 1.6 mm (\(\frac{1}{16}\) in.) in thickness shall be used to protect the cable or tubing. Exception: A listed and marked steel plate less than 1.6 mm (\(\frac{1}{16}\) in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(C) Cables Through Spaces Behind Panels Designed to Allow Access.

Cables or raceway-type wiring methods, installed behind panels designed to allow access, shall be supported according to their applicable articles.
Cables and Raceways Parallel to Framing Members and Furring Strips.

In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed parallel to framing members, such as joists, rafters, or studs, or is installed parallel to furring strips, the cable or raceway shall be installed and supported so that the nearest outside surface of the cable or raceway is not less than 32 mm (1 ⅛ in.) from the nearest edge of the framing member or furring strips where nails or screws are likely to penetrate. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by nails or screws by a listed and marked steel plate, sleeve, or equivalent at least 1 6 mm (4/16 in.) thick.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: For concealed work in finished buildings, or finished panels for prefabricated buildings where such supporting is impracticable, it shall be permissible to fish the cables between access points. Exception No. 3: A listed and marked steel plate less than 1 6 mm (4/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Cables, Raceways, or Boxes Installed in or Under Roof Decking.

A cable, raceway, or box, installed in exposed or concealed locations under metal-corrugated sheet roof decking, shall be installed and supported so there is not less than 38 mm (1 ½ in.) measured from the lowest surface of the roof decking to the top of the cable, raceway, or box. A cable, raceway, or box shall not be installed in concealed locations in metal-corrugated, sheet deck- type roof.

Informational Note: Roof decking material is often repaired or replaced after the initial raceway or cabling and roofing installation and may be penetrated by the screws or other mechanical devices designed to provide "hold down" strength of the waterproof membrane or roof insulating material.

Exception: Rigid metal conduit and intermediate metal conduit shall not be required to comply with 300.4(E).

Cables and Raceways Installed in Shallow Grooves.

Cable- or raceway-type wiring methods installed in a groove, to be covered by wallboard, siding, paneling, carpeting, or similar finish, shall be protected by 1 6 mm (4/16 in.) thick a listed and marked steel plate, sleeve, or equivalent or by not less than 32 mm (1 ⅛ in.) free space for the full length of the groove in which the cable or raceway is installed.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing. Exception No. 2: A listed and marked steel plate less than 1 6 mm (4/16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Insulated Fittings.

Where raceways contain 4 AWG or larger insulated circuit conductors, and these conductors enter a cabinet, box, an enclosure, or a raceway, the conductors shall be protected by an identified fitting providing a smoothly rounded insulating surface, unless the conductors are separated from the fitting or raceway by identified insulating material that is securely fastened in place.

Exception: Where threaded hubs or bosses that are an integral part of a cabinet, box, enclosure, or raceway provide a smoothly rounded or flared entry for conductors.

Conduit bushings constructed wholly of insulating material shall not be used to secure a fitting or raceway. The insulating fitting or insulating material shall have a temperature rating not less than the insulation temperature rating of the installed conductors.

Structural Joints.

A listed expansion/deflection fitting or other approved means shall be used where a raceway crosses a structural joint intended for expansion, contraction or deflection, used in buildings, bridges, parking garages, or other structures.

Statement of Problem and Substantiation for Public Comment

The Panel 3 response to PI 1592 noted a lack of evaluation of protector plates from several manufacturers. This has now been addressed. Video is accessible at the link which demonstrates that several NEC-compliant protector plates from different manufacturers do not stop penetration from self-drilling drywall screws. https://erico.box.com/s/0uvbl0bqapv2j5jh3zaqgyq6ix7r

If the NEC does not require listing of all protector plates, then there is a safety issue that is not being addressed. Self-drilling drywall screws easily penetrate 1/16" thick protector plates made from low carbon steel (like they all are). Please watch the linked video which demonstrates that NEC-compliant protector plates from several manufacturers clearly exhibit poor resistance to penetration. As it stands today, STP2239 and CANENA withdrew the proposal which had already been accepted to define testing requirements for protector plates, likely due to pressure from specific manufacturers. Without a listing requirement in the NEC, there is no motivation for STP2239 to follow through with defining evaluation requirements for all protector plates.

Note that in the video demonstration there is no drywall. Without drywall providing support to the drywall screw, it requires the installer to use less force to prevent the screw from skipping off the protector plate. Therefore, if drywall was present, the screws would penetrate in even less time.
**Related Item**

Public Input No. 1592-NFPA 70-2014 [Section No. 300.4]

<table>
<thead>
<tr>
<th><strong>Submitter Information Verification</strong></th>
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<tbody>
<tr>
<td><strong>Submitter Full Name:</strong> ROBERT JENSEN</td>
</tr>
<tr>
<td><strong>Organization:</strong> DBI-TELECOMMUNICATION INFRASTR</td>
</tr>
<tr>
<td><strong>Affiliation:</strong> BICSI</td>
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<td><strong>Street Address:</strong></td>
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<td><strong>City:</strong></td>
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<td><strong>State:</strong></td>
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<td><strong>Zip:</strong></td>
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<tr>
<td><strong>Submittal Date:</strong> Fri Aug 28 16:07:34 EDT 2015</td>
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</tbody>
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<table>
<thead>
<tr>
<th><strong>Committee Statement</strong></th>
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<tbody>
<tr>
<td><strong>Committee Action:</strong> Rejected</td>
</tr>
<tr>
<td><strong>Resolution:</strong> Section 5.2.4 in UL 2239 only requires that a protector plate or protector bushing provide sufficient resistance to penetration to create ready awareness of the presence of concealed wires and cables through a framing member and a degree of protection from driven screws and nails. Section 5.2.5 requires a protector plate to be made of steel that is a minimum of 1/16 inch thick and must be provided with corrosion protection. Accepting the proposed new text would exclude the use of FHA straps and similar protection used throughout the building industry without technical substantiation for protection of plumbing, electrical, and other building applications where protection from penetration is necessary.</td>
</tr>
</tbody>
</table>
Where subject to physical damage, conductors, raceways, and cables shall be protected.

Informational Note: Physical damage is not expected to occur to concealed wiring methods during normal building operation. Minor damage to a raceway, cable armor or cable insulation does not necessarily violate the integrity of either the contained conductors or the conductors’ insulation.

Statement of Problem and Substantiation for Public Comment

This informational note provides guidance regarding wiring integrity and physical damage. There are many places in the NEC that refer to "physical damage", and concealment behind walls in accordance with installation requirements in the NEC protects wiring from physical damage during normal building operation. Since we have no definition of "physical damage" in the NEC and there have been instances of inspectors rejecting installations with minor scrapes on wiring methods, the second sentence provides guidance for those cases.

The panel stated that "The addition of this Informational Note does not provide any valuable information to the user to determine violation of integrity of the conductors or conductor insulation where damage to the raceway has occurred." This informational note is not intended to provide such information. It is intended to indicate to users of the code that minor blemishes on a wiring method do not necessarily mean that the wiring method must be replaced or that it is incapable of functioning. To clarify that, the word "Visible" was replaced with "Minor" as the first word in the second sentence.

Related Item

Public Input No. 4306-NFPA 70-2014 [Section No. 300.4 [Excluding any Sub-Sections]]

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 05:57:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: The informational note provides guidance to an electrical inspector that minor (superficial) damage to the jacket of a cable is not an issue. The first sentence of the proposed informational note is unnecessary since it states the obvious that physical damage doesn't just occur from normal building operation.
(B) Nonmetallic-Sheathed Cables and Electrical Nonmetallic Tubing Through Metal Framing Members.

(1) Nonmetallic-Sheathed Cable.

In both exposed and concealed locations where nonmetallic-sheathed cables pass through either factory- or field-punched, cut, or drilled slots or holes in metal members, the cable shall be protected by listed bushings or listed grommets covering all metal edges that are securely fastened in the opening prior to installation of the cable.

(2) Nonmetallic-Sheathed Cable, Cables, and Electrical Nonmetallic Tubing.

Where nails or screws are likely to penetrate nonmetallic-sheathed cable or electrical nonmetallic tubing, a steel sleeve, steel plate, or steel clip not less than 1.6 mm (\(1\frac{1}{16}\) in.) in thickness shall be used to protect the cable or tubing.

Exception: A listed and marked steel plate less than 1.6 mm (\(1\frac{1}{16}\) in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Statement of Problem and Substantiation for Public Comment

What generated the original input was the very common use of metallic 'shallow studs' (which are considerably narrower than a standard 3.5” stud) these also have factory field punched holes but do not offer the same protection as a standard 3.5” metal stud. This same code article requires protection for MC cable when running parallel where 11/4” is not met. The same possible short circuit would occur when running horizontal in shallow studs because maintaining 11/4” is not possible. I entered this same proposal in 2014 and the panel stated that it was already required in 300.4. Please look closely and reconsider for at least consistency or remove the protection requirement when running parallel

Related Item

Public Input No. 3789-NFPA 70-2014 [Section No. 300.4(B)]

Submitter Information Verification

Submitter Full Name: james dorsey
Organization: Douglas county
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 23:17:34 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Both Type MC and AC cables have requirements in 330.12(1) and 320.12(1) that preclude installing these cables in locations subject to physical damage. The proposed text in both the Public Input and the Public Comment would be too restrictive since it would require any cables installed in metal framing members to comply with this application. For example, Type MI cable would not require the same protection. As stated in the Panel Statement for Public Input 3789, there has been no indication or technical substantiation that a problem exists and none has been provided by the Public Comment.
Minimum Cover Requirements.
Direct-buried cable or conduit or other raceways shall be installed to meet the minimum cover requirements of Table 300.5.

<table>
<thead>
<tr>
<th>Location of Wiring Method or Circuit</th>
<th>Column 1 Direct Burial Cables or Conductors</th>
<th>Column 2 Rigid Metal Conduit or Intermediate Metal Conduit</th>
<th>Column 3 Nonmetallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceways</th>
<th>Column 4 Residential Branch Circuits Rated 120 Volts or Less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes</th>
<th>Column 5 Circuits for Control of Irrigation and Landscape Lighting Limited to Not More Than 30 Volts and Installed with Type UF or in Other Identified Cable or Raceway</th>
</tr>
</thead>
<tbody>
<tr>
<td>All locations not specified below</td>
<td>600 mm</td>
<td>24 in.</td>
<td>150 mm</td>
<td>6 in.</td>
<td>450 mm</td>
</tr>
<tr>
<td>In trench below 50 mm (2 in.) thick concrete or equivalent</td>
<td>450 mm</td>
<td>18 in.</td>
<td>150 mm</td>
<td>6 in.</td>
<td>300 mm</td>
</tr>
<tr>
<td>Under a building, provided the slab on grade is not being used as a parking lot</td>
<td>0 mm</td>
<td>0 in.</td>
<td>0 mm</td>
<td>0 in.</td>
<td>0 mm</td>
</tr>
<tr>
<td>Under minimum of 102 mm (4 in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 152 mm (6 in.) beyond the underground installation</td>
<td>450 mm</td>
<td>18 in.</td>
<td>100 mm</td>
<td>4 in.</td>
<td>100 mm</td>
</tr>
<tr>
<td>Under streets, highways, roads, alleys, driveways, and parking lots</td>
<td>600 mm</td>
<td>24 in.</td>
<td>600 mm</td>
<td>24 in.</td>
<td>600 mm</td>
</tr>
<tr>
<td>One- and two-family dwelling driveways and outdoor parking areas, and used only for dwelling-related purposes</td>
<td>450 mm</td>
<td>18 in.</td>
<td>450 mm</td>
<td>18 in.</td>
<td>450 mm</td>
</tr>
<tr>
<td>In or under airport runways, including adjacent areas where trespassing prohibited</td>
<td>450 mm</td>
<td>18 in.</td>
<td>450 mm</td>
<td>18 in.</td>
<td>450 mm</td>
</tr>
</tbody>
</table>

A lesser depth shall be permitted where specified in the installation instructions of a listed low voltage lighting system.

Notes:
1. Cover is defined as the shortest distance in millimeters (inches) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.
2. Raceways approved for burial only where concrete encased shall require concrete envelope not less than 50 mm (2 in.) thick.
3. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.
4. Where one of the wiring method types listed in Columns 1 through 3 is used for one of the circuit types in Columns 4 and 5, the shallowest depth of burial shall be permitted.
5. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal raceway, or a nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of
Concrete extending down to rock.

Statement of Problem and Substantiation for Public Comment

Webster's Definition of a "parking lot": an area, usually divided into individual spaces, intended for parking motor vehicles. This additional language trying to declare that it is still a parking lot was rejected with the panel statement declaring that 24" are required in some cases but not all depending on the construction of the slab. I reach out to the inspector members and try and explain to a contractor that Yes we are under a building but 24" is required where on the 2nd level of parking there is only 6" of concrete and it is allowed to place conduits in it. Adding this language or an informational note would allow for consistency. Is it under a building or is it under a parking lot??? thank you for the consideration

Related Item

Public Input No. 2923-NFPA 70-2014 [Section No. 300.5(A)]

Submitter Information Verification

Submitter Full Name: James Dorsey
Organization: Douglas County
Street Address:  
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 10:57:58 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The Panel reaffirms the Public Input Statement as follows: “Adding an exclusion for under a building where the lower level is not a parking lot is already in Table 300.5 where the burial depth would be zero inches for most building at grade level without a parking area at grade level and 24 inches under a building with parking at grade level due to the flexing of the floor when a vehicle is driving over that area of the floor. There may be mitigating circumstances where the floor at grade is constructed using pre-stress cables or other construction methods to ensure the floor would not flex where vehicles are driving over it.” Building and slab on grade construction, such as post tension slabs, and similar architectural designs can certainly mitigate or eliminate the problems with slabs and underground raceway flexing. The structural engineer and plan review engineers can and should make the determination on whether a design will permit electrical raceways to be installed at lesser depths that shown in the Table.
Public Comment No. 1219-NFPA 70-2015 [Section No. 300.5(D)(3)]

(3) Service Conductors.

Underground service conductors and feeders, that are not encased in concrete and that are buried 450 mm (18 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the underground installation.

Statement of Problem and Substantiation for Public Comment

Please reconsider the action taken at the public input stage. This is a potential safety issue for electrical workers.

Note that the public comment restricts this to feeders from the original public input.

The NEC Handbook states that this ribbon is not required for feeders because, unlike service conductors, these have short circuit and overload protection. Throughout the NEC the code goes to great lengths to provide physical protection of electrical conductors so it's difficult to find logic with the reason given in the NEC Handbook. A warning ribbon installed at the proper height above the feeders provides a higher degree of safety for electrical workers. It also can be a great value for so little cost considering repairs and down time in the event these conductors are hit. It is a sensible precaution in preventing ground faults or short circuits.

Related Item

Public Input No. 1133-NFPA 70-2014 [Section No. 300.5(D)(3)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 13:39:35 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This Public Comment did not provide any technical substantiation for adding a warning ribbon for all underground feeders. Feeders, just like branch circuits, can be 15 amperes and higher with both feeders and branch circuits protected against short circuits and ground faults with appropriate overcurrent protective devices, unlike service conductors that are only protected at their load side against overload. The original purpose of the ribbon installation for directly buried service conductors has not changed since the text was inserted into the 1999 NEC. Cable and conductor location companies and devices are readily available to help determine where there are underground directly buried conductors. Section 130.9 of NFPA 70E further states “before excavation starts where there exists a reasonable possibility of contacting electrical lines or equipment, the employer shall take the necessary steps to contact the appropriate owners or authorities to identify and mark the location of the electrical lines or equipment. When it has been determined that a reasonable possibility of contacting electrical lines or equipment exists, appropriate safe work practices and PPE shall be used during the excavation.”
Public Comment No. 1392-NFPA 70-2015 [Section No. 300.5(D)(3)]

(3) Service Conductors.
Underground service conductors and feeders, that are not encased in concrete and that are buried 450 mm (18 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the underground installation.

Statement of Problem and Substantiation for Public Comment

This language would provide a very low cost to an installation that could save major costs to equipment that may be damaged by digging into underground feeders. This minimum installation provides a greater degree of safety to property and electrical equipment.

Related Item
Public Input No. 1133-NFPA 70-2014 [Section No. 300.5(D)(3)]

Submitter Information Verification

Submitter Full Name: Susan Scearce
Organization: City of Humboldt, TN
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 09:27:53 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This Public Comment did not provide any technical substantiation for adding a warning ribbon for all underground feeders. Feeders, just like branch circuits, can be 15 amperes and higher with both feeders and branch circuits protected against short circuits and ground faults with appropriate overcurrent protective devices, unlike service conductors that are only protected at their load side against overload. The original purpose of the ribbon installation for directly buried service conductors has not changed since the text was inserted into the 1999 NEC. Cable and conductor location companies and devices are readily available to help determine where there are underground directly buried conductors. Section 130.9 of NFPA 70E further states “before excavation starts where there exists a reasonable possibility of contacting electrical lines or equipment, the employer shall take the necessary steps to contact the appropriate owners or authorities to identify and mark the location of the electrical lines or equipment. When it has been determined that a reasonable possibility of contacting electrical lines or equipment exists, appropriate safe work practices and PPE shall be used during the excavation.”
(3) Service Conductors.

Underground service conductors and feeder conductors that are not encased in concrete and that are buried 450 mm (18 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the underground installation.

Statement of Problem and Substantiation for Public Comment

As an electrical inspector on a military base, we constantly see underground installations damaged by new construction cutting into existing raceways/cables. We almost NEVER see that damage occur when the ribbon is installed, only on existing installations where the ribbon is not required. Frankly, the cost of the ribbon is negligible and the benefit of not damaging the existing circuits would far outweigh the minimal cost. We have a LOT of raceways underground around here. Digging is almost always an adventure, even though we "locate" the existing stuff before we start. That science is helpful, but by no means absolute. I'd like to see the practice of installing the ribbon applied to EVERY underground installation (18 inches and deeper), including branch circuits, but for now, I'm suggesting that we add feeders to the requirement.

Related Item

Public Input No. 1133-NFPA 70-2014 [Section No. 300.5(D)(3)]

Submitter Information Verification

Submitter Full Name: ED SITTON
Organization: FT CAMPBELL KY DPW
Affiliation: Electrical Inspector
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 09:40:13 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This Public Comment did not provide any technical substantiation for adding a warning ribbon for all underground feeders. Feeders, just like branch circuits, can be 15 amperes and higher with both feeders and branch circuits protected against short circuits and ground faults with appropriate overcurrent protective devices, unlike service conductors that are only protected at their load side against overload. The original purpose of the ribbon installation for directly buried service conductors has not changed since the text was inserted into the 1999 NEC. Cable and conductor location companies and devices are readily available to help determine where there are underground directly buried conductors. Section 130.9 of NFPA 70E further states "before excavation starts where there exists a reasonable possibility of contacting electrical lines or equipment, the employer shall take the necessary steps to contact the appropriate owners or authorities to identify and mark the location of the electrical lines or equipment. When it has been determined that a reasonable possibility of contacting electrical lines or equipment exists, appropriate safe work practices and PPE shall be used during the excavation."
(4) Enclosure or Raceway Damage.
Where the enclosure or raceway is subject to physical damage, the conductors shall be installed in steel (not aluminum) electrical metallic tubing, rigid metal conduit, intermediate metal conduit, RTRC-XW, Schedule 80 PVC conduit, or equivalent.

Statement of Problem and Substantiation for Public Comment

Aluminum EMT has a much lower crush/bend rating than steel EMT, and therefore should not be considered as a viable method of protection of conductors against damage.

Related Item
First Revision No. 606-NFPA 70-2015 [Section No. 300.5(D)(4)]

Submitter Information Verification

Submitter Full Name: WILLIAM NOACK
Organization: WLN ENTERPRISES
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 16:49:40 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Section 358.12(1) does not differentiate between steel EMT and aluminum EMT as to the limitation and restriction of severe physical damage. Both types of EMT will withstand a certain amount of physical damage but not severe physical damage. Care must be taken with the use of aluminum EMT in underground applications. Compliance with 300.6 for extra corrosion protection may be necessary in certain soil conditions.
Public Comment No. 99-NFPA 70-2015 [Section No. 300.7(B)]

(B) Expansion Fittings.
Raceways shall be provided with expansion fittings or expansion/deflection fittings where necessary to compensate for thermal expansion and contraction.

Informational Note: Table 352.44 and Table 355.44 provide the expansion information for polyvinyl chloride (PVC) and for reinforced thermosetting resin conduit (RTRC), respectively. A nominal number for steel conduit can be determined by multiplying the expansion length in Table 352.44 by 0.20. The coefficient of expansion for steel electrical metallic tubing, intermediate metal conduit, and rigid metal conduit is $1.170 \times 10^{-5}$ (0.0000117 mm per mm of conduit for each °C in temperature change) [$0.650 \times 10^{-5}$ (0.0000065 in. per inch of conduit for each °F in temperature change)].

A nominal number for aluminum conduit and aluminum electrical metallic tubing can be determined by multiplying the expansion length in Table 352.44 by 0.40. The coefficient of expansion for aluminum electrical metallic tubing and aluminum rigid metal conduit is $2.34 \times 10^{-5}$ (0.0000234 mm per mm of conduit for each °C in temperature change) [1.30 $\times 10^{-5}$ (0.000013 in. per inch of conduit for each °F in temperature change)].

Statement of Problem and Substantiation for Public Comment

Reconsider Resolved Public Input #1899 and revise 300.7(B). A standard expansion fitting works when the raceways is installed a straight axial alignment whereas the expansion/deflection fitting accommodates for the raceway's thermal expansion or contraction when the raceways are off-set or misaligned. The proposed language makes it clear to inspectors, designers and contractors that expansion/deflection fittings are acceptable to be used with a raceways to address thermal expansion and contraction.

Related Item

Public Input No. 1899-NFPA 70-2014 [Section No. 300.7(B)]

Submitter Information Verification

Submitter Full Name: DAVID KENDALL
Organization: THOMAS BETTS CORPORATION
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 01 09:19:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-602-NFPA 70-2015
Statement: The revised text makes it clear to inspectors, designers, and contractors that expansion-deflection and deflection fittings are acceptable to be used with raceways to address thermal expansion, deflection, and contraction. Revising the text also requires a revision of the title to this subsection.
Public Comment No. 1641-NFPA 70-2015 [Section No. 300.9]

300.9 Raceways in Wet Locations Abovegrade.
Where raceways are installed in wet locations abovegrade, the interior of these raceways shall be considered to be a wet location unless all fittings and enclosures are listed watertight. Insulated conductors and cables installed in raceways in wet locations abovegrade without all fittings and enclosures listed watertight shall comply with 310.10(C).

Statement of Problem and Substantiation for Public Comment

I submitted PI 627 and PI 628 and both PIs were resolved. I read the committee statement and wanted to submit a public comment however the system will not let me relate this public comment to either of my PIs. Hopefully this will work and CMP 3 will be able to respond to my public comment. This comment applies to 300.9 and 300.38.

When I submitted PI 627 and PI 628 I used the term "raintight" and that was an error. I should have used the term "watertight".

Sections 300.9 and 300.38 as currently written do not recognize material listed as "watertight". Installers are required to use fittings and enclosures listed for use in wet locations when installing raceway systems on the exterior of a building. The UL White Book states "For equipment designated watertight the equipment is so constructed that water does not enter the enclosure when subjected to a stream of water." The definition in Article 100 for watertight is "constructed so that moisture will not enter the enclosure under specified test conditions." The NEC must recognize that a listed product will perform to the standard for which it was tested. Throughout the NEC are listing requirements and AHJs put their faith in qualified electrical testing laboratories that the listed products will perform as tested. The interior of raceways installed in wet locations above grade utilizing listed watertight fittings and enclosures cannot be considered a wet location.

Related Item

Public Input No. 640-NFPA 70-2014 [Section No. 300.9]

Submitter Information Verification

Submitter Full Name: ROBERT JONES
Organization: IEC Texas Gulf Coast

Committee Statement

Committee Action: Rejected
Resolution: The use of "raintight" and "watertight" is really not the issue here, however, the marking on a package of fittings for raintight, wet location, or the equivalent on the carton indicates suitability for use where directly exposed to rain. The issue here is that raceways installed above grade may have water entry from outside or may have a difference of temperature, either during the day or night, such that the humidity in the area may cause moisture to develop on the conductors and within the raceway. Section 312.2 covering enclosures that states as follows: "In damp or wet locations, surface-type enclosures within the scope of this article shall be placed or equipped so as to prevent moisture or water from entering and accumulating within the cabinet or cutout box, and shall be mounted so there is at least 6-mm (1/4-in.) airspace between the enclosure and the wall or other supporting surface. Enclosures installed in wet locations shall be weatherproof. For enclosures in wet locations, raceways or cables entering above the level of uninsulated live parts shall use fittings listed for wet locations.; and 314.15 for boxes in damp or wet locations that states the following: "In damp or wet locations, boxes, conduit bodies, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the box, conduit body, or fitting. Boxes, conduit bodies, and fittings installed in wet locations shall be listed for use in wet locations. Approved drainage openings not larger than 6 mm (1/4 in.) shall be permitted to be installed in the field in boxes or conduit bodies listed for use in damp or wet locations. For installation of listed drain fittings, larger openings are permitted to be installed in the field in accordance with manufacturer’s instructions." The common application within each one of the previous examples in the existing NEC illustrates that fittings, enclosures, and raceways may or will have water entry from external sources or internal sources, such as condensation; hence, the reason 300.9 requires compliance with 310.10(C) for a wet location. Section 8.7.1 of UL 514B provides test results for testing fittings designed for use in wet locations with the following result: "As a result of the test, no amount of water greater than 0.1 ml or 0.1 g shall enter the fitting."
300.11 Securing and Supporting.

(A) Secured in Place.

Raceways, cable assemblies, boxes, cabinets, and fittings shall be securely fastened in place.

(B) Wiring Systems Installed Above Suspended Ceilings.

Support wires that do not provide secure support shall not be permitted as the sole support. Support wires and associated fittings that provide secure support and that are installed in addition to the ceiling grid support wires shall be permitted as the sole support. Where independent support wires are used, they shall be secured at both ends. Cables and raceways shall not be supported by ceiling grids.

(1) Fire-Rated Assemblies.

Wiring located within the cavity of a fire-rated floor-ceiling or roof-ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means from those that are part of the fire-rated design.

Exception: The ceiling support system shall be permitted to support wiring and equipment that have been tested as part of the fire-rated assembly.

Informational Note: One method of determining fire rating is testing in accordance with ANSI/ASTM E119-2014, Method for Fire Tests of Building Construction and Materials.

(2) Non–Fire-Rated Assemblies.

Wiring located within the cavity of a non–fire-rated floor-ceiling or roof-ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means.

Exception: The ceiling support system shall be permitted to support branch-circuit wiring and associated equipment where installed in accordance with the ceiling system manufacturer’s instructions.

(C) Raceways Used as Means of Support.

Raceways shall be used only as a means of support for other raceways, cables, or nonelectrical equipment under any of the following conditions:

(1) Where the raceway or means of support is identified as a means of support

(2) Where the raceway contains power supply conductors for electrically controlled equipment and is used to support Class 2 circuit conductors or cables that are solely for the purpose of connection to the equipment control circuits

(3) Where the raceway is used to support boxes or conduit bodies in accordance with 314.23 or to support luminaires in accordance with 410.36(E)

(D) Cables Not Used as Means of Support.

Cable wiring methods shall not be used as a means of support for other cables, raceways, or nonelectrical equipment.

(E) Metallic Means of Support Above Egress

Metallic means of support for flexible conduit and conductors shall be used in spaces above egress, which includes doorways, hallways, stairways, corridors, passageways, lobbies, landings, and equivalent spaces.

Informational note: Nonmetallic supports exhibit significant weakening and failure during fires which can affect the safety of occupants and emergency personnel entering and exiting buildings due to entanglement in fallen cable.

Statement of Problem and Substantiation for Public Comment

Emergency responders and building occupant safety is at risk during building fires because people can become entangled and trapped in cabling which has fallen out of molten or failing plastic supports/raceway. Even if people can free themselves from fallen cabling, this takes time which is otherwise needed to exit the building or fulfill the objectives of emergency personnel. The frequency of emergency responders becoming trapped in fallen cabling has become so common that firefighters have created and publicly distributed training videos on how to escape in these situations (http://www.fireengineering.com/topics/m/video/36926837/the-quick-release-method.htm?q=cable+entanglement) [1]. Additionally, the Greater Tucson Fire Foundation raised financial support in 2011 to purchase cable cutters for hundreds of Tucson, Arizona firefighters so that they are equipped to deal with cable entanglement [2].

The ideal scope of this requirement should include all wiring methods which are susceptible to falling during a fire. This includes insulated conductors, flexible metal conduit, and nonmetallic raceways with plastic supports. It should include power conductors, signaling conductors, fire alarm cables, and communications circuits. Although CMP 3 can only address a portion of the relevant scope,
I urge you to address what you can within the scope of 300.11 by accepting the intent of this proposal.

Since CMP 3 review of Public Input 4649 in January 2015, BS 7671 (UK Wiring Regulations) was published with Amendment 3 which requires metal supports for cables installed in escape routes [3, 4] and went into effect on July 1, 2015. This requirement is no longer limited only to fire alarm systems, but now includes all wiring methods.

Bibliography:


**Related Public Comments for This Document**

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 1677-NFPA 70-2015 [Section No. 725.24]</td>
<td></td>
</tr>
<tr>
<td>Public Comment No. 1685-NFPA 70-2015 [Section No. 760.24(A)]</td>
<td></td>
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</table>

**Related Item**

Public Input No. 4649-NFPA 70-2014 [New Section after 300.11]

**Submitter Information Verification**

Submitter Full Name: WARD JUDSON
Organization: ERICO INTERNATIONAL CORP
Street Address: City: State: Zip: Submittal Date: Fri Sep 25 15:56:27 EDT 2015

**Committee Statement**

Committee Action: Rejected but held

Resolution: This should be addressed as a global issue within the NEC since it will affect many different articles throughout the NEC, such as many of the raceway and cable requirements in Chapter 3, Chapter 7, and Chapter 8 so it can only be dealt with initially by the NEC Correlating Committee. Panel 3 requests that the NEC Correlating Committee appoint a task group to address this issue before the next NEC cycle and also refer this to the Fire Protection Research Foundation for further research.
Fire-Rated Assemblies.

Wiring located within the cavity of a fire-rated floor-ceiling or roof-ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means from those that are part of the fire-rated design.

Exception: The ceiling support system shall be permitted to support wiring and equipment that have been tested as part of the fire-rated assembly.


Statement of Problem and Substantiation for Public Comment

Referenced correct SDO and updated edition.

Related Item
First Revision No. 610-NFPA 70-2015 [Section No. 300.11]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 06 11:18:12 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-603-NFPA 70-2015
Statement: The ANSI/ASTM E119 has been changed from 2014 to 2015.
Public Comment No. 801-NFPA 70-2015 [Section No. 300.11(B)(1)]

(1) Fire-Rated Assemblies.

Wiring located within the cavity of a fire-rated floor-ceiling or roof-ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means from those that are part of the fire-rated design.

Exception: The ceiling support system shall be permitted to support wiring and equipment that have been tested as part of the fire-rated assembly.

Informational Note: One method of determining fire rating is testing in accordance with ANSI/ASTM E119-2014, Method for Fire Tests of Building Construction and Materials.

Statement of Problem and Substantiation for Public Comment

Standard date update

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Comment No. 800-NFPA 70-2015 [Section No. 110.31(A)(5)]</td>
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</tr>
<tr>
<td>Public Comment No. 803-NFPA 70-2015 [Section No. 450.21(B)]</td>
<td></td>
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<tr>
<td>Public Comment No. 804-NFPA 70-2015 [Section No. 450.42]</td>
<td></td>
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Related Item

Public Input No. 1728-NFPA 70-2014 [Section No. 110.31(A)(5)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Sep 20 19:38:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-603-NFPA 70-2015
Statement: The ANSI/ASTM E119 has been changed from 2014 to 2015.
### 300.12 Mechanical Continuity — Raceways and Cables.

**A** Raceways and Cables. Raceways, cable armors, and cable sheaths shall be continuous between cabinets, boxes, fittings, or other enclosures or outlets.

*Exception No. 1:* Short sections of raceways used to provide support or protection of cable assemblies from physical damage shall not be required to be mechanically continuous.

*Exception No. 2:* Raceways and cables installed into the bottom of open bottom equipment, such as switchboards, motor control centers, and floor or pad-mounted transformers, shall not be required to be mechanically secured to the equipment.

**B** Reducing Washers. Metal reducing washers are permitted to be used with metal enclosures having a minimum thickness of 0.053 in. for non-service conductors only. Nonconductive coatings (such as paint, lacquer, and enamel) on metallic enclosures shall be removed from contact surfaces to ensure good electrical continuity as required by 250.12. Reducing washers are permitted to be installed in enclosures provided with concentric or eccentric knockouts, only after all of the concentric and eccentric rings have been removed.

*Exception:* Those enclosures containing concentric and eccentric knockouts that have been certified for bonding purposes shall be permitted to be used with reducing washers without all knockouts being removed.

### Statement of Problem and Substantiation for Public Comment

Reducing washers are commonly used in electrical installations and their installation should be covered in the NEC. At the present time the limited installation rules are in the UL White book under Outlet Bushings and Fittings (QCRV). This rule should be located here in Article 300 as the use of reducing washers is common to every cable and conduit wiring method that is connected to an enclosure as covered throughout the remainder of Chapter 3. Other articles such as Article 250 deal with the installation of reducing washers in a limited way.

The general requirement should be here in Article 300.

### Related Item

Public Input No. 4748-NFPA 70-2014 [Section No. 300.12]

### Submitter Information Verification

**Submitter Full Name:** Phil Simmons  
**Organization:** Simmons Electrical Services  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Wed Sep 02 17:35:43 EDT 2015

### Committee Statement

<table>
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<tr>
<th>Committee Action:</th>
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<tbody>
<tr>
<td>Resolution:</td>
<td>The text introduced in this Public Comment is already adequately covered in Article 250, such as 250.12, 250.92, and 250.97 so insertion into Article 300 is unnecessary and does not provide clarity.</td>
</tr>
</tbody>
</table>
(A) Spacing Intervals — Maximum.

Conductors in vertical raceways shall be supported if the vertical rise exceeds the values in Table 300.19(A). At least one support method shall be provided for each conductor or cable assembly at the top of the vertical raceway or as close to the top as practical. Intermediate supports shall be provided as necessary to limit supported conductor lengths to not greater than those values specified in Table 300.19(A).

Exception: Steel wire armor cable shall be supported at the top of the riser with a cable support that clamps the steel wire armor. A safety device shall be permitted at the lower end of the riser to hold the cable in the event there is slippage of the cable in the wire-armored cable support. Additional wedge-type supports shall be permitted to relieve the strain on the equipment terminals caused by expansion of the cable under load.

<table>
<thead>
<tr>
<th>Conductor Size</th>
<th>Support of Conductors in Vertical Raceways</th>
<th>Aluminum or Copper-Clad Aluminum</th>
<th>Copper</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 AWG through 8 AWG</td>
<td>Not greater than</td>
<td>30 m/ft</td>
<td>30 m/ft</td>
</tr>
<tr>
<td>6 AWG through 1/0 AWG</td>
<td>Not greater than</td>
<td>60 m/ft</td>
<td>30 m/ft</td>
</tr>
<tr>
<td>2/0 AWG through 4/0 AWG</td>
<td>Not greater than</td>
<td>55 m/ft</td>
<td>25 m/ft</td>
</tr>
<tr>
<td>Over 4/0 AWG through 350 kcmil</td>
<td>Not greater than</td>
<td>41 m/ft</td>
<td>18 m/ft</td>
</tr>
<tr>
<td>Over 350 kcmil through 500 kcmil</td>
<td>Not greater than</td>
<td>36 m/ft</td>
<td>15 m/ft</td>
</tr>
<tr>
<td>Over 500 kcmil through 750 kcmil</td>
<td>Not greater than</td>
<td>28 m/ft</td>
<td>12 m/ft</td>
</tr>
<tr>
<td>Over 750 kcmil</td>
<td>Not greater than</td>
<td>26 m/ft</td>
<td>11 m/ft</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

A cable assembly is multiple conductors grouped together (usually by plexing) without an overall covering. Deleting "cable assembly" from the revised language ensures that each individual conductor is supported at the top of a vertical raceway, which can be accomplished by gland type fittings or other identified means of support.

Related Item
First Revision No. 612-NFPA 70-2015 [Section No. 300.19(A)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 22:38:15 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-604-NFPA 70-2015
Statement: Deleting cable assembly ensures that each individual conductor is supported at the top of a vertical raceway.
Public Comment No. 580-NFPA 70-2015 [Section No. 300.20(B)]

(B) Individual Conductors.

Where a single conductor carrying alternating current passes through metal with magnetic properties, the inductive effect shall be minimized by (1) cutting slots in the metal between the individual holes through which the individual conductors pass or (2) passing all the conductors in the circuit through an insulating wall sufficiently large for all of the conductors of the circuit.

Exception: In the case of circuits supplying vacuum or electric-discharge lighting systems, constant current regulator outputs used for airfield lighting series circuits, or signs or X-ray apparatus, the currents carried by the conductors are so small that the inductive heating effect can be ignored where these conductors are placed in metal enclosures or pass through metal.

Informational Note: Because aluminum is not a magnetic metal, there will be no heating due to hysteresis; however, induced currents will be present. They will not be of sufficient magnitude to require grouping of conductors or special treatment in passing conductors through aluminum wall sections.

Statement of Problem and Substantiation for Public Comment

The modification to the exception is necessary due to the way the series circuit conductors are routed through the light bases on the airfield.

A typical series circuit installation will have one leg of the circuit enter the galvanized steel light base on one side (let's say at 0 degrees), this conductor will connect to the isolation transformer. The other leg of the isolation transformer will connect to another conductor. This second conductor will exit the galvanized steel light base on the opposite side of the light base (at 180 degrees). The primary conductor enters and exits the galvanized steel enclosure (light base) through separate/distinct openings. No slots are cut between the openings. No effort or attempt is made to address inductive heating.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Comment No. 579-NFPA 70-2015 [New Section after 392.10(D)]</td>
<td>additional explanation of typical airfield lighting series circuit.</td>
</tr>
<tr>
<td>Related Item</td>
<td></td>
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<tr>
<td>Public Input No. 2739-NFPA 70-2014 [New Section after 392.10(D)]</td>
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Submitter Information Verification

Submitter Full Name: Carl Johnson II

Organization: AVCON, Inc.

Affiliation: none

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 09 11:06:50 EDT 2015

Committee Statement

Committee Action: Rejected

Resolution: Public Input 2739, as referenced in the related items, doesn't appear to have been accepted as a First Revision. Article 392 applies to cable tray systems and this would seem to be more adequately addressed in 310.10(F), Exception No. 2 rather than in 392.10(D) as indicated in Related Comments for this Document at the bottom of the Public Comment 580. Article 300 contains general requirements for wiring methods. Specific wiring methods should be inserted in the appropriate Article in Chapter 3.
Public Comment No. 1788-NFPA 70-2015 [Section No. 300.22(B)]

(B) Ducts Specifically Fabricated for Environmental Air.

Equipment, devices, and the wiring methods specified in this section shall be permitted within such ducts only if necessary for the direct action upon, or sensing of, the contained air. Where equipment or devices are installed and illumination is necessary to facilitate maintenance and repair, enclosed gasketed-type luminaires shall be permitted.

Only wiring methods consisting of Type MI cable without an overall nonmetallic covering, Type MC cable employing a smooth or corrugated impervious metal sheath without an overall nonmetallic covering, electrical metallic tubing, intermediate metal conduit, or rigid metal conduit without an overall nonmetallic covering shall be installed in ducts specifically fabricated to transport environmental air. Flexible metal conduit shall be permitted, in lengths not to exceed 1.2 m (4 ft), to connect physically adjustable equipment and devices permitted to be in these fabricated ducts. The connectors used with flexible metal conduit shall effectively close any openings in the connection.

Exception: Wiring methods and cabling systems, listed for use in other spaces used for environmental air (plenums), shall be permitted to be installed in ducts specifically fabricated for environmental air-handling purposes under the following conditions:

1. The wiring methods or cabling systems shall be permitted only if necessary to connect to equipment or devices associated with the direct action upon or sensing of the contained air, and
2. The total length of such wiring methods or cabling systems shall not exceed 1.2 m (4 ft).

Statement of Problem and Substantiation for Public Comment

The Correlating Committee also directs that FR 3309 be referred to Panel 3 for comment, in regards to the limited distance in 300.22(B).

Related Item

First Revision No. 3309-NFPA 70-2015 [Section No. 640.3(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:53:32 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The Panel reviewed FR 3309 and proposes that Panel 12 consider revisions to 640.3 (B).
(3) Equipment.

Electrical equipment with a metal enclosure, or electrical equipment with a nonmetallic enclosure listed for use within an air-handling space and having low smoke and heat release properties, and associated wiring material suitable for the ambient temperature shall be permitted to be installed in such other space unless prohibited elsewhere in this Code.

Informational Note: One method to determine low smoke and heat release properties is that the equipment exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100kW or less when tested in accordance with ANSI/UL 2043-2013, Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

Exception: Integral fan systems shall be permitted where specifically identified for use within an air-handling space.

Statement of Problem and Substantiation for Public Comment

Referenced current edition of UL 2043.

Related Item
First Revision No. 645-NFPA 70-2015 [Section No. 300.22(C)(3)]
First Revision No. 3309-NFPA 70-2015 [Section No. 640.3(B)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 06 23:32:13 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-605-NFPA 70-2015
Statement: This updates the informational note to the latest version of UL 2043. ANSI has been retained in the title of the UL Standard.
300.37 Aboveground Wiring Methods.

Aboveground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in electrical metallic tubing, in RTRC and PVC conduit, in cable trays, in auxiliary gutters, as busways, as cablebus, in other identified raceways, or as exposed runs of metal-clad cable suitable for the use and purpose. In locations accessible to qualified persons only, exposed runs of Type MV cables, exposed runs of FAA L-824 cables, bare conductors, and bare busbars shall also be permitted. Busbars shall be permitted to be either copper or aluminum.

Informational Note: Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>DSCN2209.JPG</td>
<td>Photo of a L-829 constant current regulator (CCR) with output L-824 cables routed in free air to underground duct run powering airfield lighting series circuit. Exposed L-824 cables have L-823 connectors installed to facilitate the quick replacement of the power source. An adjacent CCR can be quickly and easily connected to the field circuit.</td>
<td></td>
</tr>
<tr>
<td>DSCN2188.JPG</td>
<td>Photo of FAA owned Runway Visual Range cabinet utilizing exposed runs of L-824 cable. The FAA also allows exposed runs of L-824 on FAA owned equipment.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

I strongly support PI 2762 and request the CMP reconsider the PI.

Based upon my research, prior to 2004 and the first issue of FAA Advisory Circular 150/5340-30 there was no FAA prohibition to the practice of installing L-824 cable in free air within the airfield lighting vault. It appears the FAA requirements were revised to comply with the NEC at that time.

Historically many airfield lighting vaults were powered by 4,160 volt and 2,400 volt systems. Many of these installations were powered by distribution cable mounted on insulators attached to the airfield lighting vault walls. A cable tap protected by a fused cut-out powered the constant current regulator. Thankfully, this practice was also eliminated by the new AC in 2004.

The effort to bring harmony between the FAA Advisory Circulars and the NEC created an unexpected consequence.

The electrical characteristics of an airfield lighting series (current) circuit are significantly different than those of a conventional parallel (voltage) circuit we are all familiar with.

The practice of routing L-824 cable in free air (in locations accessible to qualified persons only) has been used safely and successfully throughout the industry to expedite troubleshooting and repair of airfield lighting circuits.

Related Item

Public Input No. 2762-NFPA 70-2014 [Section No. 300.37]

Submitter Information Verification

Submitter Full Name: CARL JOHNSON II
Organization: AVCON INC
Affiliation: none
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Jul 03 17:46:24 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-624-NFPA 70-2015
| Statement: | This revision recognizes that these cables are often installed exposed within a restricted airport lighting vault to facilitate easy access for modifications and reconnections during emergency situations. |
300.37 Aboveground Wiring Methods.

Aboveground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in electrical metallic tubing, in RTRC and PVC conduit, in cable trays, in auxiliary gutters, as busways, as cablebus, in other identified raceways, or as exposed runs of metal-clad cable suitable for the use and purpose. In locations accessible to qualified persons only, exposed runs of Type MV cables, exposed runs of FAA L-824 cables, bare conductors, and bare busbars shall also be permitted. Busbars shall be permitted to be either copper or aluminum.

Informational Note: Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Additional Proposed Changes

<table>
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<th>Description</th>
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</thead>
<tbody>
<tr>
<td>DSC05118.JPG</td>
<td>L-824 Cable installed in hand hole. Demonstrates the harsh environment that L-824 cable is designed to survive.</td>
</tr>
<tr>
<td>DSC05530.JPG</td>
<td>L-824 Cable installed in manhole. Demonstrates the harsh environment that L-824 cable is designed to survive.</td>
</tr>
<tr>
<td>DSCN1369.JPG</td>
<td>L-824 Cable installed exposed in airfield lighting vault (accessible to qualified persons only). Demonstrates the controlled environment of an airfield lighting vault.</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

L-824 cable is designed to withstand a very harsh environment of direct earth burial and installation underground in raceways, manholes, hand holes and light bases. Please see photos attached to this Public Comment.

It is an extremely rare occurrence for the L-824 cable to fail in the controlled environment of an airfield lighting vault. In my 28 years of airfield lighting experience, I am aware of only two cable failures. Both of these L-824 cable failures were caused by the breakdown of the equipment to which the L-824 cable was connected.

Airfield lighting series circuits are current circuits; where a short circuit is considered as no load. There is virtually no arc-flash hazard involved on the output of a constant current regulator.

The constant current regulator output current is designed to stay fixed at the FAA mandated values of 6.6 amps (±0.1 A) or 20 amps (±0.3 A). The constant current regulator (CCR) output overcurrent protective device will not trip due to a change in series circuit resistance, shorts, or grounds in the airfield lighting circuit. The CCR recognizes a change in series circuit resistance, shorts, or grounds in the airfield lighting circuit as a change in load characteristics, and it adjusts the output voltage up or down to maintain the specified current. An open circuit is understood as an infinite increase in load, causing the CCR to trip on overvoltage.

I respectfully request the CMP re-examine PI-2762 and approve the use of exposed runs of FAA type L-824 cables in (airfield lighting vaults) locations accessible to qualified persons only.

Related Item

Public Input No. 2762-NFPA 70-2014 [Section No. 300.37]

Submitter Information Verification

Submitter Full Name: CARL JOHNSON II
Organization: AVCON INC
Affiliation: none
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 04 11:29:37 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
<table>
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<th>Resolution:</th>
<th>SR-624-NFPA 70-2015</th>
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<tbody>
<tr>
<td>Statement:</td>
<td>This revision recognizes that these cables are often installed exposed within a restricted airport lighting vault to facilitate easy access for modifications and reconnections during emergency situations.</td>
</tr>
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</table>
Aboveground Wiring Methods.

Aboveground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in electrical metallic tubing, in RTRC and PVC conduit, in cable trays, in auxiliary gutters, as busways, as cablebus, in other identified raceways, or as exposed runs of metal-clad cable suitable for the use and purpose. In locations accessible to qualified persons only, exposed runs of Type MV cables, exposed runs of FAA L-824 cables, bare conductors, and bare busbars shall also be permitted. Busbars shall be permitted to be either copper or aluminum.

Informational Note: Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Additional Proposed Changes

<table>
<thead>
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<th>Approved</th>
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<tbody>
<tr>
<td>DSCN1370.JPG</td>
<td>Photo demonstrates limited length of exposed L-824 cable at connection to constant current regulator. L-824 cable is equipped with L-823 connectors for quick change of CCR.</td>
<td></td>
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<tr>
<td>DSCN2203.JPG</td>
<td>Photo demonstrates limited length of exposed L-824 cable at connection to constant current regulator with Kellums wire basket cable grips for cable support. L-824 cable is equipped with L-823 connectors for quick change of CCR.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

There are typically many thousands of feet of L-824 airfield lighting cable installed at airports; tens of thousands of feet at commercial airports. The requested exception is a very narrow application of the L-824 airfield lighting cable. The narrow limited application would be for use inside the airfield lighting vault. Access to the airfield lighting vault is limited to qualified persons. The free air cable length would typically be less than 5 or 6 feet and would nominally be supported by cable grips, ty-raps or other acceptable means.

I respectfully request the CMP re-examine PI-2762 and approve the use of exposed runs of FAA type L-824 cables in locations accessible to qualified persons only.

Related Item

Public Input No. 2762-NFPA 70-2014 [Section No. 300.37]

Submitter Information Verification

Submitter Full Name: CARL JOHNSON II
Organization: AVCON INC
Affiliation: none
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 04 17:52:33 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-624-NFPA 70-2015
Statement: This revision recognizes that these cables are often installed exposed within a restricted airport lighting vault to facilitate easy access for modifications and reconnections during emergency situations.
Aboveground Wiring Methods.

Aboveground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in electrical metallic tubing, in RTRC and PVC conduit, in cable trays, in auxiliary gutters, as busheus, as cablebus, in other identified raceways, or as exposed runs of metal-clad cable suitable for the use and purpose. In locations accessible to qualified persons only, exposed runs of Type MV cables, exposed runs of FAA L-824 cables, bare conductors, and bare busbars shall also be permitted. Busbars shall be permitted to be either copper or aluminum.

Informational Note: Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Statement of Problem and Substantiation for Public Comment

Provide an alternative method that has proven successful over many years. It has been shown to be reliable, simpler and safe while providing more wiring options to maintaining the integrity of the series circuit.

Related Item

Public Input No. 2739-NFPA 70-2014 [New Section after 392.10(D)]

Submitter Information Verification

Submitter Full Name: Seward Ford
Organization: Visual Aids Services Inc
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 12:53:27 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-624-NFPA 70-2015
Statement: This revision recognizes that these cables are often installed exposed within a restricted airport lighting vault to facilitate easy access for modifications and reconnections during emergency situations.
Aboveground Wiring Methods.

Aboveground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in electrical metallic tubing, in RTRC and PVC conduit, in cable trays, in auxiliary gutters, as busways, as cablebus, in other identified raceways, or as exposed runs of metal-clad cable suitable for the use and purpose. In locations accessible to qualified persons only, exposed runs of Type MV cables, exposed runs of FAA L-824 cables, bare conductors, and bare busbars shall also be permitted. Busbars shall be permitted to be either copper or aluminum.

Informational Note: Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSCF2471.JPG</td>
<td>Typical Airport lighting vault utilizing raceways with FAA L824 cable which is accessible to those properly qualified as defined in FAA AC 150/5340-26C This practice has been in use for decades and facilitates troubleshooting and quick rewiring of constant current regulator circuits upon failure of regulator or wiring in the electrical vault.</td>
<td></td>
</tr>
<tr>
<td>DSCN0778.JPG</td>
<td>Although not shown in this picture it is common practice to run L824 cable in a raceway imbedded in the electrical vault floor covered by an appropriate grate which allow easy access to the cables should maintenance be required.</td>
<td></td>
</tr>
<tr>
<td>IMG_1397.JPG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

Allowing multiple L824 cables to be routed in raceways provides relatively quick access to cables in the electrical vault and with cables terminated with FAA L823 plugs and receptacles give the maintenance worker a number of options as to how to get a series circuit critical to the operation of a runway back in operation. Spare or alternate cable paths can quickly be patched in thus bypassing failed components or cable.

Related Item

Public Input No. 2762-NFPA 70-2014 [Section No. 300.37]

Submitter Information Verification

Submitter Full Name: Seward Ford
Organization: Visual Aids Services Inc
Affiliation: None
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:12:34 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-624-NFPA 70-2015
Statement: This revision recognizes that these cables are often installed exposed within a restricted airport lighting vault to facilitate easy access for modifications and reconnections during emergency situations.
Public Comment No. 246-NFPA 70-2015 [Section No. 300.37]

300.37 Aboveground Wiring Methods.

Aboveground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in electrical metallic tubing, in RTRC and PVC conduit, in cable trays, in auxiliary gutters, as busways, as cablebus, in other identified raceways, or as exposed runs of metal-clad cable suitable for the use and purpose. In locations accessible to qualified persons only, exposed runs of Type MV cables, exposed runs of FAA L-824 cables, bare conductors, and bare busbars shall also be permitted. Busbars shall be permitted to be either copper or aluminum.

Informational Note: Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Statement of Problem and Substantiation for Public Comment

Exposed runs of FAA L-824 cable is not specifically permitted in the NEC. Some authorities having jurisdiction do not see equivalence in permitting exposed runs of MV cables and exposed runs of L-824 cables in locations accessible only to qualified persons.

Substantiation:

Exposed portions of FAA L-824 Type C cable within airfield lighting vault buildings which have controlled access to qualified personnel only have been part of industry practice for decades. In particular, airfield lighting series circuits utilize series cutouts for maintenance and troubleshooting which may be wall mounted per the manufactures instructions. Wires connecting to the series cutouts are exposed when the series cutouts are wall mounted. FAA L-824 Type C cable is permitted and rated by the manufacturers for aerial use in addition to underground direct burial, raceways, and in ducts. Aerial use is exposed above ground use. FAA advisory circular 150/5345-7E and F permits FAA L-824 Type C cable to be used in buildings and with controlled access by authorized personnel only the exposed cable complies with Article 300.37.

Related Item

Public Input No. 2762-NFPA 70-2014 [Section No. 300.37]

Submitter Information Verification

Submitter Full Name: Matt Szabo
Organization: Aviation Alliance, Inc.
Affiliation: none
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 15 13:00:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-624-NFPA 70-2015
Statement: This revision recognizes that these cables are often installed exposed within a restricted airport lighting vault to facilitate easy access for modifications and reconnections during emergency situations.
Public Comment No. 416-NFPA 70-2015 [Section No. 300.37]

300.37 Aboveground Wiring Methods.

Aboveground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in electrical metallic tubing, in RTRC and PVC conduit, in cable trays, in auxiliary gutters, as busways, as cablebus, in other identified raceways, or as exposed runs of metal-clad cable suitable for the use and purpose. In locations accessible to qualified persons only, exposed runs of Type MV cables, bare conductors, and bare busbars shall also be permitted. Busbars shall be permitted to be either copper or aluminum.

Statement of Problem and Substantiation for Public Comment

Public Input No. 2762-NFPA 70-2014 (Section No. 300.37)

• Comments to Substantiation commentary from Carl Johnson – Avcon10/29/14

Section No. 300.37 discusses the application and protection of L824 cables that are used to power airfield lights. The system is set up such that Edison Power, which is voltage controlled is brought into a vault on the airfield. The Edison power goes through switchgear to transform to airfield application needs and then is transformed via a plurality of constant current regulators to deliver power to airfield circuits that are current controlled in series. The constant current regulator is used to control current at specified steps or intensities to control the brightness of the lights on the airfield depending on varying visibility conditions. Each constant current regulator typically controls the lighting for a designated geographic area on the airfield (ie, Taxiway A Edge Lights, Runway 18 Centerline Lights, Runway 27 Edge Lights, Runway 9 Threshold Lights, etc.).

The airfield vault houses the switchgear and constant current regulator units and is similar to an electrical substation. It is the key area and acts as the brain of the airfield lighting system. Therefore, it is very important that the equipment is maintained and serviced to the highest quality standards to support the effective lighting of an airfield, which is critical to aircraft and personal safety.

It is a very controlled area. Only authorized personnel are allowed in the airfield vault for monitoring or maintenance needs. Carl Johnson II discusses some of those needs in his post from 10/29/14. The point I want to highlight is the criticality of timeliness of completion of those tasks. If there are issues that need to be diagnosed and tested on an airfield, the vault, regulators and their fed circuits must be accessed quickly and resolutions employed right away to prevent an unsafe airport operation.

Section No. 300.37 addresses the safety of access to L824 cables throughout the airfield environment which is open to many contractors and construction personnel as they work on electrical systems. The protection of these cables in conduit and the other protection devices mentioned is critically important to safety as the ability to control personnel that come into interaction with such cables is more difficult to manage. However, access to and in the vault is more controlled and procedures are validated and audited. Further, the equipment in the vault must be readily accessible to authorized personnel to properly maintain and control with timely solutions in an effort to protect the safety of everyone in an airfield environment that uses airfield lighting to transport passengers via aircraft.

It is critically important that authorized personnel have readily available access to L824 cables and those cables should be permitted to be installed in exposed runs in the airfield lighting vault only.

Related Item

Public Input No. 2762-NFPA 70-2014 [Section No. 300.37]

Submitter Information Verification

Submitter Full Name: John Bogart
Organization: Integro
Affiliation: Integro - Airfield Lighting Manufacturer
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 18 09:54:40 EDT 2015

Committee Statement

Committee Action: Rejected

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
Resolution: This Comment is not in conformance with 4.4.4.3(c) of the NFPA Rules and Regulations since Public Comments must include the proposed text of the Public Comment, including the wording to be added, revised (and how revised), or deleted. The changes must be indicated through the use of underlines for new text and strike through for deleted text.
Public Comment No. 374-NFPA 70-2015 [Section No. 310.15(A)(2)]

(2) Selection of Ampacity.
Where more than one ampacity applies for a given circuit length, the lowest value shall be used.

Exception: Where different ampacities apply to portions of a circuit because of temperature correction in accordance with 310.15(B)(3)(a), the higher ampacity shall be permitted to be used if the total portion(s) of the circuit with lower ampacity does not exceed the lesser of 3.0 m (10 ft) or 10 percent of the total circuit.

Informational Note: See 110.14(C) for conductor temperature limitations due to termination provisions.

Statement of Problem and Substantiation for Public Comment

Since the exception only applies to temperature correction, the exception should make this clear. Also 310.15(B)(3)(a) is proposed to exclude the exception.

Related Item
First Revision No. 1502-NFPA 70-2015 [Section No. 310.15(A)(2)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 19:38:58 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The change proposed by the comment in no longer applicable. See Panel action taken on SR1506.
Selection of Ampacity.

Where more than one ampacity applies for a given circuit length, the lowest value shall be used.

Exception: Where different ampacities apply to portions of a circuit because of conductor ampacity temperature correction in accordance with 310.15(B)(3)(a), the higher ampacity shall be permitted to be used if the total portion(s) of the circuit with lower ampacity does not exceed the lesser of 3.0 m (10 ft) or 10 percent of the total circuit.

Informational Note: See 110.14(C) for conductor temperature limitations due to termination provisions.

Statement of Problem and Substantiation for Public Comment

310.15(B)(3)(a) now prohibits the use of this exception, then the exception should state the condition that it applies.

Related Item
First Revision No. 1503-NFPA 70-2015 [Section No. 310.15(B)(3)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 19:43:22 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The change proposed by the comment in no longer applicable. See Panel action taken on SR1506.
(3) Adjustment Factors.

(a) More than Three Current-Carrying Conductors. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multicconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Section 310.15(A)(2) exception shall not apply. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23 for adjustment factors for conductors and ampacity for bare copper and aluminum bars in auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(1) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

(2) Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).

(3) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

(4) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:

a. The cables do not have an overall outer jacket.

b. Each cable has not more than three current-carrying conductors.

c. The conductors are 12 AWG copper.

d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on "bridle rings."

Exception: A 60 percent adjustment factor shall be applied if the current-carrying conductors in these cables that are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing exceeds 20.

(5) An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:

a. The cables do not have an overall outer jacket.

b. The number of current carrying conductors exceeds 20.

c. The cables are stacked or bundled longer that 600 mm (24 in.) without spacing being maintained.

Table 310.15(B)(3)(a) Adjustment Factors for More than Three Current-Carrying Conductors

<table>
<thead>
<tr>
<th>Number of Conductors</th>
<th>Percent of Values in Table 310.15(B)(16) through Table 310.15(B)(19) as Adjusted for Ambient Temperature if Necessary</th>
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<tr>
<td>4–6</td>
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</table>

1Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(5) and (6). The count shall not include conductors that are connected to electrical components that cannot be simultaneously energized.

(b) Raceway Spacing. Spacing between raceways shall be maintained.

(c) Raceways and Cables Exposed to Sunlight on Rooftops. Where raceways or cables are exposed to direct sunlight on or above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm (.7/8 - in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm (.7/8 - in.), a temperature adder of 33°C (60°F) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

Exception - Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.

Statement of Problem and Substantiation for Public Comment

The adders in 310.15(B)(3)(c) are unnecessary. The Southern Nevada Chapter of IAEI sponsored an additional investigative experiment.
during the summer of 2015. The experimental data was gathered and analyzed by the University of Las Vegas, Nevada. The UNLV report was submitted to NFPA as supporting material. The conclusions of the study indicate the following:

- Maximum recorded ambient temperature in summer 2015: 44°C
- Conductor rated temperature: 90°C
- Allowable ampacity of installed conductors with adders: 15.6 A.
- Allowable ampacity of installed conductors without adders: 20.88 A.
- Average load current (continuous): 21.7 A
- The above load current is 4% higher than the allowable ampacity without adders.
- The conductor temperature never reached its rated temperature
- Its temperature never exceeded 85°C
- Its temperature exceeded 80°C for only 1.5% of the time
- The adders in Table 310.15(B)(3)(c) of the NEC are not necessary.

Related Item
First Revision No. 1503-NFPA 70-2015 [Section No. 310.15(B)(3)]

Submitter Information Verification
Submitter Full Name: HOWARD HERNDON
Organization: SOUTHWEST ELECTRITECH SVCS LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 05:45:30 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The submitted data did not include evidence of wiring methods placed in direct contact with the rooftop surface. The evidence that was submitted strongly supports the actions taken in FR 1503 to delete any temperature adders for wiring methods that maintain separation from the rooftop surface.
(3) Adjustment Factors.

(a) More than Three Current-Carrying Conductors. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Section 310.15(A)(2) exception shall not apply. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23 for adjustment factors for conductors and ampacity for bare copper and aluminum bars in auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

1. Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

2. Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).

3. Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

4. Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. Each cable has not more than three current-carrying conductors.
   c. The conductors are 12 AWG copper.
   d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on "bridle rings."

Exception: A 60 percent adjustment factor shall be applied if the current-carrying conductors in these cables that are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing exceed 20.

5. An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. The number of current-carrying conductors exceeds 20.
   c. The cables are stacked or bundled longer that 600 mm (24 in.) without spacing being maintained.

Table 310.15(B)(3)(a) Adjustment Factors for More than Three Current-Carrying Conductors


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1Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(5) and (6). The count shall not include conductors that are connected to electrical components that cannot be simultaneously energized.

(b) Raceway Spacing. Spacing between raceways shall be maintained.

(c) Raceways and Cables Exposed to Sunlight on Rooftops. Where raceways or cables are exposed to direct sunlight on or above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm (1 ⅜ in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm (1 ⅜ in.), a temperature adder of 33°C (60°F) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.
310.15(B)(4) and (B)(5).

**Related Item**
First Revision No. 1503-NFPA 70-2015 [Section No. 310.15(B)(3)]

**Submitter Information Verification**

- **Submitter Full Name:** Phil Simmons
- **Organization:** Simmons Electrical Services
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Wed Sep 23 10:48:09 EDT 2015

**Committee Statement**

- **Committee Action:** Rejected but see related SR
- **Resolution:** SR-1506-NFPA 70-2015
- **Statement:**

  Statement: No instances of compromised safety were submitted to the panel to support the prohibition against using the Exception in 310.15(A)(2). While the language in 310.15(A)(2) Exception and 310.15(B)(3)(a) may conflict in a limited number of cases, more information needs to be submitted to the panel.

  The rewrite of 310.15(B)(3)(a)(4) exception to “4” makes it clear that the exception applies to the same size, type and construction of cables, but that an adjustment factor is necessary for a different installation condition than indicated in list item (d). The exception language and placement is in accordance with the NEC Style Manual 2.6.1 and addresses the CC concerns.

  The committee agrees to delete the language in 310.15(B)(3)(a)(5) as recommended in PI 3375 and PC 1041; those changes were not properly reflected in the First Draft.
Adjustment Factors.

(a) More than Three Current-Carrying Conductors. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Section 310.15(A)(2) exception shall not apply. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23 for adjustment factors for conductors and ampacity for bare copper and aluminum bars in auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(1) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

(2) Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).

(3) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

(4) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. Each cable has not more than three current-carrying conductors.
   c. The conductors are 12 AWG copper.
   d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on “bridle rings.”

Exception: A 60 percent adjustment factor shall be applied if the current-carrying conductors in these cables that are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing exceeds 20.

(5) An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. The number of current-carrying conductors exceeds 20.
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Table 310.15(B)(3)(a) Adjustment Factors for More than Three Current-Carrying Conductors

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</table>

1Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(6) and (6). The count shall not include conductors that are connected to electrical components that cannot be simultaneously energized.

(b) Raceway Spacing. Spacing between raceways shall be maintained.

(c) Raceways and Cables Exposed to Sunlight on Roof tops. Where raceways or cables are exposed to direct, direct sunlight on or above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm (.7/8 in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm (7/8 in.), a temperature adder of 33°C (60°F) the adjustments shown in Table 310.15(B)(3)(c) shall be added to the outdoor temperature temperature, to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) - (f).

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.
Additional Proposed Changes

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<td>31015B3c_Table.jpg</td>
<td>Insert in Section 310.15(B)(3)(c)</td>
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</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

This comment urges the Committee to recognize and accept the science that resulted in Table 310.15(B)(3)(c) and text that was included in the 2014 Edition of the NEC. The table and text from the 2014 NEC should be restored. The accuracy of the testing performed that resulted in the text and table was verified by Underwriters Laboratories in a Fact Finding Report. No such verified science has been provided by the naysayers who have submitted faulty recommendations that have been accepted by this Committee. I urge the Committee to do the right thing and accept the documented and verified science.

Related Item
First Revision No. 1503-NFPA 70-2015 [Section No. 310.15(B)(3)]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 10:59:47 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter’s substantiation is incorrect. The studies submitted to the committee in previous cycles on behalf of the Copper Development Association were not comprehensive and did not consider the effects of the multiple factors present in energized conductor installations. Notably, those studies did not include any energized conductors. In reviewing the totality of the record over the last few cycles, it is apparent that the rooftop adders are unnecessary for most installations. The only remaining item of contention is wiring methods placed in direct contact with rooftop surfaces. No substantive information was submitted to refute the findings of the Correlating Committee Task Group, and the language accepted in FR 1503 is considered to be correct based on available data and adequate to ensure safe installations.
Adjustment Factors.

(a) More than Three Current-Carrying Conductors. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Section 310.15(A)(2) exception shall not apply. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23 for adjustment factors for conductors and ampacity for bare copper and aluminum bars in auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(1) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

(2) Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).

(3) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

(4) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. Each cable has not more than three current-carrying conductors.
   c. The conductors are 12 AWG copper.
   d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on "bridle rings."
   Exception: A 60 percent adjustment factor shall be applied if the current-carrying conductors in these cables that are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing exceeds 20.

(5) An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. The number of current-carrying conductors exceeds 20.
   c. The cables are stacked or bundled longer that 600 mm (24 in.) without spacing being maintained.

Table 310.15(B)(3)(a) Adjustment Factors for More than Three Current-Carrying Conductors

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1 Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(6) and (6). The count shall not include conductors that are connected to electrical components that cannot be simultaneously energized.

(b) Raceway Spacing. Spacing between raceways shall be maintained.

(c) Raceways and Cables Exposed to Sunlight on Rooftops. Where raceways or cables are exposed to direct sunlight on or above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm ( ¾ in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm ( ¾ in.), a temperature adder of 33°C (60°F) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

Exception: Type XHHW-2, Type RHW-2 and Type PV thermoset insulated conductors shall not be subject to this ampacity adjustment.

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.
Thermoset insulated conductors (including XHHW-2, PV and RHW-2) are capable of handling the heating effect of direct sunlight on rooftops with no safety concerns. Thermoset insulation is superior to thermoplastic insulation in high heat applications. Industry standards from IEEE, ICEA and NEMA indicate that thermoset insulation is adequate for much higher temperatures than those experienced on rooftops for the period of time indicated. There are many types of thermoset insulation allowed in the NEC: XHHW-2, RHW-2, and PV wire are a few of the more common types. Of these, XHHW-2 has the thinnest wall requirements and the lowest electrical testing requirements in the UL standards. There is no reason to believe that the other thermoset types would not perform as well as or better than XHHW-2.

Related Item
First Revision No. 1503-NFPA 70-2015 [Section No. 310.15(B)(3)]

Submitter Information Verification
Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 22:43:39 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The additional insulation types proposed are of equal or more robust construction and composition than the currently allowed XHHW-2. More information is needed to guarantee that these conductor types will perform the same as XHHW-2 under the test conditions that warranted the exception for these conductors to be exempt from the requirements in 310.15(B)(3)(c). The panel recommends the submitter provide a comparison of the testing procedures and properties be submitted for the next cycle.
(3) Adjustment Factors.

(a) More than Three Current-Carrying Conductors. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multi-conductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Exception shall not apply. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23 for adjustment factors for conductors and ampacity for bare copper and aluminum bars in auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(1) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

(2) Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).

(3) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

(4) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. Each cable has not more than three current-carrying conductors.
   c. The conductors are 12 AWG copper.
   d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on "bride rings."

   Exception: A 60 percent adjustment factor shall be applied if the current-carrying conductors in these cables that are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing exceeds 20.

(5) An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. The number of current-carrying conductors exceeds 20.
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1Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(5) and (6). The count shall not include conductors that are connected to electrical components that cannot be simultaneously energized.

(b) Raceway Spacing. Spacing between raceways shall be maintained.

(c) Raceways and Cables Exposed to Sunlight on rooftops. Where raceways or cables are exposed to direct sunlight on or above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm ( ⅞ in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm ( ⅞ in.), a temperature adder of 33°C (60°F) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.

Statement of Problem and Substantiation for Public Comment

No substantiation was provided in any of the public inputs to warrant adding the new language to 310.15(B)(3)(a). The new language
would not allow the option to use the exception to 310.15(A)(2) where there are more than three current carrying conductors in a raceway or cable. The exception allows the higher ampacity to be used for either 10% or 10' whichever is less. This exception should apply for either temperature correction or adjustment for number of conductors over three in a raceway or cable.

Related Item
First Revision No. 1503-NFPA 70-2015 [Section No. 310.15(B)(3)]

Submitter Information Verification
Submitter Full Name: Christopher Jensen
Organization: North Logan City
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 18:02:22 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1506-NFPA 70-2015
Statement: Statement: No instances of compromised safety were submitted to the panel to support the prohibition against using the Exception in 310.15(A)(2). While the language in 310.15(A)(2) Exception and 310.15(B)(3)(a) may conflict in a limited number of cases, more information needs to be submitted to the panel.

The rewrite of 310.15(B)(3)(a)(4) exception to “4” makes it clear that the exception applies to the same size, type and construction of cables, but that an adjustment factor is necessary for a different installation condition than indicated in list item (d). The exception language and placement is in accordance with the NEC Style Manual 2.6.1 and addresses the CC concerns.

The committee agrees to delete the language in 310.15(B)(3)(a)(5) as recommended in PI 3375 and PC 1041; those changes were not properly reflected in the First Draft.
(3) Adjustment Factors.
More than Three Current-Carrying Conductors. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Section 310.15(A)(2) exception shall not apply. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23 for adjustment factors for conductors and ampacity for bare copper and aluminum bars in auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(1) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

(2) Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).

(3) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

(4) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. Each cable has not more than three current-carrying conductors.
   c. The conductors are 12 AWG copper.
   d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on “bridge rings.”
   Exception: A 60 percent adjustment factor shall be applied if the current-carrying conductors in these cables that are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing exceeds 20.

(5) An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
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¹Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(5) and (6). The count shall not include conductors that are connected to electrical components that cannot be simultaneously energized.

(b) Raceway Spacing. Spacing between raceways shall be maintained.

(c) Raceways and Cables Exposed to Sunlight on Rooftops.

Where raceways or cables are exposed to direct sunlight on or above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm (7/8 in.), the distance above the roof to the bottom of the raceway is less than 23 mm (7/8 in.), a temperature adder of 33°C (60°F).

The adjustments shown in Table 310.15(B)(3)(c) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

Table 310.15(B)(3)(c) Ambient Temperature Adjustment for Rooftops

Rooftops
Statement of Problem and Substantiation for Public Comment

First Revision 1503
Comment to NEC 310.15(B)(3)

My 30-plus-year practice as a metallurgical and materials consultant (BS Met. E. (Lafayette College), M.S. (Penn State), Ph.D.
Metallurgy (Case Institute of Technology)) is located in a suburb of Tucson, Arizona, where daytime summer temperatures can exceed 45 C (113 F) and daily highs can pass 38 C (100 F) for three months in a row. Here, it is literally possible to fry eggs on pavement or, more to the subject of this meeting, on an unshaded rooftop. Ambient temperature inside rooftop-mounted electrical conduit is a valid and very real design consideration in the Southwest, as it is in the South and a surprising portion of the rest of the country.

Adding to the risk is the common practice of mounting large, heavily and continuously loaded air conditioners and/or evaporative coolers on the flat roofs of commercial buildings, malls, shopping centers and the like. Such facilities do not all employ on-site electricians to conduct appropriate inspection and maintenance. Material deterioration can proceed unchecked under such circumstances, and it is quite possible that insulation failures in overheated, conduit-enclosed feeder cables have led to building fires in the past. Unfortunately, the direct cause of the resulting fires is impossible to ascertain after the fact (the evidence being destroyed) and, failing the presence of a certified fire inspector backed up by a suitably equipped laboratory, difficult to report (Who would do the reporting, and to whom?). But just because the root cause (overheated conduit environments) rarely if ever makes it to the pages of the morning paper, its existence cannot and should not be ruled out.

Ambient adjustments and “rooftop adders” are demonstrably important for fire prevention and public safety. Insulation deterioration due to excessive intra-conduit temperatures, i.e., beyond the insulation’s capability and rating, is well known and can be hazardous. We need only look to electric motor and transformer manufacturers for a practical rule-of-thumb: exposure of insulation to temperatures higher than 10 degrees Celsius above the insulation’s rated operating temperature for more than six to eight hours cuts equipment life by one-half. In Tucson, we enjoy 300-plus days of sunshine a year. If our roof-mounted air conditioner motors fail —as they regularly do—why cannot conduit-encased cables also be at risk?

It is for these reasons that I strongly object to the removal of rooftop adders as now found in Table 350.15 (B)(3)(c) from NEC 2017. The question of intra-conduit thermal environments under strong insulation is clearly an issue of fire prevention and public safety.

For the sake of full disclosure: my clients include a variety of metals-producing, metals-related and metals-using organizations, and in this instance, the Copper Development Association (CDA), I became aware of the rooftop adder issue several years ago during job for TLCS Inc., dealing with insulation material properties. At the time, my client was conducting early research on conduit temperatures for CDA, work that was subsequently expanded in considerable detail by UL and documented in two UL Fact-Finding Studies, an earlier EATS study report, as well as a peer-reviewed IEEE- IAS paper. In my opinion, the UL Fact-Finding Studies (and earlier work cited above) were conducted with appropriate technical and scientific rigor. Investigations of all variables addressed were properly documented, methodology was clearly described, data were correctly recorded and the conclusions drawn were technically reasonable and justifiable. Peer review of the published results substantiates this assertion.

My specific comments regarding the substitution of a revised Table 350.15 (B)(3)(c) for the approved version published in NEC 2014 include the following:
• We should not base changes in NEC 2017 on junk science. The rooftop adder values contained in the existing NEC 2014 Table 350.15 (B)(3)(c) are based on more than a decade of thorough, broad-based, technical research. The Rooftop Adder Table proposed to be published in NEC 2017 should/must be based on precisely that level of rigorous and thorough investigations, this literally being a potential matter of life or death. To my knowledge, and based upon my review of the UNLV study, a brief PowerPoint presentation, etc. this is certainly not the case. One example: cable loading for the single test described in the UNLV study was less than one-half of the Code limit for the AWG 12-gage wire used. Of course the temperature rise will be lower than that permitted under NEC 2014 under those circumstances.
• Specifically, while the proposed replacement table calls for retaining the current table’s rooftop adder of 33°C at “less than one inch” above the roof surface, it changes the value of all adders for conduit placement distances above one inch to zero. (The current table sets the value of the adder at 17 C for five inches above the surface, for example.) That value, zero, is arbitrary and scientifically
The submitter's contention that rooftop fires have been caused by conductor insulation failure inside conduits is unsupported. The submitter does not describe how mid-span insulation failures within metallic conduits cause building fires without operating overcurrent protective devices. The submitter is directed to the NFPA Fire Analysis and Research division for fire statistics and reports. Insulation deterioration within conduits due to exposure to direct sunlight is not well-known; reports submitted in previous cycles from panel members representing the International Association of Electrical Inspectors and the American Chemistry Council lead to the opposite conclusion. Robert Huddleston's Rooftop Wiring Study demonstrated that rooftop conductors installed in a Southern US location (sized prior to the rooftop temperature adders in the NEC) did not suffer material deterioration after many years (14 years for one location, approximately 40 for another) of service. Evidence has been submitted to the panel in multiple studies showing that the operating temperature of insulated conductors is not being exceeded when installed in accordance with the rules in the NEC (even without the rooftop adders). There has been no evidence presented to the panel of rooftop conductors failing due to solar heating, or of building fires caused by such conductors. While we respect the peer review process, engineers on this panel have seen multiple instances of peer reviewed papers with opposite conclusions; being peer-reviewed doesn't mean the conclusions of a paper are necessarily correct or actionable. The actions of this panel in FR 1503 are not based on junk science; they are based on evidence submitted from multiple credible sources. The submitter failed to account for the required temperature correction and adjustment factors present in Article 310 and required to determine the ampacity of a conductor under conditions of use. The panel agrees that there is not an "abrupt temperature discontinuity" at one inch above the rooftop surface; we look forward to future submissions with a more justifiable rooftop adder than the currently accepted 60F. The temperature corrections and adjustment factors in the NEC apply to both aluminum and copper conductors. Cable loading for the UNLV study was based on the ampacity and temperature tables in the NEC. The UL studies did not provide for any loading of conductors, and so this important information is absent from those reports. One of the conclusions of the first UL report was that "temperature rise above ambient for wiring systems mounted 0.5, 3.5, and 12.0 inches above the roof were not affected significantly by distance. Therefore distances greater than 0.5 inches can be considered far from the roof and roof distance does not need to be a consideration in calculating temperature rise." The positioning of the UNLV wiring systems at 8" above the roof is thus completely representative of heating effects related to wiring system position above the roof.
(3) Adjustment Factors.
More than Three Current-Carrying Conductors. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multi-conductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Section 310.15(A)(2) exception shall not apply. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

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(c) Raceways and Cables Exposed to Sunlight on Rooftops.

Where raceways or cables are exposed to direct sunlight on or above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 33 mm (1 1/4 in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm (7/8 in.), a temperature adder of 33°C (60°F) the adjustments shown in Table 310.15(B)(3)(c) shall be added to the outdoor temperature.

To determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a), or Table 310.15(B)(2)(b),

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Table 310.15(B)(3)(c) Ambient Temperature Adjustment for Raceways or Cables Exposed to Sunlight on or Above
### Rooftops

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<th>Distance Above Roof to</th>
<th>Temperature Adder</th>
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<tr>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>On roof 0 – 13 mm (0 — 1 1/2 in.)</td>
<td>33</td>
</tr>
<tr>
<td>Above roof 13 mm (1 1/2 in. — 3 1/2 in.)</td>
<td>22</td>
</tr>
<tr>
<td>Above 90 mm – 300 mm (3 1/2 in. — 12 in.)</td>
<td>17</td>
</tr>
<tr>
<td>Above 300 mm – 900 mm (12 in. — 36 in.)</td>
<td>14</td>
</tr>
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**Informational Note:** One source for the ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.

### Statement of Problem and Substantiation for Public Comment

Supporting information for – FR 1503

**NEC 310.15(B)(3)**

Panel 6 members were not provided full access to the reports used in working groups to develop consensus occurring the day before code hearings, thus improperly biasing final actions by improperly restricting access to the documentation. Task group opinions and the UNLV report were similarly incomplete prior to the code panel meeting. The result was a rushing and crippling of the process. The panel then accepted unscientific, untested statements as in the case for both the task group presentation and the UNLV research report. The task group evaluated some mathematical modeling. The mathematics, assumptions and variables of this modeling were not reviewed by any other outside third party. The assumptions and task group statements resulting from this modeling have been disproven by previous research, and can be disproven repeatedly in further research. No written report was ever generated from this work which could then be reviewed by outside parties. Numeric modeling was not peer-reviewed and not verified by any research work. Modeling as submitted conflicted with previously developed test data as certified by the Fact Finding investigations and as covered in IEEE peer reviewed transactions. Assumptions were incorrect. Wicking or thermal transfer was mentioned as a factor in the task group presentation but experienced UL panel members have testified that heat does not significantly move along the conductor material to a cooler portion or from a hot spot to cold cooling a hot spot on a conductor. As for the UNLV Research project, this was filled with the most glaring errors. Obscure calculations were used to demonstrate that a portable cord plug connected load, a continuous load and other values would reduce the allowable ampacity of a 12 AWG 90C copper conductor to 13.3 amps. By loading the conductor to 13.3 amps, UNLV then would erroneously theorize from this loading, and derived temperatures, that no conductor allowable temperature would ever be exceeded. A much more realistic examination would be a load, such as an air conditioning load, operating close to 100% of the allowable ampacity at just less than three hours (2.9 hours), relaxed sparingly, allowed to cool for a few minutes and then restarted and cycled this way repeatedly. This circuit could comply with the NEC requirements. A four foot vertical riser was created in each raceway and cable sample, enabling an updraft not typical of most installations. The updraft provided unusual and excessive air movement inside the raceway samples nullifying results. The air movement was also not accounted for in findings. Additionally, the thermocouple sensors were placed at the lower portion of raceway samples, however, the highest temperatures would be experienced in the upper elevations where no sensors were placed. For cable type samples the interior air movement was not present because of the densely packed construction of the cable samples. The effect of this can be seen in the black MC Cable which achieved temperature of 22.6 C unloaded at 8 inches above the roof. The temperature of the MC Cable sample exceeded the required 17C adjustment of NEC table 310.15(B)(3)(c) confirming the original research. It is obvious from this fact, that only selected findings were important to the authors of this report.

**Related Item**

First Revision No. 1503-NFPA 70-2015 [Section No. 310.15(B)(3)]

### Submitter Information Verification

**Submitter Full Name:** TRAVIS LINDSEY  
**Organization:** TLC SERVICES Inc  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Fri Sep 25 10:10:10 EDT 2015
Committee Statement

Committee Action: Rejected

Resolution: The substantiation provided by the submitter is incorrect. The referenced reports were provided to the task group and distributed to the full committee at the meeting. No committee members other than the task group requested the reports prior to the meeting, even though the public inputs clearly indicated that such reports were available for their review. It is the responsibility of the committee members to review the materials prior to the committee meeting. The UNLV report was submitted and received by NFPA in compliance with the published deadline. The task group recommendations were available to the full committee prior to the meeting. • The submitter indicates that "Assumptions were incorrect," but does not specify which assumptions. It is of interest that the submitter referred to the NEC calculations in the UNLV report as obscure, and the panel directs the submitter to review Article 310 of the National Electrical Code. The panel does not accept that a more realistic examination would include an air conditioner running for 2.9 hours, turned off for a short time, then turned on for another 2.9 hours. However, the panel will review any testing submitted. Thermocouples were placed at several locations in the wiring methods, including both the highest and lowest elevations. The wiring methods terminated in wireways at both ends, limiting potential airflow. The UNLV research from 2014 was documented in a report that was provided to CMP6. Significant information regarding temperature rise on insulated conductors due to solar heating is provided by test data, as well as examination of actual conductors exposed to rooftop temperature conditions over time. The UNLV reports and Robert Huddleston's report provided this information.
(3) Adjustment Factors.

(a) More than Three Current-Carrying Conductors. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multi-conductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Section 310.15(A)(2) exception shall not apply. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23 for adjustment factors for conductors and ampacity for bare copper and aluminum bars in auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(1) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

(2) Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).

(3) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

(4) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. Each cable has not more than three current-carrying conductors.
   c. The conductors are 12 AWG copper.
   d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on “bridle rings.”

   Exception: A 60 percent adjustment factor shall be applied if the current-carrying conductors in these cables that are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing exceeds 20.

(5) An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. The number of current-carrying conductors exceeds 20.
   c. The cables are stacked or bundled longer that 600 mm (24 in.) without spacing being maintained.

Table 310.15(B)(3)(a) Adjustment Factors for More than Three Current-Carrying Conductors

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Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(6) and (6). The count shall not include conductors that are connected to electrical components that cannot be simultaneously energized.

(b) Raceway Spacing. Spacing between raceways shall be maintained.

(c) Raceways and Cables Exposed to Sunlight on Rooftops. Where raceways or cables are exposed to direct sunlight on or above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm ( ⅞ in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm ( ⅞ in.), a temperature adder of 33°C (60°F) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

   Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook—Fundamentals.

Statement of Problem and Substantiation for Public Comment

There seems to be no technical substantiation in the public inputs to remove the allowances of 310.15(A)(2) Ex.
Committee Action: Rejected but see related SR
Resolution: SR-1506-NFPA 70-2015
Statement: No instances of compromised safety were submitted to the panel to support the prohibition against using the
Exception in 310.15(A)(2). While the language in 310.15(A)(2) Exception and 310.15(B)(3)(a) may conflict in a limited
number of cases, more information needs to be submitted to the panel.

The rewrite of 310.15(B)(3)(a)(4) exception to "4" makes it clear that the exception applies to the same size, type and
construction of cables, but that an adjustment factor is necessary for a different installation condition than indicated in list
item (d). The exception language and placement is in accordance with the NEC Style Manual 2.6.1 and addresses the
CC concerns.

The committee agrees to delete the language in 310.15(B)(3)(a)(5) as recommended in PI 3375 and PC 1041; those
changes were not properly reflected in the First Draft.
### Adjustment Factors.

(a) **More than Three Current-Carrying Conductors.** Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Section 310.15(A)(2) exception shall not apply. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23 for adjustment factors for conductors and ampacity for bare copper and aluminum bars in auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(1) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

(2) Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).

(3) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

(4) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. Each cable has not more than three current-carrying conductors.
   c. The conductors are 12 AWG copper.
   d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on "bride rings."

   Exception: A 60 percent adjustment factor shall be applied if the current-carrying conductors in these cables that are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing exceeds 20.

(5) An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:
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   b. The number of current carrying conductors exceeds 20.
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(b) **Raceway Spacing.** Spacing between raceways shall be maintained.

(c) **Raceways and Cables Exposed to Sunlight on rooftops.** Where raceways or cables are exposed to direct sunlight on or above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm (7/8 in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm (7/8 in.), a temperature adder of 33°C (60°F) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.

**Statement of Problem and Substantiation for Public Comment**

The Correlating Committee directs that this First Revision, specifically the new exception to 310.15(B)(3)(4)(d), be rewritten to comply...
with the NEC Style Manual. The exception in 310.15(B)(3)(4)(d) is not an exception, it is a rule.

**Related Item**
First Revision No. 1503-NFPA 70-2015 [Section No. 310.15(B)(3)]

**Submitter Information Verification**

**Submitter Full Name:** CC on NEC-AAC  
**Organization:** NFPA  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Mon Sep 28 15:54:37 EDT 2015

**Committee Statement**

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-1506-NFPA 70-2015  
**Statement:** Statement: No instances of compromised safety were submitted to the panel to support the prohibition against using the Exception in 310.15(A)(2). While the language in 310.15(A)(2) Exception and 310.15(B)(3)(a) may conflict in a limited number of cases, more information needs to be submitted to the panel.

The rewrite of 310.15(B)(3)(a)(4) exception to “4” makes it clear that the exception applies to the same size, type and construction of cables, but that an adjustment factor is necessary for a different installation condition than indicated in list item (d). The exception language and placement is in accordance with the NEC Style Manual 2.6.1 and addresses the CC concerns.

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   Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.
Statement of Problem and Substantiation for Public Comment

See Comment file

Related Item
Public Input No. 1503-NFPA 70-2014 [New Section after 500.4(B)]

Submitter Information Verification

Submitter Full Name: STEPHEN SHULL
Organization: The Empire District Electric Company
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 30 10:26:22 EDT 2015

Committee Statement

Committee Action: Rejected

Resolution: The submitter’s substantiation is incorrect. 1) The 33C value was taken from previously submitted work; since no alternate values were provided, the 33C will remain. Additionally, no rooftop cable failures due to sunlight exposure have been submitted to the committee; in fact, numerous examples of insulated conductors that were in service for decades in some of the hottest regions of the country were submitted to the committee as evidence that the rooftop adders were unnecessary. 2) FR 1503 is the culmination of scientific studies submitted by multiple credible sources. 3) Insulations have already been tested and evaluated at higher temperature than insulations manufactured in past decades. Insulated conductors are commonly available at 90C for use in wet locations. FR 1503 is technically sound and ensures the practical safeguarding of persons and property. One of the conclusions of the first UL report was that 'temperature rise above ambient for wiring systems mounted 0.5, 3.5, and 12.0 inches above the roof were not affected significantly by distance. Therefore distances greater than 0.5 inches can be considered far from the roof and roof distance does not need to be a consideration in calculating temperature rise.' The UNLV reports have demonstrated that insulation temperatures inside rooftop cables and conduits do not exceed the temperature ratings of the wire.
**Adjustment Factors.**

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**Additional Proposed Changes**

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Statement of Problem and Substantiation for Public Comment

PI 2808 was approved by the Panel removing the exception for XHHW-2, and does not appear in the First Revision. The vote was not recorded and the text was not appropriately changed.

Related Item
First Revision No. 1503-NFPA 70-2015 [Section No. 310.15(B)(3)]

Submitter Information Verification

Submitter Full Name: David Brender
Organization: Copper Development Association
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 09 15:25:29 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter's assertion is incorrect. PI 2808 was resolved by the committee with the following statement: "Multiple test reports were submitted during the 2014 NEC cycle to substantiate the use of XHHW-2 as allowed in the Exception. This decision was upheld by the NEC Correlating Committee, on the floor at the NFPA Association Technical meeting, and by the NFPA Standards Council." See report available on nfpa.org titled "Public Inputs with Responses."
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<th>Percent of Values in Table 310.15(B)(16) through Table 310.15(B)(19) as Adjusted for Ambient Temperature if Necessary</th>
</tr>
</thead>
<tbody>
<tr>
<td>4–6</td>
<td>80</td>
</tr>
<tr>
<td>7–9</td>
<td>70</td>
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<td>10–20</td>
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<td>21–30</td>
<td>45</td>
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<tr>
<td>31–40</td>
<td>40</td>
</tr>
<tr>
<td>41 and above</td>
<td>35</td>
</tr>
</tbody>
</table>

1 Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(5) and (6). The count shall not include conductors that are connected to electrical components that cannot be simultaneously energized.

Raceway Spacing. Spacing between raceways shall be maintained.

Raceways and Cables Exposed to Sunlight on rooftops. Where raceways or cables are exposed to direct sunlight on above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm (7/8 in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm (7/8 in.), a temperature adder of 33°C (60°F) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.
Statement of Problem and Substantiation for Public Comment

The Panel accepted completely unscientific submissions that defied logic. The so-called "report" and slide presentation contained numerous errors that made the validity and application to temperature in conduits on rooftops completely invalid. Among other errors and methodologies that did not conform to scientific testing, the UNLV report contained the following:

• The UNLV report used a stated load of 13.3 Amps (incorrectly omitting the ballasts) on a wire rated for 30 amps, less than half the rated load.
• The thermocouples were placed at the lowest location in the conduit run, while a bend vertically allowed a chimney effect.
• The chimney effect produced by a four foot vertical rise cooled the conductors, and likely produced air movement within the conduit, although this was not measured.
• The conduit that was measured was connected to a wireway at each end, containing multiple other raceways and cables that were not energized, causing a cooling effect and equalization of temperatures. This would negate the value of this research.
• Cables are not aspirated.
• When an electrical box is at the ends of conduits, the aspiration is restricted, mimicking the cotton UL used at conduit ends.
• Solar irradiance was not measured which would affect temperatures.
• The load was cord and plug connected and continuous. Suppose the load was permanently wired, and non-continuous? If they had chosen a long-running but non-continuous load, such as an air conditioner, the calculation would have resulted in higher temperatures. They incorrectly but purposely used portable loads.
• Had the load been permanently wired, the load could have been increased 25%. We are concerned with the temperature in the conduit, not the over-current device. The research is not applicable to permanently connected or non-portable loads.
• The report did not take different colors of rooftops into account.
• Even this flawed study produced an MC Cable temperature of 22.6 C unloaded at 8 inches above the roof. The present Code shows a 17 C design rise (at a measured solar irradiance and 90 percent of maximum) at this height. If anything, the MC temperature "adder" was exceeded.

In short, conditions for observation were chosen to make the assumptions work and the temperatures measured minimized.

 Related Item
First Revision No. 1503-NFPA 70-2015 [Section No. 310.15(B)(3)]

Submitter Information Verification

Submitter Full Name: David Brender
Organization: Copper Development Association
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 09 16:41:51 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter's assertions are incorrect. The submitter's comment regarding conductor loading failed to account for ampacity adjustment and temperature correction factors required by Article 310. Since the load was applied continuously, the 13.33 amp lamp load in the UNLV study is considered 16.67 amps based on 210.19(A)(1)(a). The smallest allowable conductor for this load based on table 310.15(B)16 is a 12 AWG copper. That was the conductor size used in the test, and it has an allowable ampacity of 20A based on the table. Including the rooftop adder adjustment from Table 310.15(B)(3)(a) reduces the allowable current to 15.6A. So the conductors were loaded to more than 85% of their rated ampacity, not less than half as stated in PC 589. Thermocouples were placed at several locations in the wiring methods, including both the highest and lowest elevations. In the conduits they were placed between the conductors, not in contact with the conduit, to accurately capture the temperature of the insulation. For the cables, the jacket was slit and the TCs again placed between the conductors so as to accurately record the temperature on the insulation, which is the critical variable. The wiring methods terminated in wireways at both ends, therefore not open to the atmosphere and limiting potential airflow. This
would greatly reduce airflow, and minimize any "chimney effect." There was no verification provided that the wiring method installation method caused a cooling effect or equalization of temperatures. The wireways used in the UNLV study would not have allowed significant aspiration, and the total interior volume is probably close to that of some electrical boxes, so any aspiration would likely be similar. Solar irradiance was measured and the values were reported to the code-making panel; refer to pages 10 and 12 in the UNLV report. Data was not submitted to demonstrate that a long-running, non-continuous load would result in higher conductor temperatures. Plug connected equipment introduces more resistance to the circuit at the connection points. Continuous loads likely reach a steady state temperature condition, but without data it is not a foregone conclusion that this temperature is lower than that of non-continuous load, as the interruption in current flow when the load is off would allow for some cooling of the conductors. The results of previously submitted studies included results using an air conditioner as the load as requested by the submitter. It is important to note that none of the conductors in the UL studies were energized. As indicated in previously submitted research, the color of the rooftop was not a primary determinant factor, leading to previous code-making panel decisions to include rules applicable to any rooftop color. The UL report indicated that for wiring systems at the 1/2 inch distance above the roof, there was no difference between black and white roof color in terms of wiring system temperatures. The UNLV roof was white, which the UL study indicated was the color allowing additional heating from solar reflection for distances greater than 1/2 inch above the roof. The UNLV wiring systems were located 8 inches above the roof, so this configuration would have captured the maximum temperatures due to roof color. A report was written, and provided to CMP6. As to the submitter's comments regarding the correlating committee task group statement, it was based on work done by scientists experienced in heat flow and electrical ampacity calculations. The work was evaluated and verified by an independent research committee assigned by the NEC Correlating Committee, which was composed of experienced and unbiased electrical and code professionals. Research from other sources supporting the modeling was submitted to the panel. A report was written. The statement and report were submitted to NFPA and the code-making panel. The primary researcher employed on behalf of the Copper Development Association for the UL report was included in the otherwise independent task group. He was an active participant representing the CDA point of view. Representatives of CDA were invited to present to the CC Task Group, as were representatives from other groups that had submitted research to the panel. CDA representatives did in fact present their point of view to the task group. Additionally, both the Copper Development Association and UL were present at the Public Input meetings and were given ample opportunity to argue their point of view. The modeling did not conflict with previously developed data, and the panel is unaware of any UL testimony regarding "wicking" in these deliberations.
(3) Adjustment Factors.

(a) More than Three Current-Carrying Conductors. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multi-conductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Section 310.15(A)(2) exception shall not apply. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23 for adjustment factors for conductors and ampacity for bare copper and aluminum bars in auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(1) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

(2) Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).

(3) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

(4) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. Each cable has not more than three current-carrying conductors.
   c. The conductors are 12 AWG copper.
   d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on "bride rings."

   Exception: A 60 percent adjustment factor shall be applied if the current-carrying conductors in these cables that are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing exceeds 20.

(5) An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:
   a. The cables do not have an overall outer jacket.
   b. The number of current carrying conductors exceeds 20.
   c. The cables are stacked or bundled longer that 600 mm (24 in.) without spacing being maintained.

Table 310.15(B)(3)(a) Adjustment Factors for More than Three Current-Carrying Conductors

<table>
<thead>
<tr>
<th>Number of Conductors&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Percent of Values in Table 310.15(B)(16) through Table 310.15(B)(19) as Adjusted for Ambient Temperature if Necessary</th>
</tr>
</thead>
<tbody>
<tr>
<td>4–6</td>
<td>80</td>
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<tr>
<td>7–9</td>
<td>70</td>
</tr>
<tr>
<td>10–20</td>
<td>50</td>
</tr>
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<td>21–30</td>
<td>45</td>
</tr>
<tr>
<td>31–40</td>
<td>40</td>
</tr>
<tr>
<td>41 and above</td>
<td>35</td>
</tr>
</tbody>
</table>

<sup>1</sup>Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(5) and (6). The count shall not include conductors that are connected to electrical components that cannot be simultaneously energized.

(b) Raceway Spacing. Spacing between raceways shall be maintained.

(c) Raceways and Cables Exposed to Sunlight on rooftops. Where raceways or cables are exposed to direct sunlight on or above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm (7 5/16 in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm (7 5/16 in.), a temperature adder of 33°C (60°F) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a) or Table 310.15(B)(2)(b).

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.

Statement of Problem and Substantiation for Public Comment

The exception for XHHW-2 was removed by the panel during deliberations but the vote was not recorded or reported. See PI 2808 First
Revision 1503

Related Item
Public Input No. 2808-NFPA 70-2014 [Section No. 310.15(B)(3)]

Submitter Information Verification

Submitter Full Name: TRAVIS LINDSEY
Organization: TLC SERVICES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 12:46:16 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter's assertion is incorrect. PI 2808 was resolved by the committee with the following statement: "Multiple test reports were submitted during the 2014 NEC cycle to substantiate the use of XHHW-2 as allowed in the Exception. This decision was upheld by the NEC Correlating Committee, on the floor at the NFPA Association Technical meeting, and by the NFPA Standards Council." See report available on nfpa.org titled "Public Inputs with Responses."
(3) Adjustment Factors.
More than Three Current-Carrying Conductors. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.) and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(3)(a). Section 310.19(A)(2) exception shall not apply. Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(B)(3)(a) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23 for adjustment factors for conductors and ampacity for bare copper and aluminum bars in auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(1) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.
(2) Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).
(3) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.
(4) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:
   a. The cables do not have an outer jacket.
   b. Each cable has not more than three current-carrying conductors.
   c. The conductors are 12 AWG copper.
   d. Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on "bridle rings."

   Exception: A 60 percent adjustment factor shall be applied if the current-carrying conductors in these cables that are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing exceeds 20.
(5) An adjustment factor of 60 percent shall be applied to Type AC cable or Type MC cable under the following conditions:
   a. The cables do not have an outer jacket.
   b. The number of current carrying conductors exceeds 20.
   c. The cables are stacked or bundled longer that 600 mm (24 in.) without spacing being maintained.

Table 310.15(B)(3)(a) Adjustment Factors for More than Three Current-Carrying Conductors

<table>
<thead>
<tr>
<th>Number of Conductors</th>
<th>Percent of Values in Table 310.15(B)(16) through Table 310.15(B)(19) as Adjusted for Ambient Temperature if Necessary</th>
</tr>
</thead>
<tbody>
<tr>
<td>4–6</td>
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<tr>
<td>7–9</td>
<td>70</td>
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</tr>
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<td>41 and above</td>
<td>35</td>
</tr>
</tbody>
</table>

1Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(B)(5) and (6). The count shall not include conductors that are connected to electrical components that cannot be simultaneously energized.

(b) Raceway Spacing. Spacing between raceways shall be maintained.

(c) Raceways and Cables Exposed to Sunlight on Rooftops.

Where raceways or cables are exposed to direct sunlight on or above rooftops, raceways or cables shall be installed a minimum distance above the roof to the bottom of the raceway or cable of 23 mm ( 7/8 in.). Where the distance above the roof to the bottom of the raceway is less than 23 mm ( 7/8 in.), a temperature adder of 33°C (60°F) the adjustments shown in Table 310.15(B)(3)(c) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(2)(a).
or Table 310.15(B)(2)(b):

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Table 310.15(B)(3)(c) Ambient Temperature Adjustment for Raceways or Cables Exposed to Sunlight on or Above Rooftops

<table>
<thead>
<tr>
<th>Distance Above Roof to Bottom of Raceway or Cable</th>
<th>°C</th>
<th>°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>On roof 0 – 13 mm (0 — 1(\frac{1}{2}) in.)</td>
<td>33</td>
<td>60</td>
</tr>
<tr>
<td>Above roof 13 mm (12 in.)</td>
<td>22</td>
<td>40</td>
</tr>
<tr>
<td>Above 90 mm – 300 mm (31(\frac{1}{2}) in. – 12 in.)</td>
<td>17</td>
<td>30</td>
</tr>
<tr>
<td>Above 300 mm – 900 mm (12 in. – 36 in.)</td>
<td>14</td>
<td>25</td>
</tr>
</tbody>
</table>

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook — Fundamentals.

Statement of Problem and Substantiation for Public Comment

The results by Dr. Shedd and the task group do not contain a problem formulation, do not show how the numbers were developed, and there is also concern about heat transfer coefficients used in the model. The UNLV report contains many errors and miscalculations. The chimney effect from the conduit risers and associated errors should negate the validity this research.

Since the concern is that the temperature of insulation should not rise above critical designed temperatures, direct measurements of temperature on the insulation are most relevant. The effect of flowing current when the conductor is loaded on the heat generated and its effect on the temperature of the insulation would be very important since the conductors will carry current.

In addition to a decrease in strength of conductor insulation with temperature, there will be creep of the insulation material when the temperatures are high since the exposure times are quite long.

The heat transfer coefficient on the outer and inner surfaces of conduits and between the copper and insulation would also influence the results.

We must rely more on experiments than calculations and therefore the results on actual measurements by Underwriters Laboratories are most reliable and should be used in selecting the ampacity and insulation.

Related Item

First Revision No. 1503-NFPA 70-2015 [Section No. 310.15(B)(3)]

Submitter Information Verification

Submitter Full Name: Pradeep Rohatgi
Organization: UW Milwaukee
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 16:54:24 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter's substantiation contained no new information. The submitter did not identify which items in the UNLV reports he believes are errors and miscalculations. No evidence was submitted that any chimney effect was present, or that such effect would negate the validity of the research. The wiring systems in the UNLV tests were terminated in wireways, which would greatly reduce any ‘chimney effect’. Direct measurements on the insulation were taken in the UNLV study and the IAEI study submitted in the 2014 NEC cycle. We agree that the heating effect of flowing current is important, and the information submitted by IAEI, UNLV and the Correlating Committee task group all considered this factor; the CDA reports did not. Heat transfer of various components was considered in the Correlating Committee task group information. The UNLV reports provided data for insulation temperatures and also provided data for current-carrying conductors. The panel has reviewed all studies and other evidence submitted over the last few cycles, and FR 1503 is the result of that review. Multiple studies were submitted showing that energized conductors exposed to direct sunlight on rooftops will not exceed the conductor insulation rating, even without the use of the rooftop adders.
Statement of Problem and Substantiation for Public Comment

This Table was a useful for 36 years. Adding the table back into the NEC will help those in the field. Most electricians in the field do not have calculator and this would be more user friendly. The table was removed and replaced with an 83% calculation and the calculation produces the same numbers as the table. If the table needs to be expanded to include larger services, that can be done too. The table can be added without deleting any of the existing text.

Related Item
Public Input No. 2938-NFPA 70-2014 [Section No. 310.15(B)(7)]

Submitter Information Verification

Submitter Full Name: Jim Muir
Organization: Building Safety Division, Clark County, WA
Affiliation: NFPA’s Building Code Development Committee (BCDC)
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:29:40 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The panel understands that table 310.15(B)(7) is helpful; however, the panel is also aware that there has been some misunderstanding on how to use this table. Specifically the term “ratings” has been confused to mean “ampacity”. For this reason it was placed in Annex D along with an example on how to determine feeder ratings.
(7) Single-Phase Dwelling Services and Feeders.

For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, service and feeder conductors supplied by a single-phase, 120/240-volt system shall be permitted to be sized in accordance with 310.15(B)(7)(1) through (4).

Single-phase feeders from a Feeder consisting of 2 ungrounded conductors and the neutral conductor of a 4-wire, 3-phase, 208Y/120 volt system shall be permitted to use 310.15(B)(7)(1) through (4).

(1) For a service rated 100 through 400 amperes, the service conductors supplying the entire load associated with a one-family dwelling, or the service conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the service rating.

(2) For a feeder rated 100 through 400 amperes, the feeder conductors supplying the entire load associated with a one-family dwelling, or the feeder conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the feeder rating.

(3) In no case shall a feeder for an individual dwelling unit be required to have an ampacity greater than that specified in 310.15(B)(7)(1) or (2).

(4) Grounded conductors shall be permitted to be sized smaller than the ungrounded conductors, if the requirements of 220.61 and 230.42 for service conductors or the requirements of 215.2 and 220.61 for feeder conductors are met.

(5) Where correction or adjustment factors are required by 310.15(B)(2) or (3), they shall be permitted to be applied to the ampacity associated with the temperature rating of the conductor.

Informational Note No. 1: The service or feeder ratings addressed by this section are based on the standard ampacity ratings from 240.6(A).

Informational Note No. 2: See Example D7 in Annex D.

Statement of Problem and Substantiation for Public Comment

This language is consistent with the description found in 220.61.

Related Item

First Revision No. 1504-NFPA 70-2015 [Section No. 310.15(B)(7)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 22:49:17 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1505-NFPA 70-2015
Statement: The construction of a second paragraph for the 208Y/120-volt system requires the addition of the same limited-dwelling application text in order to remove any ambiguity the addition of the second paragraph might cause.

The addition of the system description text in the second paragraph is to further clarify its exact meaning.

The 208Y/120-volt application is limited to (1) through (3) due to the fact that the neutral of that system is a current-carrying conductor and must always be full sized in accordance with 220.61, and therefore the reduced neutral sizing allowed by (4) can never be applied.

The translation of the last paragraph into list item (5) during the First Revision Terra processing was in error. There is no list item (5).
Single-Phase Dwelling Services and Feeders.

For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, service and feeder conductors supplied by a single-phase, 120/240-volt system shall be permitted to be sized in accordance with 310.15(B)(7)(1) through (4).

Single-phase feeders from a 208Y/120 volt system shall be permitted to use 310.15(B)(7)(1) through (4).

(1) For a service rated 100 through 400 amperes, the service conductors supplying the entire load associated with a one-family dwelling, or the service conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the service rating.

(2) For a feeder rated 100 through 400 amperes, the feeder conductors supplying the entire load associated with a one-family dwelling, or the feeder conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the feeder rating.

(3) In no case shall a feeder for an individual dwelling unit be required to have an ampacity greater than that specified in 310.15(B)(7)(1) or (2).

(4) Grounded conductors shall be permitted to be sized smaller than the ungrounded conductors, if the requirements of 220.61 and 230.42 for service conductors or the requirements of 215.2 and 220.61 for feeder conductors are met.

(5) Where correction or adjustment factors are required by 310.15(B)(2) or (3), they shall be permitted to be applied to the ampacity associated with the temperature rating of the conductor.

Informational Note No. 1: The service or feeder ratings addressed by this section are based on the standard ampacity ratings from 240.6(A).

Informational Note No. 2: See Example D7 in Annex D.

If no temperature correction or ampacity adjustment factors are required, the following table includes conductor sizes calculated using the requirements in 310.15(B)(7).

<table>
<thead>
<tr>
<th>Service or Feeder Rating (Amperes)</th>
<th>Copper (AWG)</th>
<th>Aluminum or Copper-Clad Aluminum (kcmil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>110</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>125</td>
<td>2</td>
<td>1/0</td>
</tr>
<tr>
<td>150</td>
<td>1</td>
<td>2/0</td>
</tr>
<tr>
<td>175</td>
<td>1/0</td>
<td>3/0</td>
</tr>
<tr>
<td>200</td>
<td>2/0</td>
<td>4/0</td>
</tr>
<tr>
<td>225</td>
<td>3/0</td>
<td>250</td>
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<td>250</td>
<td>4/0</td>
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<tr>
<td>350</td>
<td>350</td>
<td>500</td>
</tr>
<tr>
<td>400</td>
<td>400</td>
<td>600</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

First I would like to thank the panel for bringing Table 310.15(B)(7) from the 2011 NEC to the 2017 NEC though it is in the Annex with the First Revision. The issue is that the NEC should be user friendly. With the code language in 310.15(B)(7) and the table in the back does not help inspectors, electricians, etc. We need to keep it simple and have all the tools together. The table works fine without going through an 83% calculation. In addition the Annex is not enforceable, however 310.15(B)(7) is. At a glance at the table conductors can be sized without referring to the Annex. As mentors of the code we have knowledge of the what the Annex is however many new users and some installers don't understand the annex and are intimidated to go there. Chapters 1-4 are their meat and potatoes. They believe the Annex is for engineers. Let's keep it simple.

Please move the following wording and the table from the Annex D to 310.15(B)(7) for the 2017 NEC.

If no temperature correction or ampacity adjustment factors are required, the following table includes conductor sizes calculated using the requirements in 310.15(B)(7).
### TABLE 310.15(B)(7)

<table>
<thead>
<tr>
<th>Service or Feeder Rating (Amperes)</th>
<th>Copper</th>
<th>Aluminum or Copper-Clad Aluminum</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>110</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>125</td>
<td>2</td>
<td>1/0</td>
</tr>
<tr>
<td>150</td>
<td>1</td>
<td>2/0</td>
</tr>
<tr>
<td>175</td>
<td>1/0</td>
<td>3/0</td>
</tr>
<tr>
<td>200</td>
<td>2/0</td>
<td>4/0</td>
</tr>
<tr>
<td>225</td>
<td>3/0</td>
<td>250</td>
</tr>
<tr>
<td>250</td>
<td>4/0</td>
<td>300</td>
</tr>
<tr>
<td>300</td>
<td>250</td>
<td>350</td>
</tr>
<tr>
<td>350</td>
<td>350</td>
<td>500</td>
</tr>
<tr>
<td>400</td>
<td>400</td>
<td>600</td>
</tr>
</tbody>
</table>

**Related Item**
- First Revision No. 1513-NFPA 70-2015 [Definition: Example D7 Sizing of Service Conductors for Dw...]
- Public Input No. 2938-NFPA 70-2014 [Section No. 310.15(B)(7)]

**Submitter Information Verification**

- **Submitter Full Name:** JOHN STACEY
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- **State:**
- **Zip:**
- **Submittal Date:** Mon Jun 29 15:12:29 EDT 2015

**Committee Statement**

- **Committee Action:** Rejected
- **Resolution:**
The panel understands that table 310.15(B)(7) is helpful; however, the panel is also aware that there has been some misunderstanding on how to use this table. Specifically the term “ratings” has been confused to mean “ampacity”. For this reason it was placed in Annex D along with an example on how to determine feeder ratings.
310.104 Conductor Constructions and Applications.
Insulated conductors shall comply with the applicable provisions of Table 310.104(A) through Table 310.104(E).

**Informational Note 1**: Thermoplastic insulation may stiffen at temperatures lower than -10°C (+14°F). Thermoplastic insulation may also be deformed at normal temperatures where subjected to pressure, such as at points of support.

**Informational Note 2**: The requirements associated with the term flame retardant for each type of insulation are contained within the listing standard for the relevant insulation. Often, one method of determining that the insulation is flame retardant is by testing the insulation, or the cable, to the VW-1 (Vertical Wire) test in ANSI/UL 1581-2011, Reference Standard for Electrical Wires, Cables and Flexible Cords.

Table 310.104(A) Conductor Applications and Insulations Rated 600 Volts

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Type</th>
<th>Maximum Operating Temperature</th>
<th>Application Provisions</th>
<th>Insulation</th>
<th>Thickness of Insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorinated ethylene propylene</td>
<td>FEP or FEPB</td>
<td>90°C (194°F)</td>
<td>Dry and damp locations</td>
<td>Fluorinated ethylene propylene</td>
<td>14–10 0.51 20 None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200°C (392°F)</td>
<td>Dry locations — special applications</td>
<td>Fluorinated ethylene propylene</td>
<td>14–8 0.36 14 Glass braid</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6–2 0.36 14 Glass or other suitable braid material</td>
</tr>
<tr>
<td>Mineral insulation (metal sheathed)</td>
<td>MI</td>
<td>90°C (194°F)</td>
<td>Dry and wet locations</td>
<td>Magnesium oxide</td>
<td>18–16 0.58 23 Copper or alloy steel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>250°C (482°F)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16–10 0.91 36 Glass or other suitable braid material</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9–4 1.27 50</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3–500 1.40 55</td>
</tr>
<tr>
<td>Moisture-, heat-, and oil-resistant thermoplastic</td>
<td>MTW</td>
<td>60°C (140°F)</td>
<td>Machine tool wiring in wet locations</td>
<td>Flame-retardant, moisture-, heat-, and oil-resistant thermoplastic</td>
<td>22–12 0.76 30 (A) None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>90°C (194°F)</td>
<td>Machine tool wiring in dry locations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Informational Note: See NFPA 79.</td>
<td></td>
<td>(A) None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td></td>
<td>85°C (185°F)</td>
<td>For underground service conductors, or by special permission</td>
<td>Paper</td>
<td>Lead sheath</td>
</tr>
<tr>
<td>Perfluoro-alkoxy</td>
<td>PFA</td>
<td>90°C (194°F)</td>
<td>Dry and damp locations</td>
<td>Perfluoro-alkoxy</td>
<td>14–10 0.51 20 None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200°C (392°F)</td>
<td>Dry locations — special applications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perfluoro-alkoxy</td>
<td>PFAH</td>
<td>250°C (482°F)</td>
<td>Dry locations only. Only for leads within apparatus or within raceways connected to apparatus (nickel or nickel-coated copper only)</td>
<td>Perfluoro-alkoxy</td>
<td>14–10 0.51 20 None</td>
</tr>
<tr>
<td>Trade Name</td>
<td>Type Letter</td>
<td>Maximum Operating Temperature</td>
<td>Application Provisions</td>
<td>Insulation</td>
<td>Thickness of Insulation</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------</td>
<td>-------------------------------</td>
<td>-------------------------------------------------</td>
<td>-------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Thermoset RHH</td>
<td></td>
<td>90°C (194°F)</td>
<td>Dry and damp locations</td>
<td>Flame-retardant, moisture-resistant thermoset</td>
<td>14–10</td>
</tr>
<tr>
<td>Moisture-resistant thermoset RHW</td>
<td></td>
<td>75°C (167°F)</td>
<td>Dry and wet locations</td>
<td>Flame-retardant, moisture-resistant thermoset</td>
<td>14–10</td>
</tr>
<tr>
<td>Silicone SA</td>
<td></td>
<td>90°C (194°F)</td>
<td>Dry and damp locations</td>
<td>Silicone rubber</td>
<td>14–10</td>
</tr>
<tr>
<td>Thermostat SIS</td>
<td></td>
<td>90°C (194°F)</td>
<td>Switchboard and switchgear wiring only</td>
<td>Flame-retardant thermoset</td>
<td>14–10</td>
</tr>
<tr>
<td>Thermoplastic and fibrous outer braid TBS</td>
<td></td>
<td>90°C (194°F)</td>
<td>Switchboard and switchgear wiring only</td>
<td>Thermoplastic</td>
<td>14–10</td>
</tr>
<tr>
<td>Extended polytetrafluoroethylene TFE</td>
<td></td>
<td>250°C (482°F)</td>
<td>Dry locations only. Only for leads within apparatus or within raceways connected to apparatus, or as open wiring (nickel or nickel-coated copper only)</td>
<td>Extruded polytetrafluoroethylene</td>
<td>14–10</td>
</tr>
<tr>
<td>Heat-resistant thermoplastic THHN</td>
<td></td>
<td>90°C (194°F)</td>
<td>Dry and damp locations</td>
<td>Flame-retardant, heat-resistant thermoplastic</td>
<td>14–12</td>
</tr>
<tr>
<td>Moisture-heat-resistant thermoplastic</td>
<td>THHW</td>
<td>75°C (167°F)</td>
<td>Wet location</td>
<td>Flame-retardant, moisture- and heat-resistant thermoplastic</td>
<td>14–10</td>
</tr>
<tr>
<td>Moisture-heat-resistant thermoplastic</td>
<td>THW</td>
<td>75°C (167°F)</td>
<td>Dry and wet locations</td>
<td>Flame-retardant, moisture- and heat-resistant thermoplastic</td>
<td>14–10</td>
</tr>
<tr>
<td>Trade Name</td>
<td>Type Letter</td>
<td>Maximum Operating Temperature</td>
<td>Application Provisions</td>
<td>Insulation</td>
<td>Thickness of Insulation</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------</td>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>THW-2</td>
<td>90°C (194°F)</td>
<td>Dry and wet locations</td>
<td>Limited to 1000 open-circuit volts or less. (size 14-8 only as permitted in 410.68)</td>
<td>Insulation</td>
<td>501–1000</td>
</tr>
<tr>
<td>THWN</td>
<td>75°C (167°F)</td>
<td>Dry and wet locations</td>
<td>Flame-retardant, moisture- and heat-resistant thermoplastic</td>
<td>AWG or kcmil</td>
<td>1001–2000</td>
</tr>
<tr>
<td>THWN-2</td>
<td>90°C (194°F)</td>
<td>Dry and wet locations</td>
<td>Flame-retardant, moisture- and heat-resistant thermoplastic</td>
<td>14–10</td>
<td>0.76</td>
</tr>
<tr>
<td>Moisture-resistant thermoplastic</td>
<td>TW</td>
<td>60°C (140°F)</td>
<td>Dry and wet locations</td>
<td>8 6–2</td>
<td>1.14</td>
</tr>
<tr>
<td>Moisture-resistant</td>
<td>UF</td>
<td>75°C (167°F)</td>
<td>Moisture-resistant</td>
<td>1–4/0</td>
<td>1.40</td>
</tr>
<tr>
<td>Underground feeder and branch-circuit cable — single conductor (for Type UF cable employing more than one conductor, see Article 340.)</td>
<td>USE</td>
<td>75°C (167°F)</td>
<td>Moisture-resistant</td>
<td>14–10</td>
<td>1.14</td>
</tr>
<tr>
<td>Underground service-entrance cable — single conductor (for Type USE cable employing more than one conductor, see Article 338.)</td>
<td>USE-2</td>
<td>90°C (194°F)</td>
<td>Heat- and moisture-resistant</td>
<td>8 6–2</td>
<td>1.52</td>
</tr>
<tr>
<td>Thermoset</td>
<td>XHH</td>
<td>90°C (194°F)</td>
<td>Dry and damp locations</td>
<td>Flame-retardant thermoset</td>
<td>14–12</td>
</tr>
<tr>
<td>Thermoset</td>
<td>XHHN</td>
<td>90°C (194°F)</td>
<td>Dry and damp locations</td>
<td>Flame-retardant thermoset</td>
<td>8 6–2</td>
</tr>
<tr>
<td>Moisture-resistant nonmetallic covering (See 338.2.)</td>
<td>USE-2</td>
<td>90°C (194°F)</td>
<td>Flame-retardant thermoset</td>
<td>4–21–4/0</td>
<td>1.02</td>
</tr>
<tr>
<td>Moisture-resistant</td>
<td>UF</td>
<td>75°C (167°F)</td>
<td>Flame-retardant, moisture- and heat-resistant thermoplastic</td>
<td>250–500</td>
<td>1.27</td>
</tr>
<tr>
<td>Moisture-resistant</td>
<td>TW</td>
<td>60°C (140°F)</td>
<td>Flame-retardant, moisture- and heat-resistant thermoplastic</td>
<td>Moisture-resistant</td>
<td>1001–2000</td>
</tr>
<tr>
<td>Moisture-resistant</td>
<td>UF</td>
<td>75°C (167°F)</td>
<td>Flame-retardant, moisture- and heat-resistant thermoplastic</td>
<td>Moisture-resistant</td>
<td>1001–2000</td>
</tr>
<tr>
<td>Thermoset</td>
<td>XHH</td>
<td>90°C (194°F)</td>
<td>Dry and damp locations</td>
<td>Flame-retardant thermoset</td>
<td>1001–2000</td>
</tr>
<tr>
<td>Moisture-resistant</td>
<td>UF</td>
<td>75°C (167°F)</td>
<td>Flame-retardant, moisture- and heat-resistant thermoplastic</td>
<td>Moisture-resistant</td>
<td>1001–2000</td>
</tr>
<tr>
<td>Thermoset</td>
<td>XHHN</td>
<td>90°C (194°F)</td>
<td>Dry and damp locations</td>
<td>Flame-retardant thermoset</td>
<td>1001–2000</td>
</tr>
</tbody>
</table>


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<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Type Letter</th>
<th>Maximum Operating Temperature</th>
<th>Application Provisions</th>
<th>Insulation</th>
<th>Thickness of Insulation</th>
<th>Outer Covering²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture-resistant thermostet</td>
<td>XHHW</td>
<td>90°C (194°F) 75°C (167°F)</td>
<td>Dry and damp locations Wet locations</td>
<td>Flame-retardant, moisture-resistant thermostet</td>
<td>14–10 8–2 1–4/0 213–500 501–1000 1001–2000</td>
<td>0.76 1.14 1.40 1.65 2.03 2.41</td>
</tr>
<tr>
<td>Moisture-resistant thermostet</td>
<td>XHHW-2</td>
<td>90°C (194°F)</td>
<td>Dry and wet locations</td>
<td>Flame-retardant, moisture-resistant thermostet</td>
<td>14–10 8–2 1–4/0 213–500 501–1000 1001–2000</td>
<td>0.76 1.14 1.40 1.65 2.03 2.41</td>
</tr>
<tr>
<td>Moisture-resistant thermostet</td>
<td>XHWN</td>
<td>75°C (167°F)</td>
<td>Dry and wet locations</td>
<td>Flame-retardant, moisture-resistant thermostet</td>
<td>14–12 10 8–6 4–2 1–4/0 250–500 501–1000</td>
<td>0.38 0.51 0.76 1.02 1.27 1.52 1.78</td>
</tr>
<tr>
<td>Moisture-resistant thermostet</td>
<td>XHWN-2</td>
<td>90°C (194°F)</td>
<td>Dry and wet locations</td>
<td>Flame-retardant, moisture-resistant thermostet</td>
<td>14–10 8–2</td>
<td>0.76 1.14</td>
</tr>
<tr>
<td>Modified ethylene tetrafluoro-ethylene</td>
<td>Z</td>
<td>90°C (194°F) 150°C (302°F)</td>
<td>Dry and damp locations Dry locations — special applications³</td>
<td>Modified ethylene tetrafluoro-ethylene</td>
<td>14–12 10 8–4 3–1 1/0–4/0</td>
<td>0.38 0.51 0.64 0.89 1.14</td>
</tr>
<tr>
<td>Modified ethylene tetrafluoro-ethylene</td>
<td>ZW</td>
<td>75°C (167°F) 90°C (194°F) 150°C (302°F)</td>
<td>Wet locations Dry and damp locations Dry locations — special applications³</td>
<td>Modified ethylene tetrafluoro-ethylene</td>
<td>14–10 8–2</td>
<td>0.76 1.14</td>
</tr>
<tr>
<td>Modified ethylene tetrafluoro-ethylene</td>
<td>ZW-2</td>
<td>90°C (194°F)</td>
<td>Dry and wet locations</td>
<td>Flame-retardant, moisture-resistant thermostet</td>
<td>14–10 8–2</td>
<td>0.76 1.14</td>
</tr>
</tbody>
</table>

1 Conductors can be rated up to 1000 V if listed and marked.
2 Some insulations do not require an outer covering.
3 Where design conditions require maximum conductor operating temperatures above 90°C (194°F).
4 For signaling circuits permitting 300-volt insulation.
5 For ampacity limitation, see 340.80.
6 Includes integral jacket.
7 Insulation thickness shall be permitted to be 2.03 mm (80 mils) for listed Type USE conductors that have been subjected to special investigations. The nonmetallic covering over individual rubber-covered conductors of aluminum-sheathed cable and of lead-sheathed or multiconductor cable shall not be required to be flame retardant. For Type MC cable, see 330.104. For nonmetallic-sheathed cable, see Article 334, Part III. For Type UF cable, see Article 340, Part III.

Table 310.104(B) Thickness of Insulation for Nonshielded Types RHH and RHW Solid Dielectric Insulated Conductors Rated 2000 Volts

<table>
<thead>
<tr>
<th>Conductor Size (AWG or kcmil)</th>
<th>Column A¹</th>
<th>Column B²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mm</td>
<td>mils</td>
</tr>
<tr>
<td>14–10 8</td>
<td>2.03</td>
<td>80</td>
</tr>
<tr>
<td>2.03</td>
<td>80</td>
<td>1.78</td>
</tr>
</tbody>
</table>
### Table 310.104(C) Conductor Application and Insulation Rated 2001 Volts and Higher

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Type Letter</th>
<th>Maximum Operating Temperature</th>
<th>Application Provision</th>
<th>Insulation</th>
<th>Outer Covering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium voltage solid dielectric</td>
<td>MV-90</td>
<td>90°C</td>
<td>Dry or wet locations</td>
<td>Thermo-plastic or thermo-setting</td>
<td>Jacket, sheath, or armor</td>
</tr>
<tr>
<td></td>
<td>MV-105*</td>
<td>105°C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Where design conditions require maximum conductor temperatures above 90°C.

### Table 310.104(D) Thickness of Insulation and Jacket for Nonshielded Solid Dielectric Insulated Conductors Rated 2001 to 5000 Volts

<table>
<thead>
<tr>
<th>Conductor Size (AWG or kcmil)</th>
<th>Dry Locations, Single Conductor</th>
<th>Wet or Dry Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without Jacket</td>
<td>With Jacket</td>
</tr>
<tr>
<td></td>
<td>Insulation</td>
<td>Insulation</td>
</tr>
<tr>
<td></td>
<td>mm</td>
<td>mils</td>
</tr>
<tr>
<td>8</td>
<td>2.79</td>
<td>110</td>
</tr>
<tr>
<td>6</td>
<td>2.79</td>
<td>110</td>
</tr>
<tr>
<td>4–2</td>
<td>2.79</td>
<td>110</td>
</tr>
<tr>
<td>1–2/0</td>
<td>2.79</td>
<td>110</td>
</tr>
<tr>
<td>3/0–4/0</td>
<td>2.79</td>
<td>110</td>
</tr>
<tr>
<td>213–500</td>
<td>3.05</td>
<td>120</td>
</tr>
<tr>
<td>501–750</td>
<td>3.30</td>
<td>130</td>
</tr>
<tr>
<td>751–1000</td>
<td>3.30</td>
<td>130</td>
</tr>
<tr>
<td>1001–1250</td>
<td>3.56</td>
<td>140</td>
</tr>
<tr>
<td>1251–1500</td>
<td>3.56</td>
<td>140</td>
</tr>
<tr>
<td>1501–2000</td>
<td>3.56</td>
<td>140</td>
</tr>
</tbody>
</table>

*Under a common overall covering such as a jacket, sheath, or armor.

### Table 310.104(E) Thickness of Insulation for Shielded Solid Dielectric Insulated Conductors Rated 2001 to 35,000 Volts

- 2001–5000 Volts
- 5001–8000 Volts
- 8001–15,000 Volts
- 15,001–25,000 Volts
- 25,001–28,000 Volts
- 28,001–35,000 Volts

<table>
<thead>
<tr>
<th>Conductor Size (AWG or kcmil)</th>
<th>100 Percent Insulation</th>
<th>133 Percent Insulation</th>
<th>173 Percent Insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level 1</td>
<td>Level 2</td>
<td>Level 3</td>
</tr>
<tr>
<td>8</td>
<td>2.29</td>
<td>90</td>
<td>—</td>
</tr>
<tr>
<td>6–4</td>
<td>2.29</td>
<td>90</td>
<td>2.92</td>
</tr>
<tr>
<td>2</td>
<td>2.29</td>
<td>90</td>
<td>2.92</td>
</tr>
<tr>
<td>1</td>
<td>2.29</td>
<td>90</td>
<td>2.92</td>
</tr>
<tr>
<td>1/0–2000</td>
<td>2.29</td>
<td>90</td>
<td>2.92</td>
</tr>
</tbody>
</table>

*Under a common overall covering such as a jacket, sheath, or armor.
**100 Percent Insulation Level.** Cables in this category shall be permitted to be applied where the system is provided with relay protection such that ground faults will be cleared as rapidly as possible but, in any case, within 1 minute. While these cables are applicable to the great majority of cable installations that are on grounded systems, they shall be permitted to be used also on other systems for which the application of cables is acceptable, provided the above clearing requirements are met in completely de-energizing the faulted section.

**133 Percent Insulation Level.** This insulation level corresponds to that formerly designated for ungrounded systems. Cables in this category shall be permitted to be applied in situations where the clearing time requirements of the 100 percent level category cannot be met and yet there is adequate assurance that the faulted section will be de-energized in a time not exceeding 1 hour. Also, they shall be permitted to be used in 100 percent insulation level applications where additional insulation is desirable.

**173 Percent Insulation Level.** Cables in this category shall be permitted to be applied under all of the following conditions:

1. In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation
2. Where the fault clearing time requirements of the 133 percent level category cannot be met
3. Where an orderly shutdown is essential to protect equipment and personnel
4. There is adequate assurance that the faulted section will be de-energized in an orderly shutdown

Also, cables with this insulation thickness shall be permitted to be used in 100 or 133 percent insulation level applications where additional insulation strength is desirable.

### Statement of Problem and Substantiation for Public Comment

The panel stated that the VW-1 test is not always required and therefore this public comment adds a sentence that states that fact. That added sentence clarifies that the listing standard contains the fire test. However, in many (if not most) cases the appropriate test is the VW-1 test. More importantly, the term "flame retardant" as such is not an appropriate term without clarification because the term flame retardant simply refers to the additives that are used to improve fire performance, unless the fire performance is clarified.

**Related Item**

Public Input No. 2478-NFPA 70-2014 [Section No. 310.104]

### Submitter Information Verification

**Submitter Full Name:** Marcelo Hirschler  
**Organization:** GBH International  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Tue Sep 22 15:19:02 EDT 2015

### Committee Statement

**Committee Action:** Rejected  
**Resolution:** The submitter states in his substantiation that “in many (if not most) cases the appropriate test is the VW-1 test.” However, this is not true for the products listed in 310.104(A). For most of these products VW-1 is not the required flame test. Therefore, the informational note may be misleading. The products standards contain the information required for flame testing.
Public Comment No. 1790-NFPA 70-2015 [Section No. 312.1]

312.1 Scope.
This article covers the installation and construction specifications of cabinets, cutout boxes, and meter socket enclosures. It does not apply to equipment operating at over 1000 volts, except as specifically referenced elsewhere in the Code.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs the panel to give further consideration to the comments expressed in voting on FR 2401.

Related Item
First Revision No. 2401-NFPA 70-2015 [Section No. 312.1]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:55:25 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: CMP 9 reviewed the record and the First Draft text. The Panel retains the First Draft text. The second sentence in 312.1 addressing the voltage limitation applicable to this article was added exactly as written in the first draft report. The statement reported in the first revision report was not the one voted by the panel. The correct statement, inserted here to clarify the record, is as follows: "CMP 9 concludes that the equipment addressed in Article 312 is not generally designed to exceed the voltage parameters in Article 408 and has applied comparable language from 408.1 to address this topic. CMP 9 recognizes that the Correlating Committee has jurisdiction over scope provisions and recommends this revision accordingly."
Statement of Problem and Substantiation for Public Comment

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rdparty devices from the market.

These 3rdparty devices have proven to be the only viable way of addressing the current install base of enclosures across the US.

3rdparty devices fill a critical role in the growth of renewable energy by providing the necessary sensor data to optimally manage a home’s participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, microgrid and demand response which are key to achieving a stable, sustainable grid.

In their statement regarding this proposed change, CMP9 references an earlier proposal to allow the installation of utilization equipment which was rejected in the 2011 cycle. We recognize that the wide variety of existing devices classified as ‘utilization equipment’ and not designed for installation inside enclosures could result in obstruction and hazard. However, we propose that a device specifically designed for installation within any listed enclosures and evaluated by qualified test lab for installation inside any listed enclosures can be safely installed.

In order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC.

To address CMP9's concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any crosssectional area. Evaluation of this limit should should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item
**Submitter Information Verification**

<table>
<thead>
<tr>
<th><strong>Submitter Full Name:</strong></th>
<th>Jarl Meagher</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization:</strong></td>
<td>[ Not Specified ]</td>
</tr>
<tr>
<td><strong>Street Address:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>City:</strong></td>
<td></td>
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<td><strong>State:</strong></td>
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<tr>
<td><strong>Zip:</strong></td>
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</tr>
<tr>
<td><strong>Submittal Date:</strong></td>
<td>Fri Sep 25 14:41:35 EDT 2015</td>
</tr>
</tbody>
</table>

**Committee Statement**

<table>
<thead>
<tr>
<th><strong>Committee Action:</strong></th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resolution:</strong></td>
<td>The action taken on SR 2401 regarding 312.8 addresses the concerns raised in the substantiation. CMP 9 rejects the comment because the heading line as well as the legislative text point to 312.5(B). The entirety of the substantiation and the referenced FR revision number clearly indicate the intent to address 312.8.</td>
</tr>
</tbody>
</table>
Public Comment No. 376-NFPA 70-2015 [Section No. 312.5(C)]

(C) Cables.
Where cable is used, each cable shall be secured to the cabinet, cutout box, or meter socket enclosure.

Exception: Cables with entirely nonmetallic sheaths shall be permitted to enter the top of a surface-mounted enclosure through one or more nonflexible raceways not less than 450 mm (18 in.) and not more than 3.0 m (10 ft) in length, provided all of the following conditions are met:

(a) Each cable is fastened within 300 mm (12 in.), measured along the sheath, of the outer end of the raceway.
(b) The raceway extends directly above the enclosure and does not penetrate a structural ceiling.
(c) A fitting is provided on each end of the raceway to protect the cable(s) from abrasion and the fittings remain accessible after installation.
(d) The raceway is sealed or plugged at the outer end using approved means so as to prevent access to the enclosure through the raceway.
(e) The cable sheath is continuous through the raceway and extends into the enclosure beyond the fitting not less than 6 mm (0.25 in.).
(f) The raceway is fastened at its outer end and at other points in accordance with the applicable article.
(g) Where installed as conduit or tubing, the cable fill does not exceed the amount that would be permitted for complete conduit or tubing systems by Table 1 of Chapter 9 of this Code and all applicable notes there to. Note 2 to Chapter 9, Table 1, Note 2: Tables does not apply to this condition.

Informational Note: See Table 1 in Chapter 9, including Note 9, for allowable cable fill in circular raceways. See 310.15(B)(3) (a) for required ampacity reductions for multiple cables installed in a common raceway.

Statement of Problem and Substantiation for Public Comment
The notes in Chapter 9, do not apply to Table 1, they apply to the tables contained in Chapter 9.

Related Item
First Revision No. 2403-NFPA 70-2015 [Section No. 312.5(C)]

Submitter Information Verification
Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 19:48:03 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-2402-NFPA 70-2015
Statement: CMP 9 agrees with the concept that the referenced notes apply to the tables generally, and not just to Table 1. This wording accomplishes the objectives of the submitter, but flows better editorially.
Public Comment No. 1040-NFPA 70-2015 [ Section No. 312.6(A) ]

(A) Width of Wiring Gutters.
Conductors shall not be deflected within a cabinet or cutout box unless a gutter having a width in accordance with Table 312.6(A) is provided. Conductors in parallel in accordance with 310.10(H) shall be judged on the basis of the number of conductors in parallel.

Table 312.6(A) Minimum Wire-Bending Space at Terminals and Minimum Width of Wiring Gutters

<table>
<thead>
<tr>
<th>Wire Size (AWG or kcmil)</th>
<th>Wires per Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>All Other Conductors</td>
<td>mm</td>
</tr>
<tr>
<td>14–10</td>
<td>Not specified</td>
</tr>
<tr>
<td>8–6</td>
<td>38.1 1½</td>
</tr>
<tr>
<td>4–3</td>
<td>50.8 2</td>
</tr>
<tr>
<td>2</td>
<td>63.5 2½</td>
</tr>
<tr>
<td>1</td>
<td>76.2 3</td>
</tr>
<tr>
<td>1/0–2/0</td>
<td>88.9 3½</td>
</tr>
<tr>
<td>3/0–4/0</td>
<td>102 4</td>
</tr>
<tr>
<td>250</td>
<td>114 4½</td>
</tr>
<tr>
<td>300–350</td>
<td>127 5</td>
</tr>
<tr>
<td>400–500</td>
<td>152 6</td>
</tr>
<tr>
<td>600–700</td>
<td>203 8</td>
</tr>
<tr>
<td>750–900</td>
<td>203 8</td>
</tr>
<tr>
<td>1000–1250</td>
<td>254 10</td>
</tr>
<tr>
<td>1500–2000</td>
<td>305 12</td>
</tr>
</tbody>
</table>

Note: Bending space at terminals shall be measured in a straight line from the end of the lug or wire connector (in the direction that the wire leaves the terminal) to the wall, barrier, or obstruction.

2. This column shall be permitted to be used to determine the required minimum wire-bending space for compact stranded aluminum conductors in sizes up to 1000 kcmil and manufactured using AA-8000 series electrical grade aluminum alloy conductor material in accordance with 310.106(B). The minimum width of the wire gutter space shall be determined using the all other conductors value in this table.

Statement of Problem and Substantiation for Public Comment

The NEMA wire bending study to validate the inclusion of AA-8000 AL wire bending allowances to this table is well underway. The results will be available by the second draft meeting.

Related Item
First Revision No. 2435-NFPA 70-2015 [Section No. 312.6(A)]

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 10:45:17 EDT 2015

Committee Statement

Committee: Rejected but see related SR
Action:
<table>
<thead>
<tr>
<th>Resolution:</th>
<th>SR-2403-NFPA 70-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement:</td>
<td>The fact-finding study sought by the panel members who objected to the action taken on FR #2435 that inserted this material into Table 312.6(A) has been completed and, together with additional information, has been reviewed by the panel. CMP 9 has some concerns relative to the fact that the study set-up did not involve actual electrical enclosures. On the other hand, Table 314.6(A), unlike the (B) table, generally covers bends that are made outside the enclosure and then set into place. In addition, there is substantial information available in the public domain relative to the more forgiving characteristics of the aluminum now being used for conductors. After reviewing all information, CMP 9 concludes that the revised dimensions for aluminum conductors are consistent with minimum safety standards and provide a useful correlation with comparable material in Table 312.6(B). The two tables cover differing facets of the same technical issues.</td>
</tr>
</tbody>
</table>

The Panel also edited the note numbering at the bottom of the table to be consistent with Table 312.6(B). |
(A) Width of Wiring Gutters.
Conductors shall not be deflected within a cabinet or cutout box unless a gutter having a width in accordance with Table 312.6(A) is provided. Conductors in parallel in accordance with 310.10(H) shall be judged on the basis of the number of conductors in parallel.

Table 312.6(A) Minimum Wire-Bending Space at Terminals and Minimum Width of Wiring Gutters

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<th>Wire Size (AWG or kcmil)</th>
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<td></td>
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<td></td>
<td>2</td>
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<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td>14–10</td>
<td>12–8</td>
</tr>
<tr>
<td></td>
<td>Not specified</td>
</tr>
<tr>
<td>8–6</td>
<td>6–4</td>
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<tr>
<td>4–3</td>
<td>2–1</td>
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<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1/0</td>
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<tr>
<td>10–2/0</td>
<td>3/0–4/0</td>
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<tr>
<td>3/0–4/0</td>
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<tr>
<td>600–700</td>
<td>800–1000</td>
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<tr>
<td>750–900</td>
<td>1000–1250</td>
</tr>
<tr>
<td>1500–2000</td>
<td>305</td>
</tr>
</tbody>
</table>

Note: Bending space at terminals shall be measured in a straight line from the end of the lug or wire connector (in the direction that the wire leaves the terminal) to the wall, barrier, or obstruction.
2. This column shall be permitted to be used to determine the required wire-bending space for compact stranded aluminum conductors in sizes up to 1000 kcmil and manufactured using AA-8000 series electrical grade aluminum alloy conductor material in accordance with 310.106(B). The minimum width of the wire gutter space shall be determined using the all other conductors value in this table.

Statement of Problem and Substantiation for Public Comment

The concept presented has merit, but lacks substantiation. This Public Comment is to restore Table 312.6(A) to the text in the 2014 NEC

Related Item
First Revision No. 2435-NFPA 70-2015 [Section No. 312.6(A)]

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 14:20:46 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2403-NFPA 70-2015
Statement: The fact-finding study sought by the panel members who objected to the action taken on FR #2435 that inserted this material into Table 312.6(A) has been completed and, together with additional information, has been reviewed by the panel. CMP 9 has some concerns relative to the fact that the study set-up did not involve actual electrical enclosures. On the other hand, Table 314.6(A), unlike the (B) table, generally covers bends that are made outside the enclosure and then set into place. In addition, there is substantial information available in the public domain relative to the more forgiving characteristics of the aluminum now being used for conductors. After reviewing all information, CMP 9 concludes that the revised dimensions for aluminum conductors are consistent with minimum safety standards and provide a useful correlation with comparable material in Table 312.6(B). The two tables cover differing facets of the same technical issues.

The Panel also edited the note numbering at the bottom of the table to be consistent with Table 312.6(B).
Public Comment No. 1791-NFPA 70-2015 [Section No. 312.6(A)]

(A) Width of Wiring Gutters.

Conductors shall not be deflected within a cabinet or cutout box unless a gutter having a width in accordance with Table 312.6(A) is provided. Conductors in parallel in accordance with 310.10(H) shall be judged on the basis of the number of conductors in parallel.

Table 312.6(A) Minimum Wire-Bending Space at Terminals and Minimum Width of Wiring Gutters

<table>
<thead>
<tr>
<th>Wire Size (AWG or kcmil)</th>
<th>All Other Conductors</th>
<th>Compact Stranded AA-8000 Aluminum Alloy Conductors (see Note 2)</th>
<th>1 mm in.</th>
<th>2 mm in.</th>
<th>3 mm in.</th>
<th>4 mm in.</th>
<th>5 mm in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>14–10</td>
<td>12–8</td>
<td></td>
<td>Not specified</td>
<td>——</td>
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<td>——</td>
<td>——</td>
</tr>
<tr>
<td>8–6</td>
<td>6–4</td>
<td></td>
<td>38.1 1 ½</td>
<td>——</td>
<td>——</td>
<td>——</td>
<td>——</td>
</tr>
<tr>
<td>4–3</td>
<td>2–1</td>
<td></td>
<td>50.8 2</td>
<td>——</td>
<td>——</td>
<td>——</td>
<td>——</td>
</tr>
<tr>
<td>2</td>
<td>1/0</td>
<td></td>
<td>63.5 2 ½</td>
<td>——</td>
<td>——</td>
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<td>——</td>
</tr>
<tr>
<td>1</td>
<td>2/0</td>
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<td>——</td>
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<td>——</td>
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<td>1/0–2/0</td>
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<td></td>
<td>88.9 3 ½</td>
<td>127 5</td>
<td>178 7</td>
<td>——</td>
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<td>3/0–4/0</td>
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<td>102 4</td>
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<td>——</td>
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<td>250</td>
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<td>114 4 ½</td>
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<td>203 8</td>
<td>254 10</td>
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<td>300–350</td>
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<td>127 5</td>
<td>203 8</td>
<td>254 10</td>
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<td>356 14</td>
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<td>406 16</td>
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<td>254 10</td>
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<td>——</td>
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</tr>
</tbody>
</table>

Note: Bending space at terminals shall be measured in a straight line from the end of the lug or wire connector (in the direction that the wire leaves the terminal) to the wall, barrier, or obstruction.

2. This column shall be permitted to be used to determine the required wire-bending space for compact stranded aluminum conductors in sizes up to 1000 kcmil and manufactured using AA-8000 series electrical grade aluminum alloy conductor material in accordance with 310.106(B). The minimum width of the wire gutter space shall be determined using the all other conductors value in this table.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to give further consideration to the comments expressed in voting on FR 2406.

Related Item
First Revision No. 2406-NFPA 70-2015 [Section No. 314.16(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:56:21 EDT 2015

Committee Statement

Committee: Rejected but see related SR
Action:
Resolution: SR-2403-NFPA 70-2015
Statement: The fact-finding study sought by the panel members who objected to the action taken on FR #2435 that inserted this material into Table 312.6(A) has been completed and, together with additional information, has been reviewed by the panel. CMP 9 has some concerns relative to the fact that the study set-up did not involve actual electrical enclosures. On the other hand, Table 314.6(A), unlike the (B) table, generally covers bends that are made outside the enclosure and then set into place. In addition, there is substantial information available in the public domain relative to the more forgiving characteristics of the aluminum now being used for conductors. After reviewing all information, CMP 9 concludes that the revised dimensions for aluminum conductors are consistent with minimum safety standards and provide a useful correlation with comparable material in Table 312.6(B). The two tables cover differing facets of the same technical issues.

The Panel also edited the note numbering at the bottom of the table to be consistent with Table 312.6(B).
Public Comment No. 1046-NFPA 70-2015 [Section No. 312.8]

(A) Switch and Overcurrent Device Enclosures.

312.8 Switch and Overcurrent Device Enclosures.

The wiring space within enclosures for switches and overcurrent devices shall be permitted for other wiring and equipment only as provided in (A) and (B).

with Splices, Taps, and Feed-Through Conductors.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

(1) The total of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.

(2) The total area of all conductors, splices, taps, devices, and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

(3) A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

(1) The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment.

(2) The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

As originally worded, this proposal appears to prohibit the field installation of truly an infinite number of flange and/or surface mounted devices whereby terminations must protrude into the interior panel enclosure space. Specific to electrical wiring devices, potentially affected products could include manual controllers, flanged straight blade and locking inlets and outlets, cam-type panel mount devices and IEC 309 pin & sleeve receptacles. In each case, the device terminations protrude inside of the enclosure if they are panel mounted on the exterior of the panelboard or motor control center. These are not atypical applications; similarly, it places a completely unreasonable burden on the manufacturers of these devices to ensure that replacement kits or the flange/surface mounted devices themselves are listed to the (once again) infinite number of panelboard and/or motor control center products offered by industry.

The request here is to revert to the existing 2014 NFPA 70 text for NEC® 312.8. Thank you.

Related Item

Public Input No. 3091-NFPA 70-2014 [Section No. 312.8]
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Stephen Rood
Organization: Legrand North America
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 11:31:54 EDT 2015

Committee Statement

Committee: Rejected but see related SR
Action: 
**Resolution:** SR-2401-NFPA 70-2015

**Statement:** CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1054-NFPA 70-2015 [Section No. 312.8]

(A) Switch and Overcurrent Device Enclosures.

The wiring space within enclosures for switches and overcurrent devices shall be permitted for other wiring and equipment only as provided in (A) and (B).

Enclosures with Splices, Taps, and Feed-Through Conductors, and Power Monitoring Equipment.

The wiring space of within enclosures for switches or overcurrent devices shall be permitted for listed power monitoring equipment, conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

1. The total of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.

2. The total area of all conductors, splices, taps, devices and equipment installed and listed power monitoring equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

3. A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment.

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The inclusion of devices and equipment is too broad and verification that all safety aspects were addressed would be very difficult. Power monitoring equipment could be installed using the general rules of this section without impacting the performance of the overcurrent devices installed in the enclosure.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 12:26:31 EDT 2015
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Switch and Overcurrent Device Enclosures.

The wiring space within enclosures for switches and overcurrent devices shall be permitted for other wiring and equipment only as provided in (A) and (B).

(A) Splices, Taps, and Feed-Through Conductors.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

1. The total of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.
2. The total area of all conductors, splices, taps, devices and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.
3. A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment switch or overcurrent device enclosures.
2. The total area of all conductors, splices, taps, devices, and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

As noted in the substantiation to FR 2404, this revision is intended to limit the inclusion of devices and equipment in a wiring space to those that are identified as field installable accessories as part of the listed equipment, or as a listed kit evaluated for field installation in the specific equipment. The phrase "listed kit evaluated for field installation in the specific equipment" may be interpreted as requiring a kit to include an itemized list of the "specific equipment" with which the kit is compatible. Additionally, this equipment may be provided in designs which are not considered a "kit". As the original submitter of the Public Input which generated the First Revision, I am providing a Public Comment which is intended to clarify a portion of this requirement in a way that is consistent with my original intent. The substantive change to the wording in 312.8(B)(1) ("...the device or equipment is listed as being evaluated for field installation in switch or overcurrent device enclosures.") would meet the original intent, which is to ensure the added device or equipment is listed equipment that has been evaluated for field installation in the application. The UL category for "Energy-Monitoring Current Transformers" (XOBA) is an example of equipment that would satisfy this requirement.

Related Item

First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 09:56:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent...
language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as "energy-monitoring CT").

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
312.8 Switch and Overcurrent Device Enclosures.

The wiring space within enclosures for switches and overcurrent devices shall be permitted for other wiring and equipment only as provided in (A) and (B).

(A) Splices, Taps, and Feed-Through Conductors.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

(1) The total area of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.

(2) The total area of all conductors, splices, taps, devices and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

(3) A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted to be occupied by devices and equipment where all of the following conditions are met:

(1) The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment switch and overcurrent device enclosures, and

(2) The total area of all conductors, splices, taps, devices, and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

As originally worded, it appears this proposal would prohibit the installation of current transformers or meters for energy monitoring in any switch and overcurrent device enclosures unless every possible current transformer or meter was evaluated and listed for use in every possible enclosure. If this interpretation is correct, it puts a financially insurmountable burden on the submetering industry. The industry as a whole has an excellent safety record with respect to recognized and listed metering devices placed within switch and overcurrent device enclosures. The success of such applications over multiple decades of use, together with the originally proposed wording for [Part B] seems, in practice, to effectively limit devices permitted within switch and overcurrent device enclosures to only those made by the enclosure manufacturer and could thus be perceived within the context of restraint of trade as anti-competitive.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Christopher Dent
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 10:25:02 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).
CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1182-NFPA 70-2015 [Section No. 312.8]

312.8 Switch and Overcurrent Device Enclosures.

The wiring space within enclosures for switches and overcurrent devices shall be permitted for other wiring and equipment only as provided in (A) and (B).

(A) Splices, Taps, and Feed-Through Conductors.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

1. The total area of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.
2. The total area of all conductors, splices, taps, devices and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.
3. A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted to be occupied by devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment switch and overcurrent device enclosures.
2. The total area of all conductors, splices, taps, devices, and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

As originally worded, it appears this proposal would prohibit the installation of current transformers or meters for energy monitoring in any switch and overcurrent device enclosures unless every possible current transformer or meter was evaluated and listed for use in every possible enclosure. If this interpretation is correct, it puts a financially insurmountable burden on the submetering industry. The industry as a whole has an excellent safety record with respect to recognized and listed metering devices placed within switch and overcurrent device enclosures. The success of such applications over multiple decades of use, together with the originally proposed wording for [Part B] seems, in practice, to effectively limit devices permitted within switch and overcurrent device enclosures to only those made by the enclosure manufacturer and could thus be perceived within the context of restraint of trade.

Related Item

First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Alexei Holstein
Organization: Veris Industries
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 10:33:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
(A) - Switch and Overcurrent Device Enclosures.

The wiring space within enclosures for switches and overcurrent devices shall be permitted for other wiring and equipment only as provided in (A) and (B).

with Splices, Taps, and Feed-Through Conductors.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

1. The total of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.

2. The total area of all conductors, splices, taps, devices and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

3. A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

(B) - Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

This FR should be revised to delete the new 312.8(B) and revert back to the NEC 2014 language with only the addition of "devices and equipment".

The original PI3091 cited "proliferation of devices and equipment" as substantiation for the change, however, the PI did not include any data that can be substantiated as safety concerns and how the PI would address those concerns. This proposal would effectively prohibit the installation of LISTED current transformers or meters for energy monitoring in any switch and overcurrent device enclosures, unless every possible current transformer or meter was evaluated and listed for use in every possible enclosure in their every possible internal, both factory and field installed, configurations. This will put a financially insurmountable burden and virtually impossible requirement on, but not limited to, the submetering industry, and to effectively limit all devices within switch and overcurrent device enclosures to only those made by the enclosure manufacturer and could thus be perceived within the context of restraint of trade. Additionally, this proposal will slow the introduction of new enclosure models as well as prohibiting entry of new enclosure manufacturers/suppliers, because all new enclosures will lack products "listed" for use with/within them. Bust most of all, the submetering industry as a whole has had an excellent safety record with respect to recognized and listed metering devices placed within switch and overcurrent device enclosures, and the original PI had provided no evidence to prove otherwise.

It seems that if the committee was concerned with maintaining adequate wiring space, the solution would be to include "devices and equipment" as part of the cross section calculations, as proposed in 312.8(A)(@) of FR2404.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification
Submitter Full Name: Andrew Kriegman
Organization: Leviton Manufacturing Company,
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:25:03 EDT 2015
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<td><strong>Committee Action:</strong></td>
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| **Statement:** | CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as "energy-monitoring CT").

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity. |
312.8 Switch and Overcurrent Device Enclosures with Splices, Taps, Feed-Through Conductors, and Power Monitoring or measuring Equipment.

The wiring space within enclosures for switches and overcurrent devices shall be permitted for other wiring and equipment only as provided in (A) and (B), listed power monitoring or measuring equipment, conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met.

(A) Splices, Taps, and Feed-Through Conductors.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for listed power monitoring or measuring equipment, conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

1. The total of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.

2. The total area of all conductors, splices, taps, devices and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

3. A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment.

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

Section 312.8 in the NEC-2014 permits Splices, Taps, and Feed-Through Conductors in the wiring space. The installation of listed monitoring or measuring equipment in industrial buildings, multiuse commercial, university campus buildings and Government facilities is vital to determine their energy usage and develop programs to reduce their energy consumption and carbon footprint. Components of the listed monitoring or measuring equipment may need to be in the wire bending space of the equipment that is already installed to accomplish this. The current section does not address this equipment and does not provide any guidance to the AHJ. With no guidance it may prevent the installation of equipment needed to meet this important emerging need or lead to unsafe installation.

FR 2404 as written can be confusing because of the use of devices and equipment. It is unclear if the requirement applies to all equipment in the enclosure and how one would distinguish the wiring space from the equipment space for some types of enclosures, particularly those used for industrial control equipment.

This proposal specifically addresses energy management or measuring equipment that is installed in the wiring space. It is the addition of this equipment that is the issue at present and is what the FR should address. Adding the requirement for Listed equipment and applying the same area limitation will enhance the safety of the installation. The language of the proposal also establishes enforceable guidelines for the AHJ through the Listing and specific area requirements.

This proposal also supports the important trend of energy measurement enabling conservation and reduction of carbon footprint. Many municipalities are in process of or are considering legislating energy measurement. The code should be aligned with this emerging need while providing the guidance for safe installations.

Related Item

Public Input No. 3091-NFPA 70-2014 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: THOMAS PAPALLO
Organization: SIEMENS
Affiliation: Siemens
Committee Statement

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<td>SR-2401-NFPA 70-2015</td>
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<td>Statement:</td>
<td>CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”). CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.</td>
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Public Comment No. 1700-NFPA 70-2015 [Section No. 312.8]

312.8 Switch and Overcurrent Device Enclosures.

The wiring space within enclosures for switches and overcurrent devices shall be permitted for other wiring and equipment only as provided in (A) and (B).

(A) Splices, Taps, and Feed-Through Conductors.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

(1) The total of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.

(2) The total area of all conductors, splices, taps, devices and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

(3) A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

(1) The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit listed and evaluated for field installation in the specific equipment installation within any listed enclosure.

(2) The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rd party devices from the market. These 3rd party devices have proven to be the only viable way of addressing the current install base of enclosures across the US.

3rd party devices fill a critical role in the growth of renewable energy by providing the necessary sensor data to optimally manage a home’s participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, microgrid and demand response which are key to achieving a stable, sustainable grid.

In their statement regarding this proposed change, CMP9 references an earlier proposal to allow the installation of utilization equipment which was rejected in the 2011 cycle. We recognize that the wide variety of existing devices classified as ‘utilization equipment’ and not designed for installation inside enclosures could result in obstruction and hazard. However, we propose that a device specifically designed for installation within any listed enclosures and evaluated by qualified test lab for installation inside any listed enclosures can be safely installed.

In order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC.

To address CMP9’s concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any cross-sectional area. Evaluation of this limit should should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Doug Brouwer
Organization: EKM Metering Inc
### Committee Statement

<table>
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<th>Committee Action:</th>
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| Statement:        | CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity. |
Switch and Overcurrent Device Enclosures.
The wiring space within enclosures for switches and overcurrent devices shall be permitted for other wiring and equipment only as provided in (A) and (B).

(A) Splices, Taps, and Feed-Through Conductors.
The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

(1) The total of all conductors installed at any cross section of the wiring space does not exceed 40% of the cross-sectional area of that space.

(2) The total area of all conductors, splices, taps, devices and equipment installed at any cross section of the wiring space does not exceed 75% of the cross-sectional area of that space.

(3) A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

(B) Devices and Equipment.
The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

(1) The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment switch and overcurrent device enclosures and

(2) The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75% of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment
As originally worded, it appears this would prohibit the installation of current transformers or meters for energy monitoring in any switch and overcurrent device enclosures unless every possible current transformer or meter was evaluated and listed for use in every possible enclosure. If this interpretation is correct, it puts a financially insurmountable burden on the submetering industry.

The industry as a whole has an excellent safety record with respect to recognized and listed metering devices placed within switch and overcurrent device enclosures. The success of such applications over multiple decades of use, together with the originally proposed wording for [Part B] seems, in practice, to effectively limit devices permitted within switch and overcurrent device enclosures to only those made by the enclosure manufacturer and could thus be perceived within the context of restraint of trade.

Committee Statement
Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).
CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 977-NFPA 70-2015 [ Section No. 312.8 ]

(A) Switch and Overcurrent Device Enclosures.

312.8 Switch and Overcurrent Device Enclosures.

The wiring space within enclosures for switches and overcurrent devices shall be permitted for other wiring and equipment only as provided in (A) and (B).

with Splices, Taps, and Feed-Through Conductors.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

(1) The total of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.

(2) The total area of all conductors, splices, and taps, devices and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

(3) A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

(1) The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment.

(2) The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

As proposed, this First Revision FR 2404 (and the Public Input PI 3091) revision to NEC® 312.8 is neither enforceable as worded, practicable in application, nor sufficiently justified to warrant these changes. Revert to existing 2014 text for NEC® 312.8.

FIELD-INSTALLABLE ACCESSORIES AS PART OF LISTED EQUIPMENT and LISTED KITS

Public Input PI 3091 that served as the basis for First Revision FR 2404 rationalized these changes: “There is a proliferation of devices and equipment intended by non-OEM’s to be installed in enclosures containing PANELBOARDS.” Article 408 covers panelboards; Article 312, by contrast, covers CABINETS. These are typically EMPTY enclosures that are “populated” by equipment that the electrician provides at the installation.

Firstly, NEC® Article 312 has no requirement that cabinets, as defined in Article 100, be listed. Indeed, such cabinets presently may be field-fabricated for the installation. Yet NEC® 312.8 as revised by FR 2404 mandates that these devices and equipment be either LISTED accessories or LISTED kits in relation to these enclosures.

Even those electrical enclosures that are listed do so in accordance with UL Standard UL 50. These are empty enclosures, typically listed by ENCLOSURE manufacturers who do NOT make any of the devices or equipment that go inside or are attached to such UL 50 enclosures. Those devices and equipment are manufactured by manufacturers with specialization and competence to manufacture such devices and equipment.

As such, there has ALWAYS been a “proliferation” of devices and equipment made by OTHER THAN the cabinet enclosure manufacturers. If there are specific hazards for panelboards, identify exactly what they are and address them in Article 408, not in Article 312. To now require that manufacturers of such devices and equipment get them listed for EACH and EVERY enclosure manufacturer’s cabinets is fundamentally unachievable. Certainly, the enclosure manufacturers do not have the resources or desire to list as an accessory or kits EACH and EVERY device and equipment that could potentially go in or on those cabinets. As proposed, the 312.8(B)(1) wording of PI 3091 and FR 2404 is not remotely achievable, especially when cabinets onto themselves are not required by Article 312 to be listed.

ENCLOSURE GEOMETRY

NEC® 312.6(A) and Table 312.6(A) establish the width of passages for conductors called wiring gutters. The width requirement is
based upon the size of the conductors in PARALLEL. As such, knowing the measureable width and depth of gutters, the cross-sectional AREA can be calculated. Percentages of conductor fill can be enforced. Any intrusion of a device or equipment in an enclosure effectively re-establishes new (reduced) gutter widths for conductor to pass around the intrusion. Those new (reduced) gutters (conductor passages) still must comply with existing Table 312.6(A). Consequently, those existing Table 312.6(A) gutter widths can still be enforced.

By contrast, the 312.8(B)(2) wording of PI 3091 and FR 2404 is not necessarily looking at where the CONDUCTORS are in PARALLEL but rather where the devices and equipment intrude into the VOLUME of the cabinet enclosure (where conductors are not necessarily running in parallel) and attempt to apply an UNORIENTED cross-section AREA restriction upon a VOLUME. Worded as it is, by whatever the issue unexplained by PI3091 may or may not be, how would this requirement ever be interpreted consistently for enforcement?

FR2404 seems to be a solution looking for a problem to solve.

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**Related Item**

First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]
Public Input No. 3091-NFPA 70-2014 [Section No. 312.8]

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**Submitter Information Verification**

**Submitter Full Name:** Brian Rock  
**Organization:** Hubbell Incorporated  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Tue Sep 22 17:37:44 EDT 2015

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**Committee Statement**

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-2401-NFPA 70-2015  
**Statement:** CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 507-NFPA 70-2015 [Section No. 312.8(A)]

(A) Splices, Taps, and Feed-Through Conductors.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for conductors feeding through, spliced, or tapping off to other enclosures, switches, or overcurrent devices where all of the following conditions are met:

1. Any and all feed through conductors are returning from the load served by the switch or overcurrent device and are fully deenergized by the operation of the switch or overcurrent device whose enclosure they pass through.
2. The total of all conductors installed at any cross section of the wiring space does not exceed 40 percent of the cross-sectional area of that space.
3. The total area of all conductors, splices, taps, devices and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.
4. A warning label complying with 110.21(B) is applied to the enclosure that identifies the closest disconnecting means for any feed-through conductors.

Statement of Problem and Substantiation for Public Comment

The Code's present allowance for conductors to pass through an enclosure for a disconnect or overcurrent device without being switched by that device is potentially perilous in practice. While the Code does provide three requirements that must be met, all three rely on the installing electrician's compliance and the AHJ's observation for a safe installation.

The first two requirements dealing with conductor cross-section/fill rely on the electrician's judgment at the time of the installation. It's reasonable to assume that there are countless installations where the electrician has added "just one more wire" if he or she cared at all about fill and the disconnect is not actually to code due to excess fill.

The third requirement for a warning label again relies on the electrician to make the effort to install said label. In installations where the disconnect is subject the OSHA or other regulatory oversight, there's a decent to good chance that this label will be installed. In many other installations, it's doubtful that the effort would be taken and even more doubtful that the label would comply with 110.21(B) as required in the 2014 edition of the Code.

Another matter that the code does not address in 312.8 is the potential for damage to any feed through conductors in the event of a fault or arcing within the enclosure.

Making the revision as I have proposed would help to eliminate undue risk to service personnel operating on the equipment side of a disconnect or overcurrent device. In most cases, it would also eliminate the opportunity for an electrician to make a field judgment on whether the feed-through conductors and any splices or taps installed in the enclosure actually fall within the allowable occupation of the available cross section in the enclosure. While additional raceways would be required as a result of this revision, the increase in cost would be offset by a substantial increase in safety. Additionally, should any conduits be routed around a disconnect, it would serve as a visual warning to a service technician that power may have an additional path into the equipment he or she is working on.

For what it is worth, this proposed revision was proposed as a result of a service technician's near miss on a project I'm working on now. A disconnect was installed with feed-through conductors leading up to a unit heater. The equipment that the disconnect will be disconnecting has not been installed yet. A technician arrived on site to commission the heater that was fed through the only conduit leaving the disconnect switch. The technician threw the disconnect and locked it in the open position. Had he not taken the moment to double check for voltage at the heater he was servicing, there is a good chance he would have at least been shocked and would have fallen off of the ladder he was on and onto equipment below him. In short, a situation created by the Code-compliant omission of an enclosure below the disconnect and a few extra feet of conduit from that enclosure to the load could easily have resulted in a lost time injury or even a fatality.

Related Item
First Revision No. 1-NFPA 70-2015 [Section No. 90.2(A)]

Submitter Information Verification

Submitter Full Name: STEVE BADENHOP
Organization: [ Not Specified ]
Street Address:
City:
State:
<table>
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<th>Committee Statement</th>
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<tr>
<td><strong>Committee Action:</strong> Rejected</td>
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<tr>
<td><strong>Resolution:</strong> This comment is not submitted on any observable public input; none was submitted by anyone on this material, and the one cited as a &quot;Related Item&quot; (FR-1) is an amendment to 90.2(A) that has no bearing on the subject of this comment. It is therefore completely new material and it cannot be acted on. CMP 9 also declines to &quot;REJECT BUT HOLD&quot; this comment because there seems to be no likelihood that it would ever be acceptable. The substantiation points to a problem that would never have occurred had the relevant code provisions been applied and enforced. The confusion with respect to the function of the disconnect switch that was locked open would never have occurred had the disconnect function been marked on the switch as required by 110.22(A). The substantiation also points to a perceived lack of appropriate inspections in the applicable jurisdiction. The NEC should never be expected to address jurisdictional failures in this regard. The North American electrical safety system relies on qualified, disinterested third-party inspection as one of three essential components for electrically safe installations. Indeed, the logo of the International Association of Electrical Inspectors describes the organization as the keystone of the electrical industry, for good reason. The other two components of the safety system, namely, a consensus based installation standard (the NEC) and appropriate product standards, were never intended to function without appropriate electrical inspections. The statement in the opening paragraph of the substantiation, that safety in the cited example relies on &quot;the AHJ’s observation for a safe installation,&quot; is quite true, and it unintentionally discredits the remainder of the argument.</td>
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</tbody>
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Public Comment No. 1077-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment.

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The safety risks associated with the installation of devices in the wiring space of enclosures for switches or overcurrent devices are best addressed by the listing of the devices in question. The proposed edit allows for devices to be evaluated in a type of enclosure, rather than each individual make/model. This, along with the provision to limit the cross-sectional area, will satisfy the intent of the proposal while allowing for devices to be installed in existing installations, where individual evaluations would be impractical or impossible.

The proposal as written would have unintended, far-reaching implications, and affect the already widespread use of devices and current transformers in energy management and monitoring systems.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: CHARLES PICARD
Organization: SolarCity
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 15:44:00 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1118-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

(1) The device or equipment is identified as a field-installable accessory as part of the listed equipment, or is a listed kit and evaluated for field installation in the specific equipment installation inside any listed enclosure.

(2) The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rd-party devices from the market. These 3rd-party devices have proven to be the only viable way of addressing the current install base of enclosures across the US.

3rd-party devices fill a critical role in the growth of renewable energy by providing the necessary sensor data to optimally manage a home’s participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, micro-grid and demand response which are key to achieving a stable, sustainable grid.

In their statement regarding this proposed change, CMP9 references an earlier proposal to allow the installation of utilization equipment which was rejected in the 2011 cycle. We recognize that the wide variety of existing devices classified as ‘utilization equipment’ and not designed for installation inside enclosures could result in obstruction and hazard. However, we propose that a device specifically designed for installation within any listed enclosure and evaluated by a qualified test lab for installation inside any listed enclosure can be safely installed.

In order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC.

To address CMP9's concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any cross-sectional area. Evaluation of this limit should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Jon Hallam
Organization: NeuRIO Technology Inc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 19:41:24 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOB, with markings that describe the CT equipment and the energy monitoring function, such as 'energy-monitoring CT').
CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1298-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

(1) The device or equipment is listed and evaluated and approved for installation within any listed enclosure. [This language would replace the following bullet 1 language completely.]

(1) The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment

(2) The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

I am director of measurement and verification for a company in the Pacific Northwest. We measure performance of homes and businesses in our region and those data feed directly into the regional planning process. We have carried out this work for over 25 years and have installed or overseen installation of rated devices such as power transducers and current transformers in a wide range of electrical panels (manufactured between the mid-1950s and present). All of the equipment we have utilized is rated for use in panels and we have had no long-term, serious issues over hundreds of sites. The intent of the proposed language in this section of the Standard would seem to be to unnecessarily constrain the types of equipment that can be installed in load centers. There is no technical or safety reason I can see for this so I must assume the intent is to artificially limit the supply chain so as to maximize profits for the panel manufacturers. I strenuously object to this limitation as it has no technical or safety basis and would make it much harder for our region to carry out various types of research that are intended to deliver electricity and natural gas resources to consumers at the lowest possible cost.

Related Item

First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]
Public Input No. 3091-NFPA 70-2014 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Robert Davis
Organization: Ecotope
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 18:24:02 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1307-NFPA 70-2015 [ Section No. 312.8(B) ]

(B) Devices and Equipment.
The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

(1) The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit listed and evaluated for field installation in the specific equipment installation within any listed enclosure.

(2) The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rd party devices from the market. This includes independent metering devices designed to measure the power use of a variety of end uses. This is critically important for my field - energy efficiency research. Without knowing how much energy something uses in the field, we cannot make accurate calculations of how much energy it saves. Laboratory testing for energy use does not replicate field conditions, which are more varied than the lab can provide. Enclosures are largely similar to one another and it should be fairly straightforward to design a test procedure that can ensure safety in all of them.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Lucinda Gilman
Organization: CLEAResult (energy efficiency consulting)
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 18:52:54 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as "energy-monitoring CT").

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1329-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit listed and evaluated for field installation in the specific equipment installation within any listed enclosure.

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

As this provision is currently written, it would be nearly impossible, and therefore impractical, to certify any new accessories for all existing and new models of equipment. It would hinder efforts of homeowners who wish to utilize energy monitoring and management equipment as well as renewable energy and battery backup systems. There are many ways to provide options for fire safety within an electrical system but these regulations should not come at the expense of improving and evolving energy balancing technology and hardware.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: E Kemper
Organization: CLEAResult
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 20:20:31 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1367-NFPA 70-2015 [ Section No. 312.8(B) ]

(B) Devices and Equipment.
The wiring space of enclosures for switches or overcurrent devices shall be permitted for to be occupied by devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit device evaluated for field installation in the specific equipment switch and overcurrent device enclosures, and

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

As originally worded, it appears this proposal would prohibit the installation of current transformers or meters for energy monitoring in any switch and overcurrent device enclosures unless every possible current transformer or meter was evaluated and listed for use in every possible enclosure. If this interpretation is correct, it puts a financially insurmountable burden on the submetering industry.

The industry as a whole has an excellent safety record with respect to recognized and listed metering devices placed within switch and overcurrent device enclosures. The success of such applications over multiple decades of use, together with the originally proposed wording for [Part B] seems, in practice, to effectively limit devices permitted within switch and overcurrent device enclosures to only those made by the enclosure manufacturer and could thus be perceived within the context of restraint of trade.

Furthermore, this restriction would make it nearly impossible to retrofit submetering into existing homes, commercial, and industrial facilities, especially those using discontinued enclosures for which no current transformers have been approved.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Nathaniel Crutcher
Organization: Continental Control Systems
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 00:34:26 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1428-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.
The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit, listed and evaluated for field installation in the specific equipment installation within any listed enclosure.

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The first draft language would prevent the installation of 3rd party monitors that make use of Current Transformers (CTs) to provide data that supports renewable credits, revenue-grade metering, and conservation efforts that focus on consumer awareness. Further, such data will be important to support the development of micro-grid and battery storage, which are integral technologies to the growth of renewable energy. We believe the proposed change strikes a good balance - both increasing safety and allowing for innovation and interoperability.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Meir Adest
Organization: SolarEdge Technologies
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 11:05:21 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1450-NFPA 70-2015 [ Section No. 312.8(B) ]

(B) Devices and Equipment.
The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit, listed and evaluated for field installation in the specific equipment, installation within any listed Enclosure.
2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Additional Proposed Changes

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<th>Description</th>
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<tr>
<td>NEC_2017_amendment_document.docx</td>
<td>Supporting document - SunEdison</td>
<td></td>
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Statement of Problem and Substantiation for Public Comment

The proposed modification to section 312.8 puts significant restrictions on the installation of 3rd party devices and equipment to only those enclosures that were assessed by qualified test labs. 3rd part devices play an important role in the growth of home energy management and energy efficiency, connected home devices, renewable energy technologies such as solar and battery storage, and in enabling microgrids and providing utility services such as demand response for a sustainable grid.

Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of 3rd party devices that are critical to enabling the above listed technology advancements. We fully recognize CMP9’s concerns around potential obstruction and hazard, and in order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC.

To address CMP9's concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any cross sectional area. Evaluation of this limit should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Kasiraman Krishnan
Organization: SunEdison
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 12:03:11 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as...
may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1456-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit listed and evaluated for field installation in the specific equipment installation within any listed enclosure.

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rdparty devices from the market. These 3rdparty devices have proven to be the only viable way of addressing the current install base of enclosures across the US.

3rdparty devices fill a critical role in the growth of renewable energy by providing the necessary sensor data to optimally manage a home’s participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, microgrid and demand response which are key to achieving a stable, sustainable grid.

In their statement regarding this proposed change, CMP9 references an earlier proposal to allow the installation of utilization equipment which was rejected in the 2011 cycle. We recognize that the wide variety of existing devices classified as ‘utilization equipment’ and not designed for installation inside enclosures could result in obstruction and hazard. However, we propose that a device specifically designed for installation within any listed enclosures and evaluated by qualified test lab for installation inside any listed enclosures can be safely installed.

In order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC.

To address CMP9’s concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any cross sectional area. Evaluation of this limit should should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item

First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Jameson Brouwer
Organization: EKM Metering Inc
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 12:24:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from
Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1479-NFPA 70-2015 [ Section No. 312.8(B) ]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

(1) The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit listed and evaluated for field installation in the specific equipment installation within any listed enclosure.

(2) The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rdparty devices from the market. These 3rdparty devices have proven to be the only viable way of addressing the current install base of enclosures across the US.

3rdparty devices fill a critical role in the growth of renewable energy by providing the necessary sensor data to optimally manage a home’s participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, microgrid and demand response which are key to achieving a stable, sustainable grid.

In their statement regarding this proposed change, CMP9 references an earlier proposal to allow the installation of utilization equipment which was rejected in the 2011 cycle. We recognize that the wide variety of existing devices classified as ‘utilization equipment’ and not designed for installation inside enclosures could result in obstruction and hazard. However, we propose that a device specifically designed for installation within any listed enclosures and evaluated by qualified test lab for installation inside any listed enclosures can be safely installed.

In order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC.

To address CMP9's concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any crosssectional area. Evaluation of this limit should should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item

First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Robert Schaefer
Organization: Also Energy
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 12:59:31 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
| Resolution: | SR-2401-NFPA 70-2015 |
| Statement: | CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”). |
| CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity. |
Public Comment No. 1508-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment.

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

It will be impractical to submit current transformers (CT) for ALL enclosures new or old. Therefore I recommend to use the following statement:

The device or equipment is listed and evaluated for installation within ANY listed enclosure.

Thanks
Sam Seyfi

Statement of Problem and Substantiation for Public Comment

It will be impractical to submit current transformers (CT) for ALL enclosures (new or old). Therefore I recommend to use the following statement:

The device or equipment is listed and evaluated for installation within ANY listed enclosure.

Thanks
Sam Seyfi

Related Item

First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Sam Seyfi
Organization: MAGNELAB INC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:22:02 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1510-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit listed and evaluated for field installation in the specific equipment installation within any listed enclosure.

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rd party devices from the market. These 3rd party devices have proven to be the only viable way of addressing the current install base of enclosures across the US. 3rd party devices fill a critical role in the growth of renewable energy by providing the necessary sensor data to optimally manage a home’s participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, microgrid and demand response which are key to achieving a stable, sustainable grid. In their statement regarding this proposed change, CMP9 references an earlier proposal to allow the installation of utilization equipment which was rejected in the 2011 cycle. We recognize that the wide variety of existing devices classified as ‘utilization equipment’ and not designed for installation inside enclosures could result in obstruction and hazard. However, we propose that a device specifically designed for installation within any listed enclosures and evaluated by qualified test lab for installation inside any listed enclosures can be safely installed. In order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC. To address CMP9’s concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any cross-sectional area. Evaluation of this limit should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item

First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Samuel Davenport
Organization: CCS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:23:59 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
Public Comment No. 1530-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit listed and evaluated for field installation in the specific equipment installation within any separately listed and evaluated enclosure.

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rd-party devices from the market. These 3rd-party devices have proven to be the only viable way of addressing the current install base of enclosures across the US.

3rd-party devices fill a critical role in the growth of renewable energy by providing the necessary sensor data to optimally manage a home's participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, microgrid and demand response which are key to achieving a stable, sustainable grid.

In their statement regarding this proposed change, CMP9 references an earlier proposal to allow the installation of utilization equipment which was rejected in the 2011 cycle. We recognize that the wide variety of existing devices classified as 'utilization equipment' and not designed for installation inside enclosures could result in obstruction and hazard. However, we propose that a device specifically designed for installation within any listed enclosures and evaluated by qualified test lab for installation inside any listed enclosures can be safely installed.

In order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC.

To address CMP9's concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any cross-sectional area. Evaluation of this limit should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Gregory Nielson
Organization: Vivint Solar
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:41:33 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as "energy-monitoring CT").

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from...
Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1578-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.
The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

(1) The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit listed and evaluated for field installation in the specific equipment installation within any listed enclosure.

(2) The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rdparty devices from the market. These 3rdparty devices have proven to be the only viable way of addressing the current install base of enclosures across the US.

3rdparty devices fill a critical role in the growth of renewable energy by providing the necessary sensor data to optimally manage a home’s participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, microgrid and demand response which are key to achieving a stable, sustainable grid.

In their statement regarding this proposed change, CMP9 references an earlier proposal to allow the installation of utilization equipment which was rejected in the 2011 cycle. We recognize that the wide variety of existing devices classified as ‘utilization equipment’ and not designed for installation inside enclosures could result in obstruction and hazard. However, we propose that a device specifically designed for installation within any listed enclosures and evaluated by qualified test lab for installation inside any listed enclosures can be safely installed.

In order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC.

To address CMP9’s concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any cross-sectional area. Evaluation of this limit should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Mike Simpson
Organization: NREL
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:41:29 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent
language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as "energy-monitoring CT").

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1608-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment.
2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rd party devices from the market. These 3rd party devices have proven to be the only viable way of addressing the current install base of enclosures across the US. 3rd party devices fill a critical role in the growth of renewable energy by providing the necessary sensor data to optimally manage a home’s participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, micro-grid and demand response which are key to achieving a stable, sustainable grid.

In their statement regarding this proposed change, CMP9 references an earlier proposal to allow the installation of utilization equipment which was rejected in the 2011 cycle. We recognize that the wide variety of existing devices classified as ‘utilization equipment’ and not designed for installation inside enclosures could result in obstruction and hazard. However, we propose that a device specifically designed for installation within any listed enclosures and evaluated by qualified test lab for installation inside any listed enclosures can be safely installed.

In order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC.

To address CMP9's concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any cross-sectional area. Evaluation of this limit should should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Greg Greenan
Organization: eGauge Systems LLC
Affiliation: eGauge Systems LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:12:33 EDT 2015

Committee Statement

Committee Action:
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1621-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment installation within any listed enclosure.
2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

Sunrun supports the proposed alternative code language for NEC 312.8. The proposed changes offered here eliminate unnecessary restrictions that would keep third party devices from being installed inside enclosures. Implementation of the proposed NEC 312.8 as written would prohibit the placement of home sided sub-metering equipment within enclosures. Effectively this change prohibits the home owner from metering his or her load without the upgrade of the entire panel board, which may render a project economically or technically not feasible. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement would result in the elimination of any third party devices from the market. Residences will not be able to use third party metering for the purposes of assessing their consumption either for general knowledge or analysis of their usage on a time of use rate or other similarly time dependent rate structure. The ability to collect and monitor this data will be important to the growth of renewable energy, providing the necessary sensor data to optimally manage a home's participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, micro-grid and demand response which are key to achieving a stable, sustainable grid.

Related Item

First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Amy Heart
Organization: Sunrun
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:27:59 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 1644-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit listed and evaluated for field installation in the specific equipment installation within any listed enclosure.

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

I tend to agree with Neurio Technology Inc's take here, but this even seems like it could quickly escalate into bureaucratic overkill, putting unhelpful burdens on new construction as well as remodels, stifling SAFE, modern, Green Initiatives:

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rd party devices from the market. These 3rd party devices have proven to be the only viable way of addressing the current install base of enclosures across the US.

3rd party devices fill a critical role in the growth of renewable energy by providing the necessary sensor data to optimally manage a home's participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, microgrid and demand response which are key to achieving a stable, sustainable grid.

In their statement regarding this proposed change, CMP9 references an earlier proposal to allow the installation of utilization equipment which was rejected in the 2011 cycle. We recognize that the wide variety of existing devices classified as 'utilization equipment' and not designed for installation inside enclosures could result in obstruction and hazard. However, we propose that a device specifically designed for installation within any listed enclosures and evaluated by qualified test lab for installation inside any listed enclosures can be safely installed.

In order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC.

To address CMP9's concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any cross-sectional area. Evaluation of this limit should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Seth B
Organization: EKM Metering, Inc
Affiliation: Green energy for consumers and also the construction industry.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:47:36 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected but see related SR</th>
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</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>SR-2401-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement:</td>
<td>CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”). CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.</td>
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National Fire Protection Association Report

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
Public Comment No. 1648-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed kit evaluated for field installation in the specific equipment listed and evaluated for installation within any listed enclosure.

2. The total area of all conductors, splices, taps, devices, and equipment at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The addition of 312.8 (B) would limit the installation of devices and equipment to only those enclosures that they were specifically assessed within by qualified test labs. Due to the large number of enclosures currently on the market, and the even greater number of discontinued enclosures already in the field, this requirement is so burdensome as to be completely impractical, and would result in the elimination of any 3rd-party devices from the market. These 3rd-party devices have proven to be the only viable way of addressing the current install base of enclosures across the US.

3rd-party devices fill a critical role in the growth of renewable energy by providing the necessary sensor data to optimally manage a home’s participation on the grid. Lack of such information will hinder the deployment of technologies such as solar, battery storage, micro-grid and demand response which are key to achieving a stable, sustainable grid.

In their statement regarding this proposed change, CMP9 references an earlier proposal to allow the installation of utilization equipment which was rejected in the 2011 cycle. We recognize that the wide variety of existing devices classified as ‘utilization equipment’ and not designed for installation inside enclosures could result in obstruction and hazard. However, we propose that a device specifically designed for installation within any listed enclosures and evaluated by qualified test lab for installation inside any listed enclosures can be safely installed.

In order to provide clarity, we suggest the NEC specifies that a device may only be installed inside an enclosure if it is listed and approved for installation inside any listed enclosure by a qualified test lab. The installation of the device must not force any components (e.g. splices, taps, conductors) out of compliance with the NEC.

To address CMP9’s concerns about obstructions in the enclosure, we propose a limit on the amount of space that can be occupied by the device, splices, taps and conductors in any cross-sectional area. Evaluation of this limit should be performed by the Inspector during the standard inspection process. A field evaluation would not be practical as no network of evaluators exists that could handle the required volume.

Related Item

First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: John Billy
Organization: Standard Energy Systems
Street Address:
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 15:48:09 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR.
<table>
<thead>
<tr>
<th>Resolution: SR-2401-NFPA 70-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as “energy-monitoring CT”).</td>
</tr>
</tbody>
</table>

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Public Comment No. 960-NFPA 70-2015 [Section No. 312.8(B)]

(B) Devices and Equipment.

The wiring space of enclosures for switches or overcurrent devices shall be permitted for devices and equipment where all of the following conditions are met:

1. The device or equipment is identified as a field installable accessory as part of the listed equipment, or is a listed product or kit evaluated for field installation in the specific equipment switch and overcurrent device enclosures, and

2. The total area of all conductors, splices, taps, devices, and equipment installed at any cross section of the wiring space does not exceed 75 percent of the cross-sectional area of that space.

Statement of Problem and Substantiation for Public Comment

The originally proposed wording would prohibit the installation of UL Listed accessories specifically tested and certified for use in switch and overcurrent device enclosures (e.g. panelboards). As millions of such products are currently installed and there is no evidence of any safety issue resulting from such installation, this seems to be an effort to force manufacturers of such products out of the marketplace. The wording change is both onerous and unfairly restrictive.

Related Item
First Revision No. 2404-NFPA 70-2015 [Section No. 312.8]

Submitter Information Verification

Submitter Full Name: Neil Czarnecki
Organization: Reliance Controls Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 15:43:54 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2401-NFPA 70-2015
Statement: CMP 9 agrees that the initial revision was excessively broad and carried unintended consequences. The inspection community does have, and has routinely applied, the tools required to police other intrusions into the wiring gutters of this equipment in the event of a problem. This action at this stage, which includes making correlating changes in the parent language, limits the additional specific coverage in this cycle to power monitoring equipment. This is now covered by a comparatively new UL Outline of Investigation (UL 2808, Guide Card XOBA, with markings that describe the CT equipment and the energy monitoring function, such as "energy-monitoring CT").

CMP 9 is retaining the two-part structure of this section so that the new Part B can be easily expanded in the future as may be judged necessary based on subsequent field experience. The final result also includes some of the language from Comment 1178, which was informed by the UL standards activity.
Paragraph 314.20: Flush-Mounted Installations.
Flush-mounted installations within or behind a surface of concrete, tile, gypsum, plaster, or other noncombustible material, including boxes employing a flush-type cover or faceplate, shall be made so that the front edge of the box, plaster ring, extension ring, or listed extender will not be set back of the finished surface more than 6 mm (1/4 in.).

Flush-mounted installations within or behind a surface of wood or other combustible surface material, boxes, plaster rings, extension rings, or listed extenders shall extend to the finished surface or project therefrom.

Statement of Problem and Substantiation for Public Comment
Have both conditions use the same intro text, the revised wording is now confusing.

Related Item
First Revision No. 2409-NFPA 70-2015 [Section No. 314.20]

Submitter Information Verification
Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Aug 04 19:56:27 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-2404-NFPA 70-2015
Statement: CMP 9 agrees that the two paragraphs should use parallel wording. The revision achieves the goal of the submitter, but does so with fewer words. The phrasing “Flush-mounted” need not be duplicated because it occurs verbatim in the section title and therefore applies equally to both paragraphs.
Public Comment No. 1792-NFPA 70-2015 [Section No. 314.23(B)(1)]

(1) Nails and Screws.
Nails and screws, where used as a fastening means, shall secure boxes by using brackets on the outside of the enclosure, or through holes provided by the enclosure manufacturer in the back or a single side of the enclosure, or by using mounting holes in the back or a single side of the enclosure, or they shall pass through the interior within 6 mm (1/4 in.) of the back or ends of the enclosure. Screws shall not be permitted to pass through the box unless exposed threads in the box are protected using approved means to avoid abrasion of conductor insulation. Mounting holes made in the field shall be approved.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs the panel to give further consideration to the comments expressed in voting on FR 2410

Related Item
First Revision No. 2410-NFPA 70-2015 [Section No. 314.23(B)(1)]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:57:29 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-2405-NFPA 70-2015
Statement:
The PC submittal correctly restated the relevant comments in the voting, which in turn correctly stated the actual panel action on FR 2410. The action and statement included incorrect text. The correct wording of the statement is as follows:

“This revision corrects the previous text that literally required only the nails and screws to be attached instead of the box, and assures that mounting holes are indeed permitted in the back or sides of a box, correcting previous oversights. The new wording also assures that if such holes are made in the field they are subject to the evaluation of the AHJ as to suitability. This is of particular importance in the case of nonmetallic boxes, where such holes are generally discouraged by manufacturers. Mounting holes drilled in steel boxes are less critical but should still be reviewable and the text in this revision provides for both.”

The Correlating Committee correctly flagged these errors in their Comment 1792, but did not provide the corrected text. This action in concert with Comment 830 provides both the correct Code text as well as a panel statement that properly aligns with and supports the revised text. Note that the legislative text in Comment 830 shows changes from the first draft text (as is required under the rules at this stage), and not from the 2014 NEC. For the benefit of members of the public who will be reviewing the second draft document, the attached word document shows the resulting changes from the 2014 edition.
(1) Nails and Screws.
Nails and screws, where used as a fastening means, shall secure boxes by using brackets on the outside of the enclosure, or through holes provided by the enclosure manufacturer in the back or a single side of the enclosure, or by using mounting holes in the back or a single side of the enclosure, or they shall pass through the interior within 6 mm (1/4 in.) of the back or ends of the enclosure. Screws shall not be permitted to pass through the box unless exposed threads in the box are protected using approved means to avoid abrasion of conductor insulation. Mounting holes made in the field shall be approved permitted.

Statement of Problem and Substantiation for Public Comment
IEC’s position is to replace the word “approved” with “permitted” in the last sentence of 314.23(B)(1) - (FR 2410)
It is unreasonable to require an AHJ to approve a mounting hole made in the field.

Related Item
First Revision No. 2410-NFPA 70-2015 [Section No. 314.23(B)(1)]

Submitter Information Verification
Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 19 16:55:16 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The submitter may not have looked at the actual panel action and statement which was lost during processing, but published in the comments in the voting. See also the action on Comment #830 creating SR 2405. The substantiation for this comment does not address the panel statement, the relevant portion of which is hereby reaffirmed: “The new wording also assures that if such holes are made in the field they are subject to the evaluation of the AHJ as to suitability. This is of particular importance in the case of nonmetallic boxes, where such holes are generally discouraged by manufacturers. Mounting holes drilled in steel boxes are less critical but should still be reviewable and the text in this revision provides for both
Nails and Screws.

Nails and screws, where used as a fastening means, shall secure boxes by using brackets on the outside of the enclosure, or through holes provided by the enclosure manufacturer in the back or a single side of the enclosure, or by using mounting holes in the back or a single side of the enclosure, or they shall pass through the interior within 6 mm (¼ in.) of the back or ends of the enclosure. Screws shall not be permitted to pass through the box unless exposed threads in the box are protected using approved means to avoid abrasion of conductor insulation. Mounting holes made in the field shall be approved.

Statement of Problem and Substantiation for Public Comment

The deleted text is not needed since the requirement is addressed in the following portion of the sentence.

Related Item

First Revision No. 2410-NFPA 70-2015 [Section No. 314.23(B)(1)]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 10:29:06 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2405-NFPA 70-2015
Statement: The PC submittal correctly restated the relevant comments in the voting, which in turn correctly stated the actual panel action on FR 2410. The action and statement included incorrect text. The correct wording of the statement is as follows:

“This revision corrects the previous text that literally required only the nails and screws to be attached instead of the box, and assures that mounting holes are indeed permitted in the back or sides of a box, correcting previous oversights. The new wording also assures that if such holes are made in the field they are subject to the evaluation of the AHJ as to suitability. This is of particular importance in the case of nonmetallic boxes, where such holes are generally discouraged by manufacturers. Mounting holes drilled in steel boxes are less critical but should still be reviewable and the text in this revision provides for both.”

The Correlating Committee correctly flagged these errors in their Comment 1792, but did not provide the corrected text. This action in concert with Comment 830 provides both the correct Code text as well as a panel statement that properly aligns with and supports the revised text. Note that the legislative text in Comment 830 shows changes from the first draft text (as is required under the rules at this stage), and not from the 2014 NEC. For the benefit of members of the public who will be reviewing the second draft document, the attached word document shows the resulting changes from the 2014 edition.
314.27 Outlet Boxes.

(A) Boxes at Luminaire or Lampholder Outlets.

Outlet boxes or fittings and outlet boxes containing locking support and mounting receptacle used in combination with compatible attachment fitting, designed for the support of luminaires and lampholders, and installed as required by 314.23, shall be permitted to support a luminaire or lampholder.

(1) Vertical Surface Outlets.

Boxes used at luminaire or lampholder outlets in or on a vertical surface shall be identified and marked on the interior of the box to indicate the maximum weight of the luminaire that is permitted to be supported by the box if other than 23 kg (50 lb).

Exception: A vertically mounted luminaire or lampholder weighing not more than 3 kg (6 lb) shall be permitted to be supported on other boxes or plaster rings that are secured to other boxes, provided that the luminaire or its supporting yoke, or the lampholder, is secured to the box with no fewer than two No. 6 or larger screws.

(2) Ceiling Outlets.

At every outlet used exclusively for lighting, the box shall be designed or installed so that a luminaire or lampholder may be attached. Boxes shall be required to support a luminaire weighing a minimum of 23 kg (50 lb). A luminaire that weighs more than 23 kg (50 lb) shall be supported independently of the outlet box, unless the outlet box is listed for not less than the weight to be supported. The interior of the box shall be marked by the manufacturer to indicate the maximum weight the box shall be permitted to support.

(B) Floor Boxes.

Boxes listed specifically for this application shall be used for receptacles located in the floor.

Exception: Where the authority having jurisdiction judges them free from likely exposure to physical damage, moisture, and dirt, boxes located in elevated floors of show windows and similar locations shall be permitted to be other than those listed for floor applications. Receptacles and covers shall be listed as an assembly for this type of location.

(C) Boxes at Ceiling-Suspended (Paddle) Fan Outlets.

Outlet boxes or outlet box systems used as the sole support of a ceiling-suspended (paddle) fan shall be listed, shall be marked by their manufacturer as suitable for this purpose, and shall not support ceiling-suspended (paddle) fans that weigh more than 32 kg (70 lb). For outlet boxes or outlet box systems designed to support ceiling-suspended (paddle) fans that weigh more than 16 kg (35 lb), the required marking shall include the maximum weight to be supported.

Outlet boxes containing listed locking support and mounting receptacle used in combination with compatible recognized attachment fitting designed for the support of ceiling-suspended (paddle) fans, and installed as required by 314.23, shall be permitted to support ceiling-suspended (paddle) fans.

Where spare, separately switched, ungrounded conductors are provided to a ceiling-mounted outlet box, in a location acceptable for a ceiling-suspended (paddle) fan in one-family, two-family, or multifamily dwellings, the outlet box or outlet box system shall be listed for sole support of a ceiling-suspended (paddle) fan.

(D) Utilization Equipment.

Boxes used for the support of utilization equipment other than ceiling-suspended (paddle) fans shall meet the requirements of 314.27(A) for the support of a luminaire that is the same size and weight.

Exception: Utilization equipment weighing not more than 3 kg (6 lb) shall be permitted to be supported on other boxes or plaster rings that are secured to other boxes, provided the equipment or its supporting yoke is secured to the box with no fewer than two No. 6 or larger screws.

(E) Separable Attachment Fittings.

Outlet boxes shall be permitted to support listed locking support and mounting receptacles used in combination with compatible attachment fittings designed for the support of equipment covered within and subject to all weight and orientation limits contemplated by the listing. Where such fittings are used, the equipment mounted shall comply with 314.27(A) through (D) as applicable. Where the supporting receptacle is installed within a box, it shall be included in the fill calculation covered in 314.16(B)(4).

Statement of Problem and Substantiation for Public Comment

This Public Comment seeks to do exactly as directed by the Correlating Committee by correcting transcription errors from the First Draft meeting. This was highlighted by the Correlating Committee (CC) in the First Draft, Correlating Committee Note No. 97-2015. The CC wrote:

"The Correlating Committee informs the public that transcription errors have occurred in the processing of the First Revision. It is imperative to open and read the first revision that applies to this section and to read all of the voting comments."
Public Inputs 4443 and 4665 suggested changed text in 314.27(A) and the second paragraph of 314.27(C); these changes were inadvertently added and should be removed. The accuracy of this Public Comment is verified when viewing the Panel Statement in FR 2411. The newly added 314.27(E) was approved by the Panel and should remain as shown in the Public Comment.

The Panel voted two other editorial changes that are reflected as the Panel intended in the Public Comment and are noted in the ballot comments. These changes are:

314.27(A)(2) changed

“A luminaire that weighs more than 23 kg (50 lb) shall be supported independently of the outlet box, unless the outlet box is listed and marked on the interior of the box to indicate the maximum weight the box shall be permitted to support.”

to

“A luminaire that weighs more than 23 kg (50 lb) shall be supported independently of the outlet box, unless the outlet box is listed for not less than the weight to be supported. The interior of the box shall be marked by the manufacturer to indicate the maximum weight the box shall be permitted to support.”

Also, 314.27(C) in the 3rd paragraph, the Panel changed “single-family” to “one family” and “multi-family” to “multifamily” and should remain in the section, as shown in the Public Comment.

Related Item

Correlating Committee Note No. 97-NFPA 70-2015 [Section No. 314.27]
First Revision No. 2411-NFPA 70-2015 [Section No. 314.27]

Submitter Information Verification

Submitter Full Name: AMY CRONIN
Organization: STRATEGIC CODE SOLUTIONS LLC
Affiliation: Safety Quick Lighting and Fans Corp.
Street Address: 
City: 
State: 
Zip: 
Submital Date: Tue Sep 15 15:47:48 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2406-NFPA 70-2015 This revision fully correlates the new text in the first revision that created 314.27(E) with revisions being made to the definition of a receptacle in Article 100 as well as coverage in 422.18 and 422.33. The general reference to 314.27 also allows for broader applications of this design approach than just luminaires and ceiling-suspended (paddle) fans. In addition, the action on this Comment addresses the transcription errors that crept into the both the purported panel action (the Code text) on FR 2411, and the panel statement. CMP 9 calls attention to the following information contained in comments in the voting, to which the Correlating Committee comment (#1793) refers: “For the benefit of members of the public reading these actions, the third paragraph of the panel statement must begin “In (A)(2), this revision ...” for obvious reasons. In addition, there was additional text voted by CMP 9 to support the revision (see PI #348) to the second paragraph of (C). In this report, it should have been formatted as a concluding sentence, worded as follows: “With respect to the change from “single-family” to “one-family” in the second paragraph of (C), CMP 9 is matching the literal text with the defined terms in Article 100.” This paragraph completes the public record and allows users to fully understand the relevant substantiation.

Statement: This revision fully correlates the new text in the first revision that created 314.27(E) with revisions being made to the definition of a receptacle in Article 100 as well as coverage in 422.18 and 422.33. The general reference to 314.27 also allows for broader applications of this design approach than just luminaires and ceiling-suspended (paddle) fans. In addition, the action on this Comment addresses the transcription errors in both the panel action (the Code text) on FR 2411, and the panel statement. CMP 9 calls attention to the following information contained in comments in the voting, to which the Correlating Committee comment (#1793) refers:

“For the benefit of members of the public reading these actions, the third paragraph of the panel statement must begin “In (A)(2), this revision ...” for obvious reasons. In addition, there was additional text voted by CMP 9 to support the revision (see PI #348) to the second paragraph of (C). In this report, it should have been formatted as a concluding sentence, worded as follows: “With respect to the change from “single-family” to “one-family” in the second paragraph of (C), CMP 9 is matching the literal text with the defined terms in Article 100.” This paragraph completes the public record and allows users to fully understand the relevant substantiation.
Public Comment No. 831-NFPA 70-2015 [Section No. 314.27]

314.27 Outlet Boxes.

(A) Boxes at Luminaire or Lampholder Outlets.
Outlet boxes or fittings and outlet boxes containing locking support and mounting receptacle used in combination with compatible attachment fitting, designed for the support of luminaires and lampholders, and installed as required by 314.23, shall be permitted to support a luminaire or lampholder.

(1) Vertical Surface Outlets.
Boxes used at luminaire or lampholder outlets in or on a vertical surface shall be identified and marked on the interior of the box to indicate the maximum weight of the luminaire that is permitted to be supported by the box if other than 23 kg (50 lb).

Exception: A vertically mounted luminaire or lampholder weighing not more than 3 kg (6 lb) shall be permitted to be supported on other boxes or plaster rings that are secured to other boxes, provided that the luminaire or its supporting yoke, or the lampholder, is secured to the box with no fewer than two No. 6 or larger screws.

(2) Ceiling Outlets.
At every outlet used exclusively for lighting, the box shall be designed or installed so that a luminaire or lampholder may be attached. Boxes shall be required to support a luminaire weighing a minimum of 23 kg (50 lb). A luminaire that weighs more than 23 kg (50 lb) shall be supported independently of the outlet box, unless the outlet box is listed for not less than the weight to be supported. The interior of the box shall be marked by the manufacturer to indicate the maximum weight the box shall be permitted to support.

(B) Floor Boxes.
Boxes listed specifically for this application shall be used for receptacles located in the floor.

Exception: Where the authority having jurisdiction judges them free from likely exposure to physical damage, moisture, and dirt, boxes located in elevated floors of show windows and similar locations shall be permitted to be other than those listed for floor applications. Receptacles and covers shall be listed as an assembly for this type of location.

(C) Boxes at Ceiling-Suspended (Paddle) Fan Outlets.
Outlet boxes or outlet box systems used as the sole support of a ceiling-suspended (paddle) fan shall be listed, shall be marked by their manufacturer as suitable for this purpose, and shall not support ceiling-suspended (paddle) fans that weigh more than 32 kg (70 lb). For outlet boxes or outlet box systems designed to support ceiling-suspended (paddle) fans that weigh more than 16 kg (35 lb), the required marking shall include the maximum weight to be supported.

Outlet boxes containing listed locking support and mounting receptacle used in combination with compatible recognized attachment fitting designed for the support of ceiling-suspended (paddle) fans, and installed as required by 314.23, shall be permitted to support ceiling-suspended (paddle) fans.

Where spare, separately switched, ungrounded conductors are provided to a ceiling-mounted outlet box, in a location acceptable for a ceiling-suspended (paddle) fan in one-family, two-family, or multifamily dwellings, the outlet box or outlet box system shall be listed for sole support of a ceiling-suspended (paddle) fan.

(D) Utilization Equipment.
Boxes used for the support of utilization equipment other than ceiling-suspended (paddle) fans shall meet the requirements of 314.27(A) for the support of a luminaire that is the same size and weight.

Exception: Utilization equipment weighing not more than 3 kg (6 lb) shall be permitted to be supported on other boxes or plaster rings that are secured to other boxes, provided the equipment or its supporting yoke is secured to the box with no fewer than two No. 6 or larger screws.

(E) Separable Attachment Fitting Termination Devices for Support of Luminaires and Ceiling-Suspended Fans.
Outlet boxes required in 314.27(A) and (C) shall be permitted to support listed locking support and mounting receptacles mounting termination devices used in combination with compatible attachment fittings designed, compatible fittings and identified, for the support of equipment covered within and subject to all weight and orientation limits contemplated by of luminaires or of ceiling-suspended fans within the weight and mounting-orientation limits of the listing. Where such fittings are used, the equipment mounted shall comply with 314.27(A) through (D) as applicable. Where the supporting receptacle the supporting termination device is installed within a box, it shall be included in the fill calculation covered in 314.16(B)(4).

Statement of Problem and Substantiation for Public Comment
The FR text in 314.27(A) and (C) relating to locking support and mounting receptacles is not necessary since 314.27(E) covers the requirements.
The term “receptacles” is changed to “termination devices” since these devices do not conform to the NEC definition of a receptacle

Related Item
First Revision No. 2411-NFPA 70-2015 [Section No. 314.27]
Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 10:33:06 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2406-NFPA 70-2015 This revision fully correlates the new text in the first revision that created 314.27(E) with revisions being made to the definition of a receptacle in Article 100 as well as coverage in 422.18 and 422.33. The general reference to 314.27 also allows for broader applications of this design approach than just luminaires and ceiling-suspended (paddle) fans. In addition, the action on this Comment addresses the transcription errors that crept into the both the purported panel action (the Code text) on FR 2411, and the panel statement. CMP 9 calls attention to the following information contained in comments in the voting, to which the Correlating Committee comment (#1793) refers: “For the benefit of members of the public reading these actions, the third paragraph of the panel statement must begin “In (A)(2), this revision ...” for obvious reasons. In addition, there was additional text voted by CMP 9 to support the revision (see PI #348) to the second paragraph of (C). In this report, it should have been formatted as a concluding sentence, worded as follows: “With respect to the change from "single-family" to "one-family" in the second paragraph of (C), CMP 9 is matching the literal text with the defined terms in Article 100.” This paragraph completes the public record and allows users to fully understand the relevant substantiation.

Statement: This revision fully correlates the new text in the first revision that created 314.27(E) with revisions being made to the definition of a receptacle in Article 100 as well as coverage in 422.18 and 422.33. The general reference to 314.27 also allows for broader applications of this design approach than just luminaires and ceiling-suspended (paddle) fans.

In addition, the action on this Comment addresses the transcription errors in both the panel action (the Code text) on FR 2411, and the panel statement. CMP 9 calls attention to the following information contained in comments in the voting, to which the Correlating Committee comment (#1793) refers:

“For the benefit of members of the public reading these actions, the third paragraph of the panel statement must begin “In (A)(2), this revision ...” for obvious reasons. In addition, there was additional text voted by CMP 9 to support the revision (see PI #348) to the second paragraph of (C). In this report, it should have been formatted as a concluding sentence, worded as follows: “With respect to the change from "single-family" to "one-family" in the second paragraph of (C), CMP 9 is matching the literal text with the defined terms in Article 100.” This paragraph completes the public record and allows users to fully understand the relevant substantiation.
Outlet boxes or fittings and outlet boxes containing locking support and mounting receptacle used in combination with compatible attachment fitting designed for the support of luminaires and lampholders, and installed as required by 314.23, shall be permitted to support a luminaire or lampholder.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 2411

Related Item

First Revision No. 2411-NFPA 70-2015 [Section No. 314.27]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:58:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2406-NFPA 70-2015 This revision fully correlates the new text in the first revision that created 314.27(E) with revisions being made to the definition of a receptacle in Article 100 as well as coverage in 422.18 and 422.33. The general reference to 314.27 also allows for broader applications of this design approach than just luminaires and ceiling-suspended (paddle) fans. In addition, the action on this Comment addresses the transcription errors that crept into the both the purported panel action (the Code text) on FR 2411, and the panel statement. CMP 9 calls attention to the following information contained in comments in the voting, to which the Correlating Committee comment (#1793) refers: “For the benefit of members of the public reading these actions, the third paragraph of the panel statement must begin “In (A)(2), this revision...” for obvious reasons. In addition, there was additional text voted by CMP 9 to support the revision (see PI #348) to the second paragraph of (C). In this report, it should have been formatted as a concluding sentence, worded as follows: “With respect to the change from “single-family” to “one-family” in the second paragraph of (C), CMP 9 is matching the literal text with the defined terms in Article 100.” This paragraph completes the public record and allows users to fully understand the relevant substantiation.

Statement: This revision fully correlates the new text in the first revision that created 314.27(E) with revisions being made to the definition of a receptacle in Article 100 as well as coverage in 422.18 and 422.33. The general reference to 314.27 also allows for broader applications of this design approach than just luminaires and ceiling-suspended (paddle) fans. In addition, the action on this Comment addresses the transcription errors in both the panel action (the Code text) on FR 2411, and the panel statement. CMP 9 calls attention to the following information contained in comments in the voting, to which the Correlating Committee comment (#1793) refers: “For the benefit of members of the public reading these actions, the third paragraph of the panel statement must begin “In (A)(2), this revision...” for obvious reasons. In addition, there was additional text voted by CMP 9 to support the revision (see PI #348) to the second paragraph of (C). In this report, it should have been formatted as a concluding sentence, worded as follows: “With respect to the change from "single-family" to "one-family" in the second paragraph of (C), CMP 9 is matching the literal text with the defined terms in Article 100.” This paragraph completes the public record and allows users to fully understand the relevant substantiation.
Public Comment No. 1794-NFPA 70-2015 [ Section No. 314.28(A)(3) ]

(3) Smaller Dimensions.

Listed boxes or listed conduit bodies of dimensions less than those required in 314.28(A)(1) and (A)(2) shall be permitted for installations of combinations of conductors that are less than the maximum conduit or tubing fill (of conduits or tubing being used) permitted by Table 1 of Chapter 9.

Listed conduit bodies of dimensions less than those required in 314.28(A)(2), and having a radius of the curve to the centerline not less than that indicated in Table 2 of Chapter 9 for one-shot and full-shoe benders, shall be permitted for installations of combinations of conductors permitted by Table 1 of Chapter 9. These conduit bodies shall be marked to show they have been specifically evaluated in accordance with this provision.

Where the permitted combinations of conductors for which the box or conduit body has been listed are less than the maximum conduit or tubing fill permitted by Table 1 of Chapter 9, the box or conduit body shall be permanently marked with the maximum number and maximum size of conductors permitted. For other conductor sizes and combinations, the total cross-sectional area of the fill shall not exceed the cross-sectional area of the conductors specified in the marking, based on the type of conductor identified as part of the product listing.

Informational Note: Unless otherwise specified, the applicable product standards evaluate the fill markings covered here based on conductors with Type XHHW insulation.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that the panel reconsider the text of the informational note in regard to possible mandatory language, assuring compliance with the NEC Style Manual.

Related Item
First Revision No. 2412-NFPA 70-2015 [Section No. 314.28(A)(3)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 15:59:47 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CMP 9 does not agree that the original language constituted mandatory material. The requirement is in the product standard; this information will be of great assistance in the field in terms of providing a basis for correctly applying the requirement. The original task group report during the input stage on this subject would have made the insulation reference to XHHW mandatory by placing it in 314.28(A)(3) as code text. That recommendation was converted by CMP 9 to an informational note so the reference would not be binding on the developer of the product standard. The need for explanatory information for users in the field was raised with some panel members by NFPA staff members who had problems presenting these calculations during NEC seminars. Current product marking protocols do not provide this information, and this is resulting in extensive confusion and uneven field enforcement. CMP 9 continues to strongly support the user-friendly initiative it has taken for the 2017 cycle accordingly.
Public Comment No. 1123-NFPA 70-2015 [Section No. 314.28(E)(1)]

(1) Installation.
Power distribution blocks installed in boxes shall be listed and labeled. Power distribution blocks installed on the line side of the service equipment shall be listed identified for the purpose and marked accordingly.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Public Comments for This Document

<table>
<thead>
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<th>Related Comment</th>
<th>Relationship</th>
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<tr>
<td>Public Comment No. 532-NFPA 70-2015</td>
<td>Addressed CMP 8 concerns that some listed products are marked or require markings on the smallest shipping package.</td>
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Related Item

- First Revision No. 2413-NFPA 70-2015 [Section No. 314.28(E)(1)]
- Public Input No. 884-NFPA 70-2014 [Section No. 314.28(E)(1)]
- Public Input No. 1072-NFPA 70-2014 [Definition: Labeled]
Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 20:13:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2407-NFPA 70-2015
Statement:

The Panel has provided clear instructions for the marking required rather than “for the purpose”.

CMP 9 declines to make the requested changes to add “and labeled” in this section because it would contradict an instruction from the Correlating Committee that this change is not to proceed in this cycle (First Correlating Revision No. 143). In its instruction, the Correlating Committee noted that it has appointed a task group to consider this throughout the NEC. CMP 9 awaits a final decision of the Correlating Committee in this matter.

The standard of product acceptance in this code provision is “listed”. Qualified testing laboratories all enforce comparable operational limitations on the use of their labels. Listing must be evidenced by a label, either on the equipment or on the smallest unit shipping carton if the characteristics of the product preclude a label. If a label comes off, it must be reapplied by test lab personnel; it cannot be sent through the mail or otherwise. At some point in every IAEI section meeting for the past few decades, this topic is covered in exquisite detail. CMP 9 is therefore unconvinced of the technical merits of the arguments supporting the change, but will comply with any instruction provided by the Correlating Committee.
Public Comment No. 1235-NFPA 70-2015 [New Section after 314.70(B)]

(4) Conduit bodies that are used to change direction are not permitted for use with shield cables rated 5kV or higher. They may be pulled through a body that does not change direction.

Additional Proposed Changes

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<td>Okonite_Recommendation_to_Avoid_Condulet.pdf</td>
<td>Okonite Recommendation to Avoid Condulet</td>
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Statement of Problem and Substantiation for Public Comment

This is my second effort to disallow shielded cables in conduit bodies due to numerous troubles in the field. Shielded cable manufacturers recommend against the use of conduit bodies since the minimum bending radius is not sufficient in these bodies and results in an unsafe and unreliable installation. Often the result is that the entire must be changed to eliminate conduit bodies which requires complete replacement of the cable which adds financial burden to the end user or installer.

Related Item

Public Input No. 3802-NFPA 70-2014 [Section No. 314.70(B)]

Submitter Information Verification

Submitter Full Name: Joseph Zimnoch
Organization: The Okonite Company
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 14:53:06 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CMP 9 reaffirms its original statement on the PI (#3802) that this comment supports. The applicable rules are already in the NEC, at 300.34. The substantiation for this comment failed to address any of the arguments made by CMP 9. In addition, the proposed language would interfere with the initiative taken by CMP 9 under FR #2414 that allows future design and evaluation for medium voltage systems of conduit bodies with two 45-degree entries that do not impose a more severe bend radius than that allowed for the entering raceways.
Pull and junction boxes and handhole enclosures shall provide approved space and dimensions for the installation of conductors, and they shall comply with the specific requirements of this section. Conduit bodies shall be permitted if they meet the dimensional requirements for boxes.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 2415. This action will be considered as a public comment.

Related Item
First Revision No. 2415-NFPA 70-2015 [Section No. 314.71 [Excluding any Sub-Sections]]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 28 16:01:35 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The text in the first draft, which deleted the exception to 314.71, is correct. In this instance errors occurred in the report of the Panel statement on the first revision, as described in the ballot comments. The correct Panel statement was: "This exception is not appropriate for medium voltage applications. The correlating committee should send this public input to CMP 11 for information, where it should be reviewed for possible action in Part XI of Article 430."
Public Comment No. 1168-NFPA 70-2015 [Section No. 320.10]

### Statement of Problem and Substantiation for Public Comment

This added language is confusing as to the application of AC cable in health care facilities. The text is unnecessary and will cause needless confusion for installers and AHJs.

#### Related Item

First Revision No. 1807-NFPA 70-2015 [Section No. 320.10]

### Submitter Information Verification

- **Submitter Full Name:** Christel Hunter
- **Organization:** General Cable
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Wed Sep 23 23:23:30 EDT 2015

### Committee Statement

- **Committee Action:** Rejected but see related SR
- **Resolution:** SR-1801-NFPA 70-2015
- **Statement:** CMP-7 deletes item (2) as it is unnecessary as 320.10 is not an all inclusive list.
### Public Comment No. 559-NFPA 70-2015 [Section No. 320.10]

#### 320.10 Uses Permitted.

Type AC cable shall be permitted as follows:

1. For feeders and branch circuits in both exposed and concealed installations
2. For life safety and critical branch circuits of the essential electrical systems in health care facilities where permitted by 517.31(C)(3)(1) and 517.31(C)(3)(3)
3. In cable trays
4. In dry locations
5. Embedded in plaster finish on brick or other masonry, except in damp or wet locations
6. To be run or fished in the air voids of masonry block or tile walls where such walls are not exposed or subject to excessive moisture or dampness

**Informational Note:** The “Uses Permitted” is not an all-inclusive list.

### Statement of Problem and Substantiation for Public Comment

IEEE statement opposing the First Revision:FR1807 The inclusion of For life safety and critical branch circuits of the essential electrical systems in health care facilities where permitted by 517.31(C)(3)(1) and 517.31(C)(3)(3) in the uses permitted section is not typical. There was already an “Information Note: The “Uses Permitted” is not an all-inclusive list.” and this inclusion does not provide additional technical use in application for the installation just more specific as to location(s). Article 517 is specific to Health Care Facilities and should list the type of cable for the system specified per CMP15 jurisdiction.

### Related Item

Public Input No. 2259-NFPA 70-2014 [Section No. 320.10]

### Submitter Information Verification

**Submitter Full Name:** Dennis Nielsen  
**Organization:** Lawrence Berkeley National Lab  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Fri Sep 04 17:17:37 EDT 2015

### Committee Statement

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-1801-NFPA 70-2015  
**Statement:** CMP-7 deletes item (2) as it is unnecessary as 320.10 is not an all inclusive list.
320.10 Uses Permitted.
Type AC cable shall be permitted as follows:

1. For feeders and branch circuits in both exposed and concealed installations
2. For life safety and critical branch circuits of the essential electrical systems in health care facilities where permitted by 517.31(C)(3)(1) and 517.31(C)(3)(3)
3. In cable trays
4. In dry locations
5. Embedded in plaster finish on brick or other masonry, except in damp or wet locations
6. To be run or fished in the air voids of masonry block or tile walls where such walls are not exposed or subject to excessive moisture or dampness

Informational Note: The "Uses Permitted” is not an all-inclusive list.

Statement of Problem and Substantiation for Public Comment

Adding this specific permission to use MC and AC for these Article 517 applications strongly implies that other cable and raceway wiring methods that do not include this specific permission in their respective xxx.10 sections are not acceptable for these Article 517 applications. For example 358.10 for EMT does not have this specific permission.

Related Item
Public Input No. 2258-NFPA 70-2014 [Section No. 330.10(A)]
Public Input No. 2259-NFPA 70-2014 [Section No. 320.10]

Submitter Information Verification
Submitter Full Name: DON GANIERE
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jun 26 13:13:01 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Statement: CMP-7 deletes item (2) as it is unnecessary as 320.10 is not an all inclusive list.
320.10 Uses Permitted.
Type AC cable shall be permitted as follows:
(1) For feeders and branch circuits in both exposed and concealed installations
(2) For life safety and critical branch circuits of the essential electrical systems in health care facilities where permitted by 517.31(C)(3)(1) and 517.31(C)(3)(3)
(3) In cable trays
(4) In dry locations
(5) Embedded in plaster finish on brick or other masonry, except in damp or wet locations
(6) To be run or fished in the air voids of masonry block or tile walls where such walls are not exposed or subject to excessive moisture or dampness

Informational Note: The “Uses Permitted” is not an all-inclusive list.

Statement of Problem and Substantiation for Public Comment
The Panel statement shows that Panel 7 requested Panel 15 review. Panel 15 has subsequently resolved all PI's allowing the use of AC Cable in 517.30(C)(3)(1). Therefore, this PI should be resolved, since there is no permitted use for AC cable in those locations. Leaving this text could lead to confusion and misinterpretation of NEC requirements.

Related Item
First Revision No. 1807-NFPA 70-2015 [Section No. 320.10]

Submitter Information Verification
Submitter Full Name: JOSEPH ANDERSON
Organization: STEEL TUBE INSTITUTE
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 18:48:13 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Statement: CMP-7 deletes item (2) as it is unnecessary as 320.10 is not an all inclusive list.
Public Comment No. 260-NFPA 70-2015 [Section No. 320.30(A)]

(A) General.
Type AC cable shall be supported and secured by staples, listed cable ties identified as Type 2S or Type 21S listed and identified for securement and support, straps, hangers, or similar fittings or other approved means designed and installed so as not to damage the cable.

Statement of Problem and Substantiation for Public Comment

The language of all cable tie-related FR's between CMP 7 and CMP 8 should be harmonized. The difference between the CMP 7 FR's (1809, 1815, 1821 and 1830) and the CMP 8 FR's (2166, 2170, 2104 and 2115) is that those from CMP 7 maintained the cable tie Type classifications. CMP 8 removed these Types with the following committee statement:

"Listing of cable ties approved for support of flexible conduits and cables is appropriate as the standard requires markings that identify critical performance ranges that can impact their suitability for use, including minimum and maximum operating temperature and resistance to ultraviolet light for outdoor installations. The proposed new requirements will provide objective determination for suitability of cable ties for this use".

Related Item
First Revision No. 1809-NFPA 70-2015 [Section No. 320.30(A)]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 17 10:24:24 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1802-NFPA 70-2015
Statement: CMP 7 removes Type 2S and Types 21S and chooses to add “labeled” to the cable ties segment for clarity and usability.
Article 324  Flat Conductor Cable: Type FCC

Part I. General

324.1 Scope.
This article covers a field-installed wiring system for branch circuits incorporating Type FCC cable and associated accessories as defined by the article. The wiring system is designed for installation under carpet squares.

324.2 Definitions.

Bottom Shield.
A protective layer that is installed between the floor and Type FCC flat conductor cable to protect the cable from physical damage and may or may not be incorporated as an integral part of the cable.

Cable Connector.
A connector designed to join Type FCC cables without using a junction box.

FCC System.
A complete wiring system for branch circuits that is designed for installation under carpet squares.

Informational Note: The FCC system includes Type FCC cable and associated shielding, connectors, terminators, adapters, boxes, and receptacles.

Insulating End.
An insulator designed to electrically insulate the end of a Type FCC cable.

Metal Shield Connections.
Means of connection designed to electrically and mechanically connect a metal shield to another metal shield, to a receptacle housing or self-contained device, or to a transition assembly.

Top Shield.
A grounded metal shield covering under-carpet components of the FCC system for the purposes of providing protection against physical damage.

Transition Assembly.
An assembly to facilitate connection of the FCC system to other wiring systems, incorporating (1) a means of electrical interconnection and (2) a suitable box or covering for providing electrical safety and protection against physical damage.

Type FCC Cable.
Three or more flat copper conductors placed edge-to-edge and separated and enclosed within an insulating assembly.

324.6 Listing Requirements.
Type FCC cable and associated fittings shall be listed.

Part II. Installation

324.10 Uses Permitted.

(A) Branch Circuits.
Use of FCC systems shall be permitted both for general-purpose and appliance branch circuits and for individual branch circuits.

(B) Branch-Circuit Ratings.

(1) Voltage.
Voltage between ungrounded conductors shall not exceed 300 volts. Voltage between ungrounded conductors and the grounded conductor shall not exceed 150 volts.

(2) Current.
General-purpose and appliance branch circuits shall have ratings not exceeding 20 amperes. Individual branch circuits shall have ratings not exceeding 30 amperes.

(C) Floors.
Use of FCC systems shall be permitted on hard, sound, smooth, continuous floor surfaces made of concrete, ceramic, or composition flooring, wood, and similar materials.

(D) Walls.
Use of FCC systems shall be permitted on wall surfaces in surface metal raceways.
(E) Damp Locations.
Use of FCC systems in damp locations shall be permitted.

(F) Heated Floors.
Materials used for floors heated in excess of 30°C (86°F) shall be identified as suitable for use at these temperatures.

(G) System Height.
Any portion of an FCC system with a height above floor level exceeding 2.3 mm (0.090 in.) shall be tapered or feathered at the edges to floor level.

324.12 Uses Not Permitted.
FCC systems shall not be used in the following locations:

1) Outdoors or in wet locations
2) Where subject to corrosive vapors
3) In any hazardous (classified) location
4) In residential, school, and hospital buildings

324.18 Crossings.
Crossings of more than two Type FCC cable runs shall not be permitted at any one point. Crossings of a Type FCC cable over or under a flat communications or signal cable shall be permitted. In each case, a grounded layer of metal shielding shall separate the two cables, and crossings of more than two flat cables shall not be permitted at any one point.

324.30 Securing and Supporting.
All FCC system components shall be firmly anchored to the floor or wall using an adhesive or mechanical anchoring system identified for this use. Floors shall be prepared to ensure adherence of the FCC system to the floor until the carpet squares are placed.

324.40 Boxes and Fittings.
(A) Cable Connections and Insulating Ends.
All Type FCC cable connections shall use connectors identified for their use, installed such that electrical continuity, insulation, and sealing against dampness and liquid spillage are provided. All bare cable ends shall be insulated and sealed against dampness and liquid spillage using listed insulating ends.

(B) Polarization of Connections.
All receptacles and connections shall be constructed and installed so as to maintain proper polarization of the system.

(C) Shields.
1) Top Shield.
A metal top shield shall be installed over all floor-mounted Type FCC cable, connectors, and insulating ends. The top shield shall completely cover all cable runs, corners, connectors, and ends.

2) Bottom Shield.
A bottom shield shall be installed beneath all Type FCC cable, connectors, and insulating ends.

(D) Connection to Other Systems.
Power feed, grounding connection, and shield system connection between the FCC system and other wiring systems shall be accomplished in a transition assembly identified for this use.

(E) Metal-Shield Connectors.
Metal shields shall be connected to each other and to boxes, receptacle housings, self-contained devices, and transition assemblies using metal-shield connectors.

324.41 Floor Coverings.
Floor-mounted Type FCC cable, cable connectors, and insulating ends shall be covered with carpet squares not larger than 1.0 m (39.37 in.) square. Carpet squares that are adhered to the floor shall be attached with release-type adhesives.

324.42 Devices.
(A) Receptacles.
All receptacles, receptacle housings, and self-contained devices used with the FCC system shall be identified for this use and shall be connected to the Type FCC cable and metal shields. Connection from any grounding conductor of the Type FCC cable shall be made to the shield system at each receptacle.

(B) Receptacles and Housings.
Receptacle housings and self-contained devices designed either for floor mounting or for in-wall or on-wall mounting shall be permitted for use with the FCC system. Receptacle housings and self-contained devices shall incorporate means for facilitating entry and termination of Type FCC cable and for electrically connecting the housing or device with the metal shield. Receptacles and self-contained devices shall comply with 406.4. Power and communications outlets installed together in common housing shall be permitted in accordance with 800.133(A)(1) (d), Exception No. 2.
324.56 Splices and Taps.

(A) FCC Systems Alterations.

Alterations to FCC systems shall be permitted. New cable connectors shall be used at new connection points to make alterations. It shall be permitted to leave unused cable runs and associated cable connectors in place and energized. All cable ends shall be covered with insulating ends.

(B) Transition Assemblies.

All transition assemblies shall be identified for their use. Each assembly shall incorporate means for facilitating entry of the Type FCC cable into the assembly, for connecting the Type FCC cable to grounded conductors, and for electrically connecting the assembly to the metal cable shields and to equipment grounding conductors.

324.60 Grounding.

All metal shields, boxes, receptacle housings, and self-contained devices shall be electrically continuous to the equipment grounding conductor of the supplying branch circuit. All such electrical connections shall be made with connectors identified for this use. The electrical resistivity of such shield system shall not be more than that of one conductor of the Type FCC cable used in the installation.

Part III. Construction Specifications

324.100 Construction.

(A) Type FCC Cable.

Type FCC cable shall be listed for use with the FCC system and shall consist of three, four, or five flat copper conductors, one of which shall be an equipment grounding conductor.

(B) Shields.

(1) Materials and Dimensions.

All top and bottom shields shall be of designs and materials identified for their use. Top shields shall be metal. Both metallic and nonmetallic materials shall be permitted for bottom shields.

(2) Resistivity.

Metal shields shall have cross-sectional areas that provide for electrical resistivity of not more than that of one conductor of the Type FCC cable used in the installation.

324.101 Corrosion Resistance.

Metal components of the system shall be either corrosion resistant, coated with corrosion-resistant materials, or insulated from contact with corrosive substances.

324.112 Insulation.

The insulating material of the cable shall be moisture resistant and flame retardant. All insulating materials in the FCC systems shall be identified for their use.

324.120 Markings.

(A) Cable Marking.

Type FCC cable shall be clearly and durably marked on both sides at intervals of not more than 610 mm (24 in.) with the information required by 310.120(A) and with the following additional information:

(1) Material of conductors
(2) Maximum temperature rating
(3) Ampacity

(B) Conductor Identification.

Conductors shall be clearly and durably identified on both sides throughout their length as specified in 310.110.

Additional Proposed Changes

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<td>CommScope Public Comment to Resolution to Public Input 2627-NFPA 70-2014 [Article 324] (Alternate Flooring)</td>
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Statement of Problem and Substantiation for Public Comment

Commercial and retail building owners are rapidly adopting alternate flooring covering for use in their facilities in addition to or instead of carpet squares, such as modular vinyl planks and tile, laminate and hard wood. For example luxury vinyl use in commercial buildings rose 32.5% in 2014 alone. These alternate floor coverings offer the building owner a highly attractive and low maintenance flooring. However they still need/demand the ability to provide power and data to open areas which do not have traditional cabling pathways and need/want the flexibility of using both FCC (Flat Conductor Cable - power) in the same manner that they are presently allowed with carpet squares. Often the installation of FCC cable is the only acceptable solution to providing powering to the middle of the room. UL
Fact Finding Report finds that FCC cable can safely be installed under these alternate floors. Modular tiles and planks are as easily removed as carpet squares allowing for access and maintenance of FCC cable.

Related Item
Public Input No. 2627-NFPA 70-2014 [Article 324]

Submitter Information Verification

Submitter Full Name: Tony Beam
Organization: CommScope
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:42:15 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter did not indicate what changes were being requested in the Public Comment as required by NFPA Regulations Governing The Development of NFPA Standards 4.4.4.3(c). From the materials submitted, it does not appear that the modular tile and plank flooring is as easy to remove as carpet squares. Video links submitted show the use of knives and screwdrivers being used to remove the tile, either of which could damage Type FCC cable installed underneath. Carpet squares installed over Type FCC are required to have release-type adhesives, allowing the carpet squares to be removed with minimal use of tools.
324.6 Listing Requirements.
Type FCC cable and associated fittings shall be listed and labeled.

Additional Proposed Changes

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<tr>
<th>File Name</th>
<th>Description</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
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Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
First Revision No. 1804-NFPA 70-2015 [Section No. 324.6]
Public Input No. 885-NFPA 70-2014 [Section No. 324.6]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
Committee Statement

Committee Action: Accepted
Resolution: SR-1803-NFPA 70-2015
Statement: CMP-7 adds "and labeled" to provide information to the AHJ regarding the suitability of equipment they encounter.
Public Comment No. 494-NFPA 70-2015 [New Section after 324.12]

Public Comment on Panel 7 results for PI#3753

As co-authors of Public Input #3753 our intent was to allow under floor wiring systems in schools and hospital non-patient care areas to address the need for power in open offices, classrooms and training rooms. The products that meet Article 324 provide a system of power distribution without a tripping issue that other floor solutions create.

Given the Panel 7 concerns of safety in schools and hospital buildings we began working on installing Beta Sites in schools to demonstrate that Article 324 products do provide a safe environment. During the process we discovered that the school solution would be best served using low voltage (Class I and II). After further investigation and research we found that there are a number of low voltage (Class I and II) products that can be used to provide a safe environment in schools and hospital non-patient care areas.

Based on our discovery we would submit the following language to enhance the Electrical Code under Article 324.12(4).

Add:

Exception 1: Class I and II wiring systems, listed for the use, are allowed in school class rooms, offices, laboratories, lounges and libraries when installed in compliance with Article 725.

Exception 2: Class I and II wiring systems, listed for the use, are allowed in hospital conference rooms, training rooms, lounges, nurse’s stations and offices when installed in compliance with Article 725.

Sherman Robbins
Consultant for Bretford Manufacturing
shermanrobbins46@gmail.com

Statement of Problem and Substantiation for Public Comment

Problem: Accessing power source at the point of use in schools and hospital non-patient environments with open class rooms, conference rooms, libraries, laboratories, teacher lounges and offices. Current solutions for existing spaces are cumbersome and expensive to install, and if they are not routed through trenches will create a tripping hazard. Technology is evolving rapidly and the need to incorporate low voltage into our space planning is growing exponentially.

Our proposal would provide the ability to access the power source for powering lap tops, cell phone charging, tablet use and recharging, LED lighting and energy saving controls in open rooms at the point of use with the ability to make changes to the space as technology changes. Class I and Class II wiring systems, listed for the use and installed under the requirements of Article 725 would provide additional safety to the end user. Flat Conductor Cable, Article 324, provides flexibility of installation, safety of installation and eliminates tripping hazards to the occupants.

Currently 57% of our schools (K-12 and Colleges) and 62% our hospitals were constructed prior to the influx of technology that is now needed to perform our daily work and to meet our needs for teaching and learning. Flat Conductor Cable, Article 324, allow existing infrastructures to be upgraded quicker and less expensively to meet today's and tomorrow's technology tools.

Related Item
Public Input No. 3753-NFPA 70-2014 [Section No. 324.12]

Submitter Information Verification

Submitter Full Name: sherman robbins
Organization: Imaginative Innovations Inc
Affiliation: Bretford Manufacturing
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 02 09:34:48 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Type FCC cable is listed at 300 volts according to the UL Guide Card, Category code IKKT. The exceptions requested by the submitter are not appropriate for Article 324 since the wiring systems described are not Type FCC cable. It is likely the submitter is referring to CMUC communications cable listed to UL 444.
324.12 Uses Not Permitted.

FCC systems shall not be used in the following locations:

1. Outdoors or in wet locations
2. Where subject to corrosive vapors
3. In any hazardous (classified) location
4. In residential, school, and hospital buildings

Additional Proposed Changes

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<td>CommScope Public Comment to Committee Resolution of Public Input 3753-NFPA 70-2014 [Section No. 324.12] (School and Patient Room Exception)</td>
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Statement of Problem and Substantiation for Public Comment

FCC systems have been proven to be safe and reliable when installed and maintained in accordance with the NEC 70 electrical code. School classrooms, computer laboratories, administration offices, teacher lounges, student lounges, reception workstations, social meeting areas, media centers and libraries do not present safety risks that are not already provided for within the current electrical code. Likewise, non-patient care and non-patient rooms in hospital and emergency care centers, such as administrative offices, training rooms, media centers, reception workstations and social meeting areas do not present safety risks that are not already provided for within the current electrical code.

Related Item

Public Input No. 3753-NFPA 70-2014 [Section No. 324.12]

Submitter Information Verification

Submitter Full Name: Tony Beam
Organization: CommScope
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:53:45 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1804-NFPA 70-2015
Statement: The revised language will allow Type FCC cable in administrative office areas of hospitals and schools.
324.112 Insulation.

The insulating material of the cable shall be moisture resistant and flame retardant. All insulating materials in the FCC systems shall be identified for their use.

Informational Note: The requirements associated with the term flame retardant for each type of cable or insulation are contained within the product standard for the relevant cable or insulation. (See also 310.104).

Statement of Problem and Substantiation for Public Comment

The panel stated that the testing requirements are not needed for this article. The informational note proposed is being revised to explain that information on the term "flame retardant" is contained in the product standard. This is important because the term "flame retardant" as such is not an appropriate term without clarification because the term flame retardant simply refers to the additives that are used to improve fire performance, unless the fire performance is clarified.

Related Item

Public Input No. 2483-NFPA 70-2014 [Section No. 324.112]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 15:42:29 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Type FCC cable is required to be listed. The informational note provides no useful information to code users.
328.30 Support.
Type MV cable terminated in equipment, installed in pull boxes, or in vaults shall be secured and supported by metallic or nonmetallic supports suitable to withstand the weight, by listed cable ties listed and identified for securement and support, or other approved means, at intervals not exceeding 1.5 m (5 ft) from terminations or a maximum of 1.8 m (6 ft) between supports.

Statement of Problem and Substantiation for Public Comment

The language of all cable tie-related FR's between CMP 7 and CMP 8 should be harmonized. The difference between the CMP 7 FR's (1809, 1815, 1821 and 1830) and the CMP 8 FR's (2166, 2170, 2104 and 2115) is that those from CMP 7 maintained the cable tie Type classifications. CMP 8 removed these Types with the following committee statement:

"Listing of cable ties approved for support of flexible conduits and cables is appropriate as the standard requires markings that identify critical performance ranges that can impact their suitability for use, including minimum and maximum operating temperature and resistance to ultraviolet light for outdoor installations. The proposed new requirements will provide objective determination for suitability of cable ties for this use".

Related Item
First Revision No. 1815-NFPA 70-2015 [New Section after 328.14]

Submitter Information Verification
Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 17 10:29:20 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1805-NFPA 70-2015
Statement: CMP 7 adds "listed, labeled and identified for securement and support" to provide information to the AHJ regarding the suitability of equipment they encounter.
Public Comment No. 1167-NFPA 70-2015 [Section No. 330.10(A)]

(A) General Uses.
Type MC cable shall be permitted as follows:

1. For services, feeders, and branch circuits.
2. For power, lighting, control, and signal circuits.
3. Indoors or outdoors.
4. Exposed or concealed.
5. To be direct buried where identified for such use.
6. In cable tray where identified for such use.
7. In any raceway.
8. As aerial cable on a messenger.
9. In hazardous (classified) locations where specifically permitted by other articles in this Code.
10. For life safety and critical branch circuits of the essential electrical systems in health care facilities where permitted by "517.31(C)(3)(1) and 517.31(C)(3)(3)".
11. In dry locations and embedded in plaster finish on brick or other masonry except in damp or wet locations.
12. In wet locations where a corrosion-resistant jacket is provided over the metallic covering and any of the following conditions are met:
   14. The metallic covering is impervious to moisture.
   15. A jacket resistant to moisture is provided under the metal covering.
   16. The insulated conductors under the metallic covering are listed for use in wet locations.
13. Where single-conductor cables are used, all phase conductors and, where used, the grounded conductor shall be grouped together to minimize induced voltage on the sheath.

Statement of Problem and Substantiation for Public Comment

This new text is confusing as to the application of MC cable in health care facilities and will create installation questions for installers and enforcers. The text is unnecessary.

Related Item
First Revision No. 1818-NFPA 70-2015 [Section No. 330.10(A)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 23:21:22 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1806-NFPA 70-2015
Statement: CMP-7 deletes item (10) as it is unnecessary as 330.10 is not an all inclusive list.
(A) General Uses.
Type MC cable shall be permitted as follows:

1. For services, feeders, and branch circuits.
2. For power, lighting, control, and signal circuits.
3. Indoors or outdoors.
4. Exposed or concealed.
5. To be direct buried where identified for such use.
6. In cable tray where identified for such use.
7. In any raceway.
8. As aerial cable on a messenger.
9. In hazardous (classified) locations where specifically permitted by other articles in this Code.
10. For life safety and critical branch circuits of the essential electrical systems in health care facilities where permitted by 517.31(C)(3)(1) and 517.31(C)(3)(3).
11. In dry locations and embedded in plaster finish on brick or other masonry except in damp or wet locations.
12. In wet locations where a corrosion-resistant jacket is provided over the metallic covering and any of the following conditions are met:
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   15. A jacket resistant to moisture is provided under the metal covering.
   16. The insulated conductors under the metallic covering are listed for use in wet locations.
13. Where single-conductor cables are used, all phase conductors and, where used, the grounded conductor shall be grouped together to minimize induced voltage on the sheath.

Statement of Problem and Substantiation for Public Comment

IEEE statement opposing the First Revision:FR1818 The inclusion of For life safety and critical branch circuits of the essential electrical systems in health care facilities where permitted by 517.30(C)(3)(1) and 517.30(C)(3)(3) in the uses permitted section is not typical. There is an “Information Note: The “Uses Permitted” is not an all-inclusive list.” and this inclusion does not provide additional technical use in application for the installation just more specific as to location(s). Article 517 is specific to Health Care Facilities and should list the type of cable for the system specified per CMP15 jurisdiction.

Related Item
Public Input No. 2258-NFPA 70-2014 [Section No. 330.10(A)]

Submitter Information Verification
Submitter Full Name: Dennis Nielsen
Organization: Lawrence Berkeley National Lab
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 16:56:06 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1806-NFPA 70-2015
Statement: CMP-7 deletes item (10) as it is unnecessary as 330.10 is not an all inclusive list.
Public Comment No. 896-NFPA 70-2015 [Section No. 330.10(A)]

(A) General Uses.
Type MC cable shall be permitted as follows:

1. For services, feeders, and branch circuits.
2. For power, lighting, control, and signal circuits.
3. Indoors or outdoors.
4. Exposed or concealed.
5. To be direct buried where identified for such use.
6. In cable tray where identified for such use.
7. In any raceway.
8. As aerial cable on a messenger.
9. In hazardous (classified) locations where specifically permitted by other articles in this Code.
10. For life safety and critical branch circuits of the essential electrical systems in health care facilities where permitted by 517.31(C)(3)(1) and 517.31(C)(3)(3).
11. In dry locations and embedded in plaster finish on brick or other masonry except in damp or wet locations.
12. In wet locations where a corrosion-resistant jacket is provided over the metallic covering and any of the following conditions are met:
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   14. A jacket resistant to moisture is provided under the metal covering.
   15. The insulated conductors under the metallic covering are listed for use in wet locations.
16. Where single-conductor cables are used, all phase conductors and, where used, the grounded conductor shall be grouped together to minimize induced voltage on the sheath.

Statement of Problem and Substantiation for Public Comment

The Panel statement shows that Panel 7 requested Panel 15 review. Panel 15 has subsequently resolved all PI's allowing the use of MC Cable in 517.30(C)(3)(1). Therefore, this PI should be resolved, since there is no permitted use for MC cable in those locations. Leaving this text could lead to confusion and misinterpretation of NEC requirements.

Related Item
First Revision No. 1818-NFPA 70-2015 [Section No. 330.10(A)]

Submitter Information Verification

Submitter Full Name: JOSEPH ANDERSON
Organization: STEEL TUBE INSTITUTE
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 18:41:21 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1806-NFPA 70-2015
Statement: CMP-7 deletes item (10) as it is unnecessary as 330.10 is not an all inclusive list.
330.15. Exposed Work. Installed exposed indoor

Exposed runs of cable, except where permitted in this article and as provided in 300.11(A), shall closely follow the surface of the building finish or on running boards. Exposed runs shall also be permitted to be installed on the underside of joists where supported at each joist and located so as not to be subject to physical damage.

Exception: In type I or II construction, MC shall be permitted to be installed in open air according to the provisions in section 330.30 where not subject to physical damage.

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Statement of Problem and Substantiation for Public Comment

The "follow the building finish" language would be impractical in a commercial and industrial installation. Where it is common practice to install the MC cables exposed in between junior beams with bridle ring supports, or installed with trapezoid strut hanger from a ceiling. What is a building finish? and is it always present?

The article has uses where it is not following the building surface such as 330.30(D)(3) & (6) & (7).

This is too restrictive a section for MC under all applications and some relief should be provided. If taken literally the cable needs to touch the building surface for its entire length, the way caddy hanger and beam clamps are installed on a beam the cable is usually two to three inches away from a beam, the new section addresses from beam to beam but not the run a long the beam installation, this usually is in a type I and II constructed building. I would suggest removing the whole section.

Related Item

First Revision No. 1820-NFPA 70-2015 [New Section after 330.12]
Public Input No. 1986-NFPA 70-2014 [New Section after 330.12]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 13:58:15 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The language does not prohibit the use of strut and trapeze installations.
330.15  Exposed Work.
Exposed runs of cable indoor.
For MC cables with ungrounded conductors 10 AWG and smaller where installed exposed, except as provided in this article and 300.11(A), shall closely follow the surface of the building finish, or of on running boards. Exposed runs shall also be permitted to be installed on the underside of joists where supported at each joist and located so as not to be subject to physical damage.

Statement of Problem and Substantiation for Public Comment

as stated in a previous PC 852 this section is to restrictive and should allow 250 KCM MC conductor to be installed on trapezoid supports 10 AWG or smaller is the language id 334 for nm cable. the is an optional PC if PC 852 fails

Related Item
First Revision No. 1820-NFPA 70-2015 [New Section after 330.12]
Public Input No. 1986-NFPA 70-2014 [New Section after 330.12]

Submitter Information Verification
Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 15:53:42 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The language does not prohibit the use of strut and trapeze installations.
Public Comment No. 262-NFPA 70-2015 [Section No. 330.30(A)]

(A) General.

Type MC cable shall be supported and secured by staples, listed cable ties identified as Type 2S or Type 21S listed and identified for securement and support, straps, hangers, or similar fittings or other approved means designed and installed so as not to damage the cable.

Statement of Problem and Substantiation for Public Comment

The language of all cable tie-related FR's between CMP 7 and CMP 8 should be harmonized. The difference between the CMP 7 FR's (1809, 1815, 1821 and 1830) and the CMP 8 FR's (2166, 2170, 2104 and 2115) is that those from CMP 7 maintained the cable tie Type classifications. CMP 8 removed these Types with the following committee statement:

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Related Item

First Revision No. 1821-NFPA 70-2015 [Section No. 330.30(A)]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 17 10:31:28 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1807-NFPA 70-2015
Statement: CMP 7 removes Type 2S and Types 21S and adds "listed, labeled and identified for securement and support" to provide information to the AHJ regarding the suitability of equipment they encounter.
334.6 Listing Requirements.
Type NM, Type NMC, and Type NMS cables and associated fittings shall be listed and labeled.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

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The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
First Revision No. 1824-NFPA 70-2015 [Section No. 334.6]
Public Input No. 886-NFPA 70-2014 [Section No. 334.6]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 
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<td><strong>Submittal Date:</strong></td>
<td><strong>Wed Sep 23 20:48:14 EDT 2015</strong></td>
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## Committee Statement

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<tr>
<th>Committee Action:</th>
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<tbody>
<tr>
<td>Resolution:</td>
<td>SR-1810-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement:</td>
<td>CMP-7 adds &quot;and labeled&quot; to provide information to the AHJ regarding the suitability of equipment they encounter.</td>
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</tbody>
</table>
Public Comment No. 263-NFPA 70-2015 [Section No. 334.30 [Excluding any Sub-Sections]]

Nonmetallic-sheathed cable shall be supported and secured by staples, listed cable ties identified as Type 2S or Type 21S listed and identified for securement and support, straps, hangers, or similar fittings designed and installed so as not to damage the cable, at intervals not exceeding 1.4 m (4 1/2 ft) and within 300 mm (12 in.) of every cable entry into enclosures such as outlet boxes, junction boxes, cabinets, or fittings. Flat cables shall not be stapled on edge.

Sections of cable protected from physical damage by raceway shall not be required to be secured within the raceway.

Statement of Problem and Substantiation for Public Comment

The language of all cable tie-related FR's between CMP 7 and CMP 8 should be harmonized. The difference between the CMP 7 FR's (1809, 1815, 1821 and 1830) and the CMP 8 FR's (2166, 2170, 2104 and 2115) is that those from CMP 7 maintained the cable tie Type classifications. CMP 8 removed these Types with the following committee statement:

"Listing of cable ties approved for support of flexible conduits and cables is appropriate as the standard requires markings that identify critical performance ranges that can impact their suitability for use, including minimum and maximum operating temperature and resistance to ultraviolet light for outdoor installations. The proposed new requirements will provide objective determination for suitability of cable ties for this use".

Related Item
First Revision No. 1830-NFPA 70-2015 [Section No. 334.30 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 17 10:33:34 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1811-NFPA 70-2015
Statement: CMP 7 removes Type 2S and Types 21S and adds "listed, labeled and identified for securement and support" to provide information to the AHJ regarding the suitability of equipment they encounter.
334.108 Equipment Grounding Conductor.

In addition to the insulated conductors, the cable shall have an insulated, covered, or bare equipment grounding conductor only.

Statement of Problem and Substantiation for Public Comment

I agree with the Committee Statement stating “the need for Qualified Persons performing all electrical installations.” Education is very important and a must for everyone. But in reality education can help but can not solve problems with equipment design flaws.

In order for a problem to be solved thru education thousands of people must be involved. The electrical industry must first recognize the problem and the teachers must be made aware of it. Producing documentation and addressing the problem in classrooms across the nation on a consistent basis is just not reality. The logistics of thousands of people required to communicate the problem is just too large and will take many years for the problem to be corrected. Over time the problem can be addressed thru the many classrooms and in the field but accidents can and will happen.

The problem of accidental contact in residential receptacles of the neutral (grounded conductor) and the bare grounding conductor in non-metallic sheathed cable and causing Objectionable Current which in turn can cause shocks, fires or electrocution can easily be solved. Not 100% but very close. Inspection can not solve the problem as they do not have the time to look behind every wall plate. Using the Standard three prong tester used for testing receptacles can not solve the problem. If the neutral (grounded conductor) screw touches the bare grounding conductor the tester will show “Correct Wiring”. And to wait years for something to be taught and still not prevent the accidental touching does not help the situation.

Insulating the bare grounding conductor in non-metallic sheathed cable will prevent the accidental touching of the neutral (grounded conductor) and the bare grounding conductor and will prevent Objectionable Current and it's associated risks of shocks, fires and electrocution. Why? Because all of the conductors are insulated. Can you prevent someone from purposely connecting neutrals (grounded conductor) and grounding conductors together? No. Education can help but not solve the problem.

What comes to mind is a quote that I quoted in the “Statement of Problem and Substantiation for Public Input”. I’m changing that quote to be more reflective of the electrical industry.

“You don’t design an electrical installation or electrical equipment on the assumption that everyone will do the right thing. You design it assuming people will make mistakes and build it in ways that withstand and minimize error”

In closing my recommendation to the Committee is to change the electrical code to allow only an insulated grounding conductor in non-metallic sheathed cable. It will not solve all problems, but it will solve the problem of accidental contact between neutral (grounded conductor) and bare grounding conductors in residential receptacles. This small change will make all residential wiring safer, which is essentially what we all want. Any time the risks of shocks, fires or electrocution can be minimized, that change should be made now. Not at some point in the future. Just like with tamper proof receptacles making it safer for young children inserting metal objects into the receptacle and possibly getting shocked. Educating the public should be enough to implement the purchase of devices to prevent these hazards, but it takes too much time. Requiring all residential receptacles to be tamper proof now eliminates the time to educate and puts safety in the hands of people immediately. Education is a must and absolutely required, but as I described above no education is required to absolutely prevent unintentional mistakes. Insulating the grounding conductor will prevent the problem of Objectionable Current causing shocks, fires or electrocution now, not sometime in the future. Why wait? Solve the problem now; insulate the grounding conductor in Non-metallic Sheathed Cable!

Related Item

Public Input No. 3748-NFPA 70-2014 [Section No. 334.108]

Submitter Information Verification

Submitter Full Name: Albert Welsh
Organization: Electrical Technologies
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 16:53:46 EDT 2015

Committee Statement

Committee: Rejected
<table>
<thead>
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<tbody>
<tr>
<td><strong>Resolution:</strong></td>
<td>This has been insufficient technical evidence presented to substantiate the removal of “covered and bare.” The deletion of “covered and bare” from Section 334.108 is unnecessary and is not practicable with the current wiring methods that are available.</td>
</tr>
</tbody>
</table>
334.112 Insulation.

The insulated power conductors shall be one of the types listed in Table 310.104(A) that are suitable for branch-circuit wiring or one that is identified for use in these cables. Conductor insulation shall be rated at 90°C (194°F).

Informational Note 1: Types NM, NMC, and NMS cable identified by the markings NM-B, NMC-B, and NMS-B meet this requirement.

Informational Note 2: The requirements associated with the term flame retardant for each type of cable or insulation are contained within the product standard for the relevant cable or insulation. (See also 310.104).

Statement of Problem and Substantiation for Public Comment

The panel stated that the testing requirements are not needed for this article. The informational note proposed is being revised to explain that information on the term "flame retardant" is contained in the product standard. This is important because the term "flame retardant" as such is not an appropriate term without clarification because the term flame retardant simply refers to the additives that are used to improve fire performance, unless the fire performance is clarified.

Related Item

Public Input No. 2487-NFPA 70-2014 [Section No. 334.116]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 15:44:29 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: An informational note about flame retardant is not needed since this is covered in the product listing.
Uses Permitted.

Type TC cable shall be permitted to be used as follows:

(1) For power, lighting, control, and signal circuits.
(2) In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).
(3) In raceways.
(4) In outdoor locations supported by a messenger wire.
(5) For Class 1 circuits as permitted in Parts II and III of Article 725.
(6) For non–power-limited fire alarm circuits if conductors comply with the requirements of 760.49.

(7) Between a cable tray and the utilization equipment or device(s), provided all of the following apply:
   (8) The cable is Type TC-ER.
   (9) The cable is installed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation.
   (10) The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
   (11) The cable that complies with the crush and impact requirements of Type MC cable and is identified with the marking “TC-ER”.
   (12) The cable is secured at intervals not exceeding 1.8 m (6 ft).
   (13) Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 AWG or smaller, the equipment grounding conductor must be provided within the cable or, at the time of installation, one or more insulated conductors must be permanently identified as an equipment grounding conductor in accordance with 250.119(B).

Exception to (7): Where not subject to physical damage, Type TC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(14) Where installed in wet locations, Type TC cable shall also be resistant to moisture and corrosive agents.

(15) In one- and two-family dwelling units, Type TC-ER cable containing both power and control conductors that is identified for pulling through structural members shall be permitted to be installed between a power inlet box or permanently installed generator and the transfer equipment. Type TC-ER cable used as exterior wiring shall be installed per the requirements of Part II of Article 340. Type TC-ER cable used as interior wiring shall be installed per the requirements of Part II of Article 334. Exception to (15): Where the generator and transfer equipment have terminals rated 75°C (167°F) or higher, the allowable ampacity of the conductor shall be determined in accordance with 110.14(C)(1)(a)(3) and 310.15. The 90°C (194°F) rating shall be permitted to be used for adjustment and correction calculations, provided the final derated ampacity does not exceed that of a 75°C (167°F) conductor.

Informational Note: TC-ER cable that is suitable for pulling through structural members is marked “JP.”

(16) Direct buried, where identified for such use

Informational Note: See 310.15(A)(3) for temperature limitation of conductors.

Statement of Problem and Substantiation for Public Comment

Articles 334.80 and 340.80 could be interpreted to limit the ampacity of the conductors to 60°C. This temperature limitation is due to devices such as receptacles and light switches having terminals rated only for a 60°C temperature rating. The terminal lugs in the generator and transfer equipment manufactured by Generac Power Systems are rated at 75°C at the generator breaker terminals and 75°C at the neutral and equipment ground bar/lugs and 90°C on the transfer mechanism lugs. If the insulation temperature rating of the conductors and temperature rating of the lugs have a 75°C minimum temperature rating, why limit the ampacity to the 60°C rating when 110.14(C)(1)(a)(3) permits the higher temperature rating if the equipment is listed and labeled for use with such conductors.

Related Item

First Revision No. 1832-NFPA 70-2015 [Section No. 336.10]
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1808-NFPA 70-2015
Statement: The revised language will allow generator and associated equipment with terminals rated 75C or greater to be used with TC cable without being limited to 60C.

The revised language will permit TC-ER cable to be used for supplying equipment other than generators in one- and two-family dwelling units.

CMP-7 has reviewed the record per the Correlating Committee’s request and consideration was given to the ballot comments expressed in FR 1840.

The use of the word "identified" is appropriate. The informational note and the marking requirement will trigger a change to the product standard requiring a joist pull test for cable that will be allowed to be marked "JP". Type TC cable is required to be listed.

Type TC cable has a nonmetallic jacket and construction similar to wiring methods commonly found in residential applications, like Types NM, UF and SE. It is unclear why the other types would be allowed for this application and Type TC would not be.

CMP-7 also adds Informational Note 2 to alert users of the separation requirements of Class 2 and 3 conductors from electric light, power or Class 1 circuits.
Uses Permitted.

Type TC cable shall be permitted to be used as follows:

(1) For power, lighting, control, and signal circuits.
(2) In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).
(3) In raceways.
(4) In outdoor locations supported by a messenger wire.
(5) For Class 1 circuits as permitted in Parts II and III of Article 725.
(6) For non–power-limited fire alarm circuits if conductors comply with the requirements of 760.49.
(7) Between a cable tray and the utilization equipment or device(s), provided all of the following apply:
   (8) The cable is Type TC-ER.
   (9) The cable is installed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation.
   (10) The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
   (11) The cable that complies with the crush and impact requirements of Type MC cable and is identified with the marking "TC-ER".
   (12) The cable is secured at intervals not exceeding 1.8 m (6 ft).
   (13) Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 AWG or smaller, the equipment grounding conductor must be provided within the cable or, at the time of installation, one or more insulated conductors must be permanently identified as an equipment grounding conductor in accordance with 250.119(B).

Exception to (7): Where not subject to physical damage, Type TC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(14) Where installed in wet locations, Type TC cable shall also be resistant to moisture and corrosive agents.

(15) In one- and two-family dwelling units, Type TC-ER cable containing both power and control conductors that is identified for pulling through structural members shall be permitted to be installed between a power inlet box or permanently installed generator and the transfer equipment supply equipment without being in a cable tray or raceway. Type TC-ER cable used as exterior wiring shall be installed per the requirements of Part II of Article 340. Type TC-ER cable used as interior wiring shall be installed per the requirements of Part II of Article 334.

Informational Note: TC-ER cable that is suitable for pulling through structural members is marked "JP."

(16) Direct buried, where identified for such use

Informational Note: See 310.15(A)(3) for temperature limitation of conductors.

Statement of Problem and Substantiation for Public Comment

Revise new list item (9) to 336.10 to permit TC-ER cable to be used for supplying equipment other than generators as proposed in PI 4359. NM and UF cable is presently permitted for this so TC-ER cable should be also. The concern for misusing TC-ER cables also applies to NM cable.

Related Item
First Revision No. 1840-NFPA 70-2015 [Detail]

Submitter Information Verification

Submitter Full Name: Paul Dobrowsky
Organization: Innovative Technology Services
Street Address:
City:
State:
### Committee Statement

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<th>Committee Action</th>
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<th>Statement</th>
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<tbody>
<tr>
<td>Rejected but see related SR</td>
<td>SR-1808-NFPA 70-2015</td>
<td>The revised language will allow generator and associated equipment with terminals rated 75C or greater to be used with TC cable without being limited to 60C. The revised language will permit TC-ER cable to be used for supplying equipment other than generators in one- and two-family dwelling units. CMP-7 has reviewed the record per the Correlating Committee’s request and consideration was given to the ballot comments expressed in FR 1840. The use of the word &quot;identified&quot; is appropriate. The informational note and the marking requirement will trigger a change to the product standard requiring a joist pull test for cable that will be allowed to be marked &quot;JP&quot;. Type TC cable is required to be listed. Type TC cable has a nonmetallic jacket and construction similar to wiring methods commonly found in residential applications, like Types NM, UF and SE. It is unclear why the other types would be allowed for this application and Type TC would not be. CMP-7 also adds Informational Note 2 to alert users of the separation requirements of Class 2 and 3 conductors from electric light, power or Class 1 circuits.</td>
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336.10 Uses Permitted.

Type TC cable shall be permitted to be used as follows:

1. For power, lighting, control, and signal circuits.
2. In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).
3. In raceways.
4. In outdoor locations supported by a messenger wire.
5. For Class 1 circuits as permitted in Parts II and III of Article 725.
6. For non-power-limited fire alarm circuits if conductors comply with the requirements of 760.49.
7. Between a cable tray and the utilization equipment or device(s), provided all of the following apply:
   a. The cable is Type TC-ER.
   b. The cable is installed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation.
   c. The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
   d. The cable that complies with the crush and impact requirements of Type MC cable and is identified with the marking “TC–ER”.
   e. The cable is secured at intervals not exceeding 1.8 m (6 ft).
   f. Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 AWG or smaller, the equipment grounding conductor must be provided within the cable or, at the time of installation, one or more insulated conductors must be permanently identified as an equipment grounding conductor in accordance with 250.119(B).

Exception to (7): Where not subject to physical damage, Type TC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

8. Where installed in wet locations, Type TC cable shall also be resistant to moisture and corrosive agents.

9. In one- and two-family dwelling units, Type TC-ER cable containing both power and control conductors that is identified for pulling through structural members shall be permitted to be installed between a power inlet box or permanently installed generator and the transfer equipment. Type TC-ER cable used as exterior wiring shall be installed per the requirements of Part II of Article 340. Type TC-ER cable used as interior wiring shall be installed per the requirements of Part II of Article 334.

Informational Note: TC-ER cable that is suitable for pulling through structural members is marked “JP.”

10. Direct buried, where identified for such use

Informational Note: See 310.15(A)(3) for temperature limitation of conductors.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1840.

Related Item

First Revision No. 1832-NFPA 70-2015 [Section No. 336.10]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 28 16:02:52 EDT 2015
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1808-NFPA 70-2015
Statement: The revised language will allow generator and associated equipment with terminals rated 75C or greater to be used with TC cable without being limited to 60C.

The revised language will permit TC-ER cable to be used for supplying equipment other than generators in one- and two-family dwelling units.

CMP-7 has reviewed the record per the Correlating Committee’s request and consideration was given to the ballot comments expressed in FR 1840.

The use of the word “identified” is appropriate. The informational note and the marking requirement will trigger a change to the product standard requiring a joist pull test for cable that will be allowed to be marked “JP”. Type TC cable is required to be listed.

Type TC cable has a nonmetallic jacket and construction similar to wiring methods commonly found in residential applications, like Types NM, UF and SE. It is unclear why the other types would be allowed for this application and Type TC would not be.

CMP-7 also adds Informational Note 2 to alert users of the separation requirements of Class 2 and 3 conductors from electric light, power or Class 1 circuits.
Uses Permitted.

Type TC cable shall be permitted to be used as follows:

(1) For power, lighting, control, and signal circuits.
(2) In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).
(3) In raceways.
(4) In outdoor locations supported by a messenger wire.
(5) For Class 1 circuits as permitted in Parts II and III of Article 725.
(6) For non–power-limited fire alarm circuits if conductors comply with the requirements of 760.49.
(7) Between a cable tray and the utilization equipment or device(s), provided all of the following apply:
   (8) The cable is Type TC-ER.
   (9) The cable is installed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation.
   (10) The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
   (11) The cable that complies with the crush and impact requirements of Type MC cable and is identified with the marking “TC–ER”.
   (12) The cable is secured at intervals not exceeding 1.8 m (6 ft).
   (13) Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 AWG or smaller, the equipment grounding conductor must be provided within the cable or, at the time of installation, one or more insulated conductors must be permanently identified as an equipment grounding conductor in accordance with 250.119(B).

Exception to (7): Where not subject to physical damage, Type TC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(10) Where installed in wet locations, Type TC cable shall also be resistant to moisture and corrosive agents.

(11) In one- and two-family dwelling units, Type TC-ER cable containing both power and control conductors that is identified for pulling through structural members shall be permitted to be installed between a power inlet box or permanently installed generator and the transfer equipment. Type TC-ER cable used as exterior wiring shall be installed per the requirements of Part II of Article 340. Type TC-ER cable used as interior wiring shall be installed per the requirements of Part II of Article 334.

Informational Note: TC-ER cable that is suitable for pulling through structural members is marked “JP.”

(12) Direct buried, where identified for such use

Informational Note: See 310.15(A)(3) for temperature limitation of conductors.

Statement of Problem and Substantiation for Public Comment

Due to the incorrect formatting used in the online systems I have posted my recommended change below as well as the substantiation below the code language as directed by NFPA.

336.10 Uses Permitted.

Type TC cable shall be permitted to be used as follows:

For power, lighting, control, and signal circuits.

In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).

In raceways.

In outdoor locations supported by a messenger wire.
For Class 1 circuits as permitted in Parts II and III of Article 725.

For non-power-limited fire alarm circuits if conductors comply with the requirements of 760.49.

Between a cable tray and the utilization equipment or device(s), provided all of the following apply:
- The cable is Type TC-ER.
- The cable is installed where conditions of maintenance and supervision ensure that only qualified persons service the installation.
- The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
- The cable that complies with the crush and impact requirements of Type MC cable and is identified with the marking “TC–ER”.
- The cable is secured at intervals not exceeding 1.8 m (6 ft).

Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 AWG or smaller, the equipment grounding conductor must be provided within the cable or, at the time of installation, one or more insulated conductors must be permanently identified as an equipment grounding conductor in accordance with 250.119(B).

Exception to (7): Where not subject to physical damage, Type TC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

Where installed in wet locations, Type TC cable shall also be resistant to moisture and corrosive agents.

In one- and two-family dwelling units, Type TC-ER cable containing both power and control conductors that is identified for pulling through structural members shall be permitted to be installed between a power inlet box or permanently installed generator and the transfer equipment. Type TC-ER cable used as exterior wiring shall be installed per the requirements of Part II of Article 340. Type TC-ER cable used as interior wiring shall be installed per the requirements of Part II of Article 334.

Informational Note: TC-ER cable that is suitable for pulling through structural members is marked “JP.”

Direct buried, where identified for such use

Informational Note: See 310.15(A)(3) for temperature limitation of conductors.

Substantiation: The reference to "industrial use only" in the permitted use item should be removed. The there is no technical substantiation as to why you would limit Type TC-ER cable from a Cable Tray to Equipment only within an Industrial Setting. In fact, many commercial settings have the same need and they also are maintained by maintenance individuals who are skilled and trained. In fact, in the 2020 NEC I will be presenting an entire revamping of Article 336 to remove this stigmatized misunderstanding on Type TC Cable. Type TC-ER Cable is robust and will hold up much better than Type SE Cable, yet the NEC permits Type SE-R cable to run all over a structures. The construction of Type TC-ER is again more robust than type SE Cable, can meet or exceed all the required properties of Type SE Cable and should be permitted to be used in the same environments at the least. I am the Manager of Codes and Standards for Encore Wire and when I presented this concept to the other members of the NEMA Wire and Cable group at a meeting in Florida, not a single individual could point to why it would not be acceptable other than the fact some companies don't product Type TC Cable. This cable is a very strong and reliable cable and it should be permitted in many others uses that what is stated here. The construction is of the same inner conductors (THHN/THWN-2 or XHHW-2) and the outer sheathing is thicker and stronger than Type SE Cable yet it is limited to its permitted use without any known substantiation as to why.

Related Item
First Revision No. 1832-NFPA 70-2015 [Section No. 336.10]
336.10 Uses Permitted.

Type TC cable shall be permitted to be used as follows:

(1) For power, lighting, control, and signal circuits.
(2) In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).
(3) In raceways.
(4) In outdoor locations supported by a messenger wire.
(5) For Class 1 circuits as permitted in Parts II and III of Article 725.
(6) For non-power-limited fire alarm circuits if conductors comply with the requirements of 760.49.
(7) Between a cable tray and the utilization equipment or device(s), provided all of the following apply:
   (8) The cable is Type TC-ER.
   (9) The cable is installed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation.
   (10) The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
   (11) The cable that complies with the crush and impact requirements of Type MC cable and is identified with the marking “TC-ER”.
   (12) The cable is secured at intervals not exceeding 1.8 m (6 ft).
   (13) Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 AWG or smaller, the equipment grounding conductor must be provided within the cable or, at the time of installation, one or more insulated conductors must be permanently identified as an equipment grounding conductor in accordance with 250.119(B).

Exception to (7): Where not subject to physical damage, Type TC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(14) Where installed in wet locations, Type TC cable shall also be resistant to moisture and corrosive agents.

(15) In one- and two-family dwelling units, Type TC-ER cable containing both power and control conductors that is listed for pulling through structural members shall be installed per the requirements of Part II of Article 340. Type TC-ER cable used as interior wiring shall be installed per the requirements of Part II of Article 334. Informational Note: TC-ER cable that is suitable for pulling through structural members is marked “JP.”

(16) Direct buried, where identified for such use

Informational Note: See 310.15(A)(3) for temperature limitation of conductors.

Statement of Problem and Substantiation for Public Comment

This cable is currently being installed as interior wiring for both air conditioning equipment as well as (specific manufactures) optional standby (generator) installation. If CMP-7 is in agreement that this product is suitable for unlimited interior cable installations (exposed and concealed) where not installed in a raceway or associated with a tray system, then it should not limit its’ use to only generator installations. If my suggestion to expand its use and require a listed product (change the UL listing card) is to excessive then I suggest it needs further investigation and a return to the 2014 language. I am sure the code panel will make the right decision.

Related Item
Public Input No. 1832-NFPA 70-2014 [Section No. 110.22(A)]

Submitter Information Verification

Submitter Full Name: Charles Palmieri
Organization: Town of Norwell
Affiliation: self
Committee Statement

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<tr>
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<td>Rejected but see related SR</td>
<td>SR-1808-NFPA 70-2015</td>
<td>The revised language will allow generator and associated equipment with terminals rated 75C or greater to be used with TC cable without being limited to 60C. The revised language will permit TC-ER cable to be used for supplying equipment other than generators in one- and two-family dwelling units. CMP-7 has reviewed the record per the Correlating Committee’s request and consideration was given to the ballot comments expressed in FR 1840. The use of the word &quot;identified&quot; is appropriate. The informational note and the marking requirement will trigger a change to the product standard requiring a joist pull test for cable that will be allowed to be marked &quot;JP&quot;. Type TC cable is required to be listed. Type TC cable has a nonmetallic jacket and construction similar to wiring methods commonly found in residential applications, like Types NM, UF and SE. It is unclear why the other types would be allowed for this application and Type TC would not be. CMP-7 also adds Informational Note 2 to alert users of the separation requirements of Class 2 and 3 conductors from electric light, power or Class 1 circuits.</td>
</tr>
</tbody>
</table>
336.10  Uses Permitted.
Type TC cable shall be permitted to be used as follows:

(1)  For power, lighting, control, and signal circuits.
(2)  In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).
(3)  In raceways.
(4)  In outdoor locations supported by a messenger wire.
(5)  For Class 1 circuits as permitted in Parts II and III of Article 725.
(6)  For non-power-limited fire alarm circuits if conductors comply with the requirements of 760.49.
(7)  Between a cable tray and the utilization equipment or device(s), provided all of the following apply:
   (8)  The cable is Type TC-ER.
   (9)  The cable is installed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation.
   (10) The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
   (11) The cable that complies with the crush and impact requirements of Type MC cable and is identified with the marking “TC-ER”.
   (12) The cable is secured at intervals not exceeding 1.8 m (6 ft).
   (13) Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 AWG or smaller, the equipment grounding conductor must be permanently identified as an equipment grounding conductor in accordance with 250.119(B).

Exception to (7): Where not subject to physical damage, Type TC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(14) Where installed in wet locations, Type TC cable shall also be resistant to moisture and corrosive agents.
(15) In one- and two-family dwelling units, Type TC-ER cable containing both power and control conductors that is identified for pulling through structural members shall be permitted to be installed between a power inlet box or permanently installed generator and the transfer equipment. Type TC-ER cable used as exterior wiring shall be installed per the requirements of Part II of Article 340. Type TC-ER cable used as interior wiring shall be installed per the requirements of Part II of Article 334.

  Informational Note: TC-ER cable that is suitable for pulling through structural members is marked “JP.”

(16)
(17) Direct buried, where identified for such use

  Informational Note: See 310.15(A)(3) for temperature limitation of conductors.

Statement of Problem and Substantiation for Public Comment

No change to Item 7.
FR 1840 should be reversed. Type TC Cable is limited to installations in cable trays, raceways and outdoor locations supported by a messenger wire, and according to 336.10(7), is only permitted to be exposed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation. Type TC Cable, which is primarily designed for use in cable tray, should not take exception to installation in conduit (or cable tray) for residential installations even with additional joist pull testing.

Related Item
First Revision No. 1840-NFPA 70-2015 [Detail]

Submitter Information Verification
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1808-NFPA 70-2015
Statement:
The revised language will allow generator and associated equipment with terminals rated 75C or greater to be used with TC cable without being limited to 60C.

The revised language will permit TC-ER cable to be used for supplying equipment other than generators in one- and two-family dwelling units.

CMP-7 has reviewed the record per the Correlating Committee’s request and consideration was given to the ballot comments expressed in FR 1840.

The use of the word "identified" is appropriate. The informational note and the marking requirement will trigger a change to the product standard requiring a joist pull test for cable that will be allowed to be marked "JP". Type TC cable is required to be listed.

Type TC cable has a nonmetallic jacket and construction similar to wiring methods commonly found in residential applications, like Types NM, UF and SE. It is unclear why the other types would be allowed for this application and Type TC would not be.

CMP-7 also adds Informational Note 2 to alert users of the separation requirements of Class 2 and 3 conductors from electric light, power or Class 1 circuits.
336.116 Jacket. The outer jacket shall be a flame-retardant, nonmetallic material. 

Informational Note: The requirements associated with the term flame retardant for each type of cable or insulation are contained within the product standard for the relevant cable or insulation. (See also 310.104).

Statement of Problem and Substantiation for Public Comment

The panel stated that the testing requirements are not needed for this article. The informational note proposed is being revised to explain that information on the term “flame retardant” is contained in the product standard. This is important because the term “flame retardant” as such is not an appropriate term without clarification because the term flame retardant simply refers to the additives that are used to improve fire performance, unless the fire performance is clarified.

Related Item
Public Input No. 2489-NFPA 70-2014 [Section No. 336.116]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler  
Organization: GBH International  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Tue Sep 22 15:50:38 EDT 2015

Committee Statement

Committee Action: Rejected  
Resolution: An informational note about flame retardant is not needed since this is covered in the product listing.
(4) Installation Methods for Branch Circuits and Feeders.

(a) **Interior Installations.** In addition to the provisions of this article, Type SE service-entrance cable used for interior wiring shall comply with the installation requirements of Part II of Article 334, excluding 334.80. Type SE cable with ungrounded conductor sizes 10 AWG and smaller, where Type SE cable is installed in thermal insulation, the ampacity shall be in accordance with 60°C (140°F) conductor temperature rating. The maximum conductor temperature rating shall be permitted to be used for ampacity adjustment and correction purposes, if the final derated ampacity does not exceed that for a 60°C (140°F) rated conductor.

   **Informational Note No. 1:** See 310.15(A)(3) for temperature limitation of conductors.

   **Informational Note No. 2:** For the installation of main power feeder conductors in dwelling units refer to 310.15(B)(7).

(b) **Exterior Installations.** In addition to the provisions of this article, service-entrance cable used for feeders or branch circuits, where installed as exterior wiring, shall be installed in accordance with Part I of Article 225. The cable shall be supported in accordance with 334.30. Type USE cable installed as underground feeder and branch circuit cable shall comply with Part II of Article 340.

   **Exception:** Single-conductor Type USE and multi-rated USE conductors shall not be subject to the ampacity limitations of Part II of Article 340.

**Statement of Problem and Substantiation for Public Comment**

I would ask the panel to reconsider their acceptance of this new language. As stated my one panel member there (as of this date) remains no technical documentation to support that Type SE Cable installed as an interior wiring method is not susceptible to thermal damage within its loading range when installed within thermal insulation. This was argued to exhaustion during the 2011 renewal cycle. As a user of the code and a student of the related science of our industry it is beyond my comprehension that a conductor sized larger than No. 10 AWG will not experience an increased $I^2R$ loss than the smaller cables. Also the comment that smaller Type NM Cables in the parent PI 1828 and reference to 334.80 is a stretch. 334.80 governs all Type NM cables which may contain conductor sizes up to No. 2 AWG (155 A Cu 90A AL). The compromise to exclude the reference to 334.80 during the 2011 cycle with the requirement to limit its ampacity to the 60 degree column when installed in insulation was somewhat given the lack of interest in independent testing.

**Committee Statement**

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<th>Committee Action:</th>
<th>Rejected</th>
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<tr>
<td>Resolution:</td>
<td>The submitter has not provided technical substantiation to make the change. Panel 7 is still open to revisions based on future testing of SE cable installed in thermal insulation. CMP-7 is again requesting that the NFPA Fire Protection Research Foundation study the effects of SE cable installed in thermal insulation.</td>
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(4) Installation Methods for Branch Circuits and Feeders.

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Informational Note No. 1: See 310.15(A)(3) for temperature limitation of conductors.

Informational Note No. 2: For the installation of main power feeder conductors in dwelling units refer to 310.15(B)(7).

(b) Exterior Installations. In addition to the provisions of this article, service-entrance cable used for feeders or branch circuits, where installed as exterior wiring, shall be installed in accordance with Part I of Article 225. The cable shall be supported in accordance with 334.30. Type USE cable installed as underground feeder and branch circuit cable shall comply with Part II of Article 340.

Exception: Single-conductor Type USE and multi-rated USE conductors shall not be subject to the ampacity limitations of Part II of Article 340.

Statement of Problem and Substantiation for Public Comment

The submitter has not provided a Fact Finding or other substantiation that #10 and larger conductors should be exempted from the requirements of this Section. There is no substantiation provided that larger SE cables behave differently than other types. There has been at least one published failure of SE cable in thermal insulation that failed and almost caused a fire. It is unlikely that there would be reporting of failures since no reporting is required.

Related Item
First Revision No. 1828-NFPA 70-2015 [Section No. 338.10(B)(4)]

Submitter Information Verification

Submitter Full Name: David Brender
Organization: Copper Development Association
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 18:30:15 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter has not provided technical substantiation to make the change. Panel 7 is still open to revisions based on future testing of SE cable installed in thermal insulation. CMP-7 is again requesting that the NFPA Fire Protection Research Foundation study the effects of SE cable installed in thermal insulation.
(4) Installation Methods for Branch Circuits and Feeders.

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Exception: Single-conductor Type USE and multi-rated USE conductors shall not be subject to the ampacity limitations of Part II of Article 340.

Statement of Problem and Substantiation for Public Comment

No change to informational notes.

FR 1828 should be reversed. No technical substantiation was provided to exempt larger sized Type SE cable from the ampacity requirements of 334.80 where the cable is installed in thermal insulation. Exemption of the ampacity requirement based on the size of the conductors is not technically substantiated. The Panel has requested technical support for several code cycles showing that Type SE cable behaves differently from NM or UF cable when installed in thermal insulation, but no such information has been provided. Revision based on size does not address the concern for overheating where larger sized cables are installed in thermal insulation.

Related Item

First Revision No. 1828-NFPA 70-2015 [Section No. 338.10(B)(4)]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 10:25:43 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter has not provided technical substantiation to make the change. Panel 7 is still open to revisions based on future testing of SE cable installed in thermal insulation. CMP-7 is again requesting that the NFPA Fire Protection Research Foundation study the effects of SE cable installed in thermal insulation.
Public Comment No. 1128-NFPA 70-2015 [Section No. 340.6]

340.6 Listing Requirements.
Type UF cable and associated fittings shall be listed and labeled.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant, the manufacturer has the option of removing the mark from the product with the mark, or holding the shipment and bringing the product into compliance. In either case the “listing” is impacted, as the “listing” is created at the time of the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
First Revision No. 1829-NFPA 70-2015 [Section No. 340.6]
Public Input No. 887-NFPA 70-2014 [Section No. 340.6]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
Committee Statement

Committee Action: Accepted
Resolution: SR-1812-NFPA 70-2015
Statement: CMP-7 adds "and labeled" to provide information to the AHJ regarding the suitability of equipment they encounter.
340.116 Sheath.

The overall covering shall be flame retardant; moisture, fungus, and corrosion resistant; and suitable for direct burial in the earth.

Informational Note: The requirements associated with the term flame retardant for each type of cable or insulation are contained within the product standard for the relevant cable or insulation. (See also 310.104).

Statement of Problem and Substantiation for Public Comment

The panel stated that the testing requirements are not needed for this article. The informational note proposed is being revised to explain that information on the term "flame retardant" is contained in the product standard. This is important because the term "flame retardant" as such is not an appropriate term without clarification because the term flame retardant simply refers to the additives that are used to improve fire performance, unless the fire performance is clarified.

Related Item

Public Input No. 2493-NFPA 70-2014 [Section No. 340.116]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 15:55:56 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: An informational note about flame retardant is not needed since this is covered in the product listing.
**Public Comment No. 1130-NFPA 70-2015 [Section No. 342.6]**

342.6 Listing Requirements.
IMC, factory elbows and couplings, and associated fittings shall be listed and labeled.

**Additional Proposed Changes**

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**Statement of Problem and Substantiation for Public Comment**

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Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

**Related Public Comments for This Document**

<table>
<thead>
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<th>Related Comment</th>
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<tbody>
<tr>
<td>Public Comment No. 532-NFPA 70-2015</td>
<td>Addresses concern that some listed products are marked or require markings on the smallest shipping package.</td>
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**Submitter Information Verification**

N National Fire Protection Association Report http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
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<td><strong>Action</strong></td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
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**344.6 Listing Requirements.**
RMC, factory elbows and couplings, and associated fittings shall be listed and labeled.

**Additional Proposed Changes**

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**Statement of Problem and Substantiation for Public Comment**

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The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

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**Related Public Comments for This Document**

- **Related Comment**
  - Public Comment No. 532-NFPA 70-2015 [Definition: Labeled.]
  - Addresses concern that some listed products are marked or require markings on the smallest shipping package.

- **Related Item**
  - First Revision No. 2133-NFPA 70-2015 [Section No. 344.6]
  - Public Input No. 889-NFPA 70-2014 [Section No. 344.6]
  - Public Input No. 1072-NFPA 70-2014 [Definition: Labeled.]

**Submitter Information Verification**
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<td>Committee Action:  Rejected</td>
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<td>Resolution:  The Correlating Committee has appointed a Task Group to address the “Listed and Labeled” Public Inputs for the 2020 NEC. This issue needs correlation throughout the Code so that there is consistency. The use of a Task Group to achieve this is necessary. It is acceptable to wait for the 2020 NEC to properly address and correlate this issue since a safety hazard has not been identified in the substantiations of either the Public Input or Comment pertaining to conduit, tubings and fittings. CMP-8 cannot accept “and labeled” until the definition of “Labeled” is addressed by the Task Group.</td>
</tr>
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</table>

Submittal Date: Wed Sep 23 21:06:28 EDT 2015
Public Comment No. 1132-NFPA 70-2015 [Section No. 348.6]

348.6 Listing Requirements.
FMC and associated fittings shall be listed and labeled.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

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Related Item

First Revision No. 2165-NFPA 70-2015 [Section No. 348.6]
Public Input No. 890-NFPA 70-2014 [Section No. 348.6]
Public Input No. 1072-NFPA 70-2014 [Definition: Labeled.]

Submitter Information Verification
Committee Statement

Committee Action: Rejected

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Public Comment No. 1204-NFPA 70-2015 [Section No. 350.6]

350.6 Listing Requirements.
LFMC and associated fittings shall be listed and labeled.

Additional Proposed Changes

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Submitter Information Verification

777 of 2282 11/19/2015 12:04 PM
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Public Comment No. 1205-NFPA 70-2015 [Section No. 352.6]

352.6 Listing Requirements.

PVC conduit, factory elbows, and associated fittings shall be listed and labeled.

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Submitter Information Verification

National Fire Protection Association Report
Committee Statement

Committee Action: Rejected

Resolution: The Correlating Committee has appointed a Task Group to address the “Listed and Labeled” Public Inputs for the 2020 NEC. This issue needs correlation throughout the Code so that there is consistency. The use of a Task Group to achieve this is necessary. It is acceptable to wait for the 2020 NEC to properly address and correlate this issue since a safety hazard has not been identified in the substantiations of either the Public Input or Comment pertaining to conduit, tubings and fittings. CMP-8 cannot accept “and labeled” until the definition of “Labeled” is addressed by the Task Group.
Add Exception

Exception: When PVC conduits are directly buried or are encased in an underground ductbank, Type MV-105 rated cables shall be permitted to be installed in PVC ducts rated 90C.

Statement of Problem and Substantiation for Public Comment

MV-105 rated cables and utility medium voltage (non-UI) cables rated 105C are often installed in underground ducts and operated with a 105C conductor temperature. The outer jacket of cables operating with a 105C conductor temperature is at 90C. Thus the section of the cable that is contact with the duct is only at 90C which is within the ducts rating. 1000 volt rated cables that operate are rated 90C have an insulation temperature of 90C since the insulation is much thinner and results in little if any temperature drop across the insulation wall.

The UL standard cited by the panel does not take the temperature differential drop across the insulation of medium voltage cables. The acceptance of this proposal would motivate conduit manufacturers to pursue a 105C rating.

A similar proposal will be made to change Section 353.10(6).

Since the NEC voted to accept 105C rated cables in the 1990's, the NEC should permit them to be installed in an NM duct without an ampacity penalty and the associated confusion.

Related Item

Public Input No. 3551-NFPA 70-2014 [New Section after 352.10(I)]

Submitter Information Verification

Submitter Full Name: Joseph Zimnoch
Organization: The Okonite Company
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 15:11:56 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter has not provided adequate technical justification to revise the requirement.
Public Comment No. 1206-NFPA 70-2015 [Section No. 353.6]

Listing Requirements.
HDPE conduit and associated fittings shall be listed and labeled.

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| Public Input No. 893-NFPA 70-2014 [Section No. 353.6] | |
| Public Input No. 1072-NFPA 70-2014 [Definition: Labeled.] | |
| First Revision No. 2108-NFPA 70-2015 [Section No. 353.6] | |

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Public Comment No. 1207-NFPA 70-2015 [Section No. 354.6]

354.6 Listing Requirements.
    NUCC and associated fittings shall be listed and labeled.

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Committee Action: Rejected

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Public Comment No. 533-NFPA 70-2015 [Section No. 355.6]

355.6  Listing Requirements.
RTRC, factory elbows, and associated fittings shall be listed and labeled.

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Related Item

- Public Input No. 895-NFPA 70-2014 [Section No. 355.6]
- Public Input No. 1072-NFPA 70-2014 [Definition: Labeled]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
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| Submittal Date: Thu Sep 03 21:12:07 EDT 2015 |

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
Public Comment No. 1212-NFPA 70-2015 [Section No. 356.6]

356.6 Listing Requirements.
LFNC and associated fittings shall be listed and labeled.

Additional Proposed Changes

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Submitter Information Verification
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**Committee Action:** Rejected

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358.6 Listing Requirements.
EMT, factory elbows, and associated fittings shall be listed and labeled.

Additional Proposed Changes

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Submitter Information Verification

790 of 2282
Committee Statement

Committee Action: Rejected

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### Public Comment No. 445-NFPA 70-2015 [Section No. 358.10(A)]

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<td>The use of EMT shall be permitted for both exposed and concealed work for the following:</td>
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<td>1) In concrete, in direct contact with the earth or in areas subject to severe corrosive influences where installed in accordance with 358.10(B)</td>
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<td>2) In dry, damp, and wet locations</td>
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<td>3) In any hazardous (classified) location as permitted by other articles in this Code</td>
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### Statement of Problem and Substantiation for Public Comment

The NEC should continue to allow EMT exposed in dry or damp locations.

**Related Item**

First Revision No. 2144-NFPA 70-2015 [Section No. 358.10]

### Submitter Information Verification

**Submitter Full Name:** MIKE HOLT  
**Organization:** MIKE HOLT ENTERPRISES INC  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Thu Aug 27 16:03:32 EDT 2015

### Committee Statement

**Committee Action:** Accepted  
**Resolution:** SR-2102-NFPA 70-2015  
**Statement:** This revision to the first draft text second revision clarifies that EMT shall be permitted for both exposed and concealed work in dry, damp and wet locations.
358.12  Uses Not Permitted.

EMT shall not be used under the following conditions:

(1) Where subject to severe physical damage

(2) For the support of luminaires or other equipment except conduit bodies no larger than the largest trade size of the tubing

Exception: Aluminum fittings and enclosures shall be permitted to be used with steel EMT where not subject to severe corrosive influences.

Statement of Problem and Substantiation for Public Comment

All references to dissimilar metals have been moved to section 358.14 therefore this exception does not belong under 358.12 and should be deleted. The exception does not have to be moved to 358.14 as the intent of the exception has been included in the wording for the new section 358.14 Dissimilar Metals.

Committee Statement

Committee Action: Accepted
Resolution: SR-2103-NFPA 70-2015
Statement: As a first revision to Article 358, all references to dissimilar metals were moved to section 358.14, Dissimilar Metals. The content of the exception to 358.12 was included in the wording of 358.14 as part of that revision. Therefore, the exception to 358.12 is no longer necessary and can be deleted.
Public Comment No. 781-NFPA 70-2015 [Section No. 358.30(A)]

(A) Securely Fastened.

EMT shall be securely fastened in place at least every 3 m (10 ft). In addition, each EMT run between termination points shall be securely fastened within 900 mm (3 ft) of each outlet box, junction box, device box, cabinet, conduit body, or other tubing termination.

Exception No. 1: Fastening of unbroken lengths shall be permitted to be increased to a distance of 1.5 m (5 ft) where structural members do not readily permit fastening within 900 mm (3 ft) of the outlet box, junction box, device box, cabinet, conduit body, or other tubing termination.

Exception No. 2: For concealed work in finished buildings or prefinished wall panels where such securing is impracticable, unbroken lengths (without coupling) of EMT shall be permitted to be fished.

Statement of Problem and Substantiation for Public Comment

To avoid confusion and misinterpretations, and improve readability of the Code.

“Securely fastened in place AT LEAST EVERY 3 m (10 ft)” is the same as saying “securely fastened in place NO LESS THAN EVERY 3 m (10 ft)”. Effectively, EMT in an installation could be secured every 30 m (100 ft) and the installation would be in compliance with this misworded requirement. In reality, “at least” should be “at most”.

Elsewhere in Chapter 3, CMP-8 has chosen to use the unequivocal words “at intervals not to exceed” where similar minimum securement requirements appear.

Related Item
Public Input No. 2150-NFPA 70-2014 [Section No. 358.30(A)]

Submitter Information Verification

Submitter Full Name: Brian Rock
Organization: Hubbell Incorporated
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 11:57:34 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2104-NFPA 70-2015
Statement: This revision clarifies the code requirement for maximum allowable securement of EMT at 3 m (10 ft) and drives consistency within the code by implementing text already employed in other Articles within NFPA 70, e.g. Articles 348, 350, 368, 376, 378 and 394.

Elsewhere in Chapter 3, CMP-8 has chosen to use the unequivocal words “at intervals not to exceed” where similar minimum securement requirements appear.
360.6  Listing Requirements.
FMT and associated fittings shall be listed and labeled.

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Submitter Information Verification
Submittal Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 13:31:28 EDT 2015

Committee Statement
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362.6 Listing Requirements.
ENT and associated fittings shall be listed and labeled.

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Public Comment No. 213-NFPA 70-2015 [New Section after 368.320]

Add New Article 369- Metal-Enclosed Bus Duct

Additional Proposed Changes

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<th>File Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Article_369.docx</td>
<td>Proposed New Article 369</td>
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Statement of Problem and Substantiation for Public Comment

The committee responded to PI-1408 with the following explanation:

"The installation requirements of the proposed article are already adequately addressed in Article 368, Parts I-IV. Busways are available in a wide range of constructions and are suitable for use in many applications including in service entrance, feeder, and branch circuits. While busways are generally designed and built in accordance with various standards, including UL857 and IEEE C37.23, it is not CMP-8’s intention to include dimensional information found in product standards, such as conductor sizes, in this installation code. No substantiation was presented to allow bus systems in areas where subject to physical damage. While CMP-8 recognizes that some busway systems are designed and marked for support spans of 12 feet or even more, there is no substantiation provided to increase the default support span from 5 feet to 12 feet. The present requirements in Article 368 are clear and adequate. The submitter has not provided evidence that a safety issue exists that would warrant the additional code language."

This isn’t necessarily a safety issue as much as it is a proposal to address a product that doesn't match the text presently in Art. 368. Busways are normally considered in the petrochemical industry to be the small to medium sized modular systems that can be installed in manufacturing facilities where there are plug on disconnects and taps to equipment. And, according to 368.17(A) overcurrent protection would need to be provided to protect the busway. The new article I've proposed would allow transformer secondary side bus duct to be installed without overcurrent protection per Art. 368, but in accordance with Section 240.21. Also, Art. 368 for example doesn't provide information such as the proposed definitions for segregated and non-seg bus ducts. I’d like to request the Panel reconsider and create new Art. 369. Or, at least accept parts of the proposed text that would make Art. 368 applicable to large metal enclosed bus ducts.

I'm not passionate about the 12ft. spacing on the bus duct. Section 368.30 allows bus duct designed for spans more than 5ft. to be installed.

I would like to respectfully request the Chair appoint a small task group to take a hard look at this issue before voting on the resolution.

Related Item

Public Input No. 1408-NFPA 70-2014 [New Section after 368.320]

Submitter Information Verification

Submitter Full Name: PAUL GUIDRY
Organization: FLUOR ENTERPRISES INC
Affiliation: Associated Builders and Contractors, Inc.
Street Address: City: State: Zip:
Submittal Date: Mon Jul 13 14:14:13 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CMP8 reaffirms the action and statement associated with NFPA 70 Public Input No.1408. The present definition in 368.2 does not exclude the "Metal-enclosed bus duct" constructions that the submitter wishes to add. While the construction types that the submitter wishes to define appear in the IEEE C37.23 product standard, they do not appear in this Code nor do they appear in the proposed "Metal-enclosed bus duct" Article and as such inclusion of the definitions is not appropriate per the NEC Style Manual section 2.2.2.1. The panel recognizes that busways are presently used in transformer secondary conductor applications. Exception No. 1 of 368.17(C) explains that overcurrent protection in such feeder applications may be as outlined in 240.21. The language in 368.1 is general and not intended to define the uses permitted and uses not permitted for busway, which can be found in 368.10 and 368.12, respectively.
Public Comment No. 316-NFPA 70-2015 [ New Section after 368.320 ]

**Article 369- Metal Enclosed Bus Duct**

Please see attached comment, revised per committee PI comments.

### Additional Proposed Changes

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<td>This PI was revised to address PI committee response.</td>
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### Statement of Problem and Substantiation for Public Comment

Contrary to the panel statement provided during the Public Input stage, major manufacturer's of metal enclosed bus duct do not consider their product to be busways. This comment offers new information that I believe needs to be included in the NEC. Among the new material, it includes definitions not currently found in the NEC and also allows the bus duct to be used in the manner that it is today such as for transformer secondary conductors. Section 368.1 doesn't allow busways to be utilized for transformer secondaries. I respectfully ask the committee to reconsider their decision based on this revised comment. This material wouldn't change anything that isn't being done today. It would simply plug a hole in the NEC.

**Related Item**

**Public Input No. 1408-NFPA 70-2014 [New Section after 368.320]**

### Submitter Information Verification

- **Submitter Full Name:** PAUL GUIDRY
- **Organization:** FLUOR ENTERPRISES INC
- **Affiliation:** Associated Builders and Contractors
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Wed Jul 29 07:15:40 EDT 2015

### Committee Statement

**Committee Action:** Rejected

**Resolution:** CMP8 is unable to identify any new information provided with this public comment. CMP8 reaffirms the action and statement associated with NFPA 70 Public Input No.1408. The panel recognizes that busways are presently used in transformer secondary conductor applications. Exception No. 1 of 368.17(C) explains that overcurrent protection in such feeder applications may be as outlined in 240.21. The language in 368.1 is general and not intended to define the uses permitted and uses not permitted for busway, which can be found in 368.10 and 368.12, respectively.
370.80 Ampacity of Conductors.

(A) The ampacity of conductors in cablebus shall be in accordance with Table 310.15(B)(17) and Table 310.15(B)(19) for installations up to and including 2000 volts, or with Table 310.60(C)(69) and Table 310.60(C)(70) for installations 2001 to 35,000 volts.

(B) Ampacity of Cables, Rated 2000 Volts or Less, in Cablebus that terminate at equipment with conductor temperature limitations.

(1) Single-Conductor Cables. The allowable ampacity of single-conductor cables shall be as permitted by 310.15(A)(2). The adjustment factors of 310.15(B)(3)(a) shall not apply to the ampacity of cables in cablebus. The ampacity of single conductor cables nominally rated 2000 volts or less, shall comply with the following:

(a) Where installed according to the requirements of 370.30, the ampacities for 600 kcmil and larger single conductor cables in ventilated cablebus shall not exceed 75 percent of the allowable ampacities in Table 310.15(B)(17) and Table 310.15(B)(19). Where cablebus are continuously covered for more than 1.8 m (6 ft) with solid unventilated covers, the ampacities for 600 kcmil and larger cables shall not exceed 70 percent of the allowable ampacities in Table 310.15(B)(17) and Table 310.15(B)(19).

(b) Where installed according to the requirements of 370.30, the ampacities for 1/0 AWG through 500 kcmil single-conductor cables in ventilated cablebus shall not exceed 65 percent of the allowable ampacities in Table 310.15(B)(17) and Table 310.15(B)(19). Where cablebus are continuously covered for more than 1.8 m (6 ft) with solid unventilated covers, the ampacities for 1/0 AWG through 500 kcmil cables shall not exceed 60 percent of the allowable ampacities in Table 310.15(B)(17) and Table 310.15(B)(19).

(C) Ampacity of Type MV and Type MC Cables (2001 Volts or Over) in Cablebus. The ampacity of cables, rated 2001 volts, nominal, or over, installed according to 392.22(C) shall not exceed the requirements of this section.

(1) Single-Conductor Cables (2001 Volts or Over). The ampacity of single-conductor cables shall comply with the following:

(a) The ampacities for 1/0 AWG and larger single-conductor cables in ventilated cablebus shall not exceed 75 percent of the allowable ampacities in Table 310.60(C)(69) and Table 310.60(C)(70). Where the cablebus are covered for more than 1.8 m (6 ft) with solid unventilated covers, the ampacities for 1/0 AWG and larger single-conductor cables shall not exceed 70 percent of the allowable ampacities in Table 310.60(C)(69) and Table 310.60(C)(70).

Informational Note No. 1: See 110.14(C) for conductor temperature limitations due to termination provisions for installations up to and including 2000 volts.

Informational Note No. 2: See 110.40 for conductor temperature limitations due to termination provisions for installations 2001 to 35,000 volts.

Statement of Problem and Substantiation for Public Comment

The committee statement did address the proposal regarding the informational notes but does not appear to address the inconsistency between cablebus allowable ampacities and the allowable ampacities for cables in cable tray. I am asking the committee to reconsider this proposal intended to align cablebus allowable ampacities with the similar installation requirements in Article 392.80.

Related Item

Public Input No. 1593-NFPA 70-2014 [Section No. 370.80]

Submitter Information Verification

Submitter Full Name: Stephen Douglas
Organization: QPS Evaluation Services Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 10:47:24 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
<table>
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<th>Resolution:</th>
<th>SR-2110-NFPA 70-2015</th>
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<tr>
<td>Statement:</td>
<td>This Second Revision provides references to clarify the allowable ampacities for cables incorporated into cablebus assemblies and aligns ampacities with cable tray installations.</td>
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</table>
Article 372  Cellular Concrete Floor Raceways

372.1  Scope.
This article covers cellular concrete floor raceways, the hollow spaces in floors constructed of precast cellular concrete slabs, together with suitable metal fittings designed to provide access to the floor cells.

372.2  Definitions.
Cell.
A single, enclosed tubular space in a floor made of precast cellular concrete slabs, the direction of the cell being parallel to the direction of the floor member.

Header.
Transverse metal raceways for electrical conductors, providing access to predetermined cells of a precast cellular concrete floor, thereby permitting the installation of electrical conductors from a distribution center to the floor cells.

II Installations

372.4  Uses Not Permitted.
Conductors shall not be installed in precast cellular concrete floor raceways as follows:
(1) Where subject to corrosive vapor
(2) In any hazardous (classified) location, except as permitted by other articles in this Code
(3) In commercial garages, other than for supplying ceiling outlets or extensions to the area below the floor but not above

Informational Note: See 300.8 for installation of conductors with other systems.

372.5  Cellular Concrete Floor Raceways Installation.

(A) Header.
The header shall be installed in a straight line at right angles to the cells. The header shall be mechanically secured to the top of the precast cellular concrete floor. The end joints shall be closed by a metal closure fitting and sealed against the entrance of concrete. The header shall be electrically continuous throughout its entire length and shall be electrically bonded to the enclosure of the distribution center.

(B) Connection to Cabinets and Other Enclosures.
Connections from headers to cabinets and other enclosures shall be made by means of listed metal raceways and listed fittings.

(C) Junction Boxes.
Junction boxes shall be leveled to the floor grade and sealed against the free entrance of water or concrete. Junction boxes shall be of metal and shall be mechanically and electrically continuous with the header.

(D) Markers.
A suitable number of markers shall be installed for the future location of cells.

(E) Inserts.
Inserts shall be leveled and sealed against the entrance of concrete. Inserts shall be of metal and shall be fitted with grounded-type receptacles. A grounding conductor shall connect the insert receptacles to a positive ground connection provided on the header. Where cutting through the cell wall for setting inserts or other purposes (such as providing access openings between header and cells), chips and other dirt shall not be allowed to remain in the raceway, and the tool used shall be designed so as to prevent the tool from entering the cell and damaging the conductors.

(E) Markers.  A suitable number of markers shall be installed for the future location of cells.

372.10  Size of Conductors.
No conductor larger than 1/0 AWG shall be installed, except by special permission.
372.11 - Maximum Number of Conductors.

The combined cross-sectional area of all conductors or cables shall not exceed 40 percent of the cross-sectional area of the cell or header.

372.12 - Ampacity of Conductors.

The ampacity adjustment factors, provided in 310.15(B)(3), shall apply to conductors installed in cellular concrete floor raceways.

372.56 - Splices and Taps.

Splices and taps shall be made only in header access units or junction boxes. A continuous unbroken conductor connecting the individual outlets is not a splice or tap.

372.13 - Discontinued Outlets.

When an outlet is abandoned, discontinued, or removed, the sections of circuit conductors supplying the outlet shall be removed from the raceway. No splices or reinsulated conductors, such as would be the case of abandoned outlets on loop wiring, shall be allowed in raceways.

372.17 - Ampacity of Conductors.

The ampacity adjustment factors, provided in 310.15(B)(3), shall apply to conductors installed in cellular concrete floor raceways.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

Reconsider Resolved Public Input #802 and revise Article 372. Common numbering of the sections within each of the raceway articles is considered to be beneficial and preferable. Per CMP-8 Resolution Statement, this Public Comment not only renumbers Section 372.4 for uses not permitted to 372.12 as proposed in Public Input #802, but renumbers the complete Article to align with the raceway numbering format. No text or requirements were revised.

Related Item

Public Input No. 802-NFPA 70-2014 [Section No. 372.4]

Submitter Information Verification

Submitter Full Name: DAVID KENDALL
Organization: THOMAS BETTS CORPORATION
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Aug 20 11:39:37 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-2105-NFPA 70-2015
Statement: Common numbering of the sections within each of the raceway articles is considered to be beneficial and preferable. Per CMP-8 Resolution Statement, this Public Comment not only renumbers Section 372.4 for uses not permitted to 372.12 as proposed in Public Input #802, but renumbers the complete Article to align with the raceway numbering format. No text or requirements were revised.
See attached proposed Changes

**Article 374** Cellular Metal Floor Raceways

**Part I. General**

374.1 Scope.

This article covers the use and installation requirements for cellular metal floor raceways.

374.2 Definitions.

**Cellular Metal Floor Raceway.**

The hollow spaces of cellular metal floors, together with suitable fittings, that may be approved as enclosed channel for electrical conductors.

**Cell.**

A single enclosed tubular space in a cellular metal floor member, the axis of the cell being parallel to the axis of the metal floor member.

**Header.**

A transverse raceway for electrical conductors, providing access to predetermined cells of a cellular metal floor, thereby permitting the installation of electrical conductors from a distribution center to the cells.

**Part II. Installation**

374.312 Uses Not Permitted.

Conductors shall not be installed in cellular metal floor raceways as follows:

1. Where subject to corrosive vapor
2. In any hazardous (classified) location, except as permitted by other articles in this Code
3. In commercial garages, other than for supplying ceiling outlets or extensions to the area below the floor but not above

Informational Note: See 300.8 for installation of conductors with other systems.

374.4 Size of Conductors.

No conductor larger than 1/0 AWG shall be installed, except by special permission.

374.5 Maximum Number of Conductors in Raceway.

The combined cross-sectional area of all conductors or cables shall not exceed 40 percent of the interior cross-sectional area of the cell or header.

374.6 Splices and Taps.

Splices and taps shall be made only in header access units or junction boxes.

For the purposes of this section, so-called loop wiring (continuous unbroken conductor connecting the individual outlets) shall not be considered to be a splice or tap.

374.7 Discontinued Outlets.

When an outlet is abandoned, discontinued, or removed, the sections of circuit conductors supplying the outlet shall be removed from the raceway. No splices or reinsulated conductors, such as would be the case with abandoned outlets on loop wiring, shall be allowed in raceways.

374.8 Markers.

A suitable number of markers shall be installed for locating cells in the future.

374.9 Junction Boxes.

374.18 Cellular Metal Floor Raceways Installations.

Cellular Metal Floor Raceways installations shall comply with 374.18(A) through (D).

374.11 (A) Connection to Cabinets and Extensions from Cells.

Connections between raceways and distribution centers and wall outlets shall be made by means of liquidtight flexible metal conduit, flexible metal conduit where not installed in concrete, rigid metal conduit, intermediate metal conduit, electrical metallic tubing, or approved fittings. Where there are provisions for the termination of an equipment grounding conductor, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, electrical nonmetallic tubing, or liquidtight flexible nonmetallic conduit shall be permitted. Where installed in concrete, liquidtight flexible metal conduit and liquidtight flexible nonmetallic conduit shall be listed and marked for direct burial.

374.9 (B) Junction Boxes.

Junction boxes shall be leveled to the floor grade and sealed against the free entrance of water.
or concrete. Junction boxes used with these raceways shall be of metal and shall be electrically continuous with the raceway.

374.

10. (C) Inserts.

Inserts shall be leveled to the floor grade and sealed against the entrance of concrete. Inserts shall be of metal and shall be electrically continuous with the raceway. In cutting through the cell wall and setting inserts, chips and other dirt shall not be allowed to remain in the raceway, and tools shall be used that are designed to prevent the tool from entering the cell and damaging the conductors.

374.

11. Connection to Cabinets and Extensions from Cells.

Connections between raceways and distribution centers and wall outlets shall be made by means of liquidtight flexible metal conduit, flexible metal conduit where not installed in concrete, rigid metal conduit, intermediate metal conduit, electrical metallic tubing, or approved fittings. Where there are provisions for the termination of an equipment grounding conductor, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, electrical nonmetallic tubing, or liquidtight flexible nonmetallic conduit shall be permitted. Where installed in concrete, liquidtight flexible metal conduit and liquidtight flexible nonmetallic conduit shall be listed and marked for direct burial.

374.17. Ampacity of Conductors.

8. (D) Markers. A suitable number of markers shall be installed for locating cells in the future.

374.20. Size of Conductors. No conductor larger than 1/0 AWG shall be installed, except by special permission.

374.22. Maximum Number of Conductors in Raceway.

The combined cross-sectional area of all conductors or cables shall not exceed 40 percent of the interior cross-sectional area of the cell or header.

374.23. Ampacity of Conductors. The ampacity adjustment factors in 310.15(B)(3) shall apply to conductors installed in cellular metal floor raceways.

Part III.

374.56. Splices and Taps. Splices and taps shall be made only in header access units or junction boxes.

For the purposes of this section, so-called loop wiring (continuous unbroken conductor connecting the individual outlets) shall not be considered to be a splice or tap.

374.58. Discontinued Outlets. When an outlet is abandoned, discontinued, or removed, the sections of circuit conductors supplying the outlet shall be removed from the raceway. No splices or reinsulated conductors, such as would be the case with abandoned outlets on loop wiring, shall be allowed in raceways.

II. III. Construction Specifications

374.

100. General.

Cellular metal floor raceways shall be constructed so that adequate electrical and mechanical continuity of the complete system will be secured. They shall provide a complete enclosure for the conductors. The interior surfaces shall be free from burrs and sharp edges, and surfaces over which conductors are drawn shall be smooth. Suitable bushings or fittings having smooth rounded edges shall be provided where conductors pass.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

Reconsider Resolved Public Input #803 and revise Article 374. Common numbering of the sections within each of the raceway articles is considered to be beneficial and preferable. Per CMP-8 Resolution Statement, this Public Comment not only renumbers Section 374.3 for uses not permitted to 374.12 as proposed in Public Input #803, but renumbers the complete Article to align with the raceway numbering format. No text or requirements were revised.

Related Item

Public Input No. 803-NFPA 70-2014 [Section No. 374.3]

Submitter Information Verification

Submitter Full Name: DAVID KENDALL
Organization: THOMAS BETTS CORPORATION
Street Address:
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**Submittal Date:** Thu Aug 20 12:06:10 EDT 2015

**Committee Statement**

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<tr>
<td>Accepted</td>
<td>SR-2106-NFPA 70-2015</td>
<td>Common numbering of the sections within each of the raceway articles is considered to be beneficial and preferable. Per CMP-8 Resolution Statement, this Public Comment not only renumbers Section 374.3 for uses not permitted to 374.12 as proposed in Public Input #803, but renumbers the complete Article to align with the raceway numbering format. No text or requirements were revised.</td>
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</tbody>
</table>
374.3  Uses Not Permitted.
Conductors shall not be installed in cellular metal floor raceways as follows:

1. Where subject to corrosive vapor
2. In any hazardous (classified) location, except as permitted by other articles in this Code
3. In commercial garages, other than for supplying ceiling outlets or extensions to the area below the floor but not above

Informational Note: See 300.8 for installation of conductors with other systems.

Additional Proposed Changes

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<td>Article_374_PI_803.docx</td>
<td>David Kendall PC</td>
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</table>

Statement of Problem and Substantiation for Public Comment

This PI should have been a First Revision; this will make the NEC more users friendly by following an already established pattern that the .12 section of an article is uses permitted. This will also follow 2.4.1 of the NEC style manual. The committee statement; "Common numbering of the sections within each of the raceway articles is considered to be beneficial and preferable. However, renumbering of Section 374.3 for uses not permitted should be completed as part of a complete renumbering of Article 374." Renumbering is not necessary; there currently is not a .12 section of Article 374.

Support David Kendall's PC to renumber Article 374.3.

Related Item

Public Input No. 803-NFPA 70-2014 [Section No. 374.3]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 03 18:31:41 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The committee agrees that a common numbering method within the raceway articles is beneficial and preferable; however, simply renumbering Section 374.3 as 374.12 would result in the relocation of the “Uses Not Permitted” section after section 374.11 and would not achieve the goal of the commenter of making the Code more user friendly. See the Panel action and statement for PC # 423 which addresses the concerns of the submitter.
Public Comment No. 1223-NFPA 70-2015 [Section No. 376.56(B)(1)]

1) Installation.

Power distribution blocks installed in metal wireways shall be listed and labeled. Power distribution blocks installed on the line side of the service equipment shall be listed and identified for the purpose.

Additional Proposed Changes

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<th>File Name</th>
<th>Description</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2101-NFPA 70-2015
Statement: The Correlating Committee has appointed a Task Group to address the “Listed and Labeled” Public Inputs for the 2020 NEC. This issue needs correlation throughout the Code so that there is consistency. The use of a Task Group to achieve this is necessary. It is acceptable to wait for the 2020 NEC to properly address and correlate this issue since a safety hazard has not been identified in the substantiations of either the Public Input or Comment pertaining to conduit, tubings and fittings.

CMP-8 cannot accept “and labeled” until the definition of “Labeled” is addressed by the Task Group.

Power distribution blocks within metal wireway and used on the line side of the service equipment shall be identified acceptable for the use.
378.6 Listing Requirements.

Nonmetallic wireways and associated fittings shall be listed and labeled.

Additional Proposed Changes

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<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Public Comments for This Document

<table>
<thead>
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<th>Related Comment</th>
<th>Relationship</th>
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<tr>
<td>Public Comment No. 532-NFPA 70-2015 [Definition: Labeled.]</td>
<td>Addressed committee concerns that some listed products are marked or require markings on the smallest shipping package.</td>
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<tbody>
<tr>
<td>Public Input No. 1072-NFPA 70-2014 [Definition: Labeled.]</td>
</tr>
<tr>
<td>Public Input No. 901-NFPA 70-2014 [Section No. 378.6]</td>
</tr>
<tr>
<td>First Revision No. 2105-NFPA 70-2015 [Section No. 378.6]</td>
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</table>
Committee Statement

Committee Action: Rejected

Resolution: The Correlating Committee has appointed a Task Group to address the “Listed and Labeled” Public Inputs for the 2020 NEC. This issue needs correlation throughout the Code so that there is consistency. The use of a Task Group to achieve this is necessary. It is acceptable to wait for the 2020 NEC to properly address and correlate this issue since a safety hazard has not been identified in the substantiations. CMP-8 cannot accept “and labeled” until the definition of “Labeled” is addressed by the Task Group.
382.6 Listing Requirements.
Concealable nonmetallic extensions and associated fittings and devices shall be listed and labeled. The starting/source tap device for the extension shall contain and provide the following protection for all load-side extensions and devices.

(1) Supplementary overcurrent protection
(2) Level of protection equivalent to a Class A GFCI
(3) Level of protection equivalent to a portable GFCI
(4) Line and load-side miswire protection
(5) Provide protection from the effects of arc faults

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
Public Input No. 902-NFPA 70-2014 [Section No. 382.6]
First Revision No. 1834-NFPA 70-2015 [Section No. 382.6]
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<tr>
<td><strong>Submitter Full Name:</strong> JEFFREY FECTEAU</td>
</tr>
<tr>
<td><strong>Organization:</strong> UNDERWRITERS LABORATORIES LLC</td>
</tr>
<tr>
<td><strong>Affiliation:</strong> UL</td>
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<td><strong>Street Address:</strong></td>
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<td><strong>City:</strong></td>
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<td><strong>Submittal Date:</strong> Thu Sep 24 14:21:18 EDT 2015</td>
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<th><strong>Committee Statement</strong></th>
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<td><strong>Committee Action:</strong> Accepted</td>
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<tr>
<td><strong>Resolution:</strong> SR-1813-NFPA 70-2015</td>
</tr>
<tr>
<td><strong>Statement:</strong> CMP-7 adds “and labeled” to provide information to the AHJ regarding the suitability of equipment they encounter.</td>
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Public Comment No. 659-NFPA 70-2015 [Section No. 384.6]

384.6 Listing Requirements.
Strut-type channel raceways, type closure strips — and accessories shall be listed, labeled, and identified for such use.

Statement of Problem and Substantiation for Public Comment

Channel is not considered a listed electrical raceway without the closure strip therefore only the fittings and closure strip will contain the listing mark.

Related Item
First Revision No. 2157-NFPA 70-2015 [Section No. 384.6]

Submitter Information Verification

Submitter Full Name: Raymond Horner
Organization: Allied Tube & Conduit
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 15 12:04:02 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2111-NFPA 70-2015
Statement: Channel is not considered a listed electrical raceway without the closure strip therefore only the fittings and closure strip will contain the listing mark.
386.6 Listing Requirements.
Surface metal raceway and associated fittings shall be listed and labeled.

Additional Proposed Changes

<table>
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<tr>
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Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards. Other NRTL’s have similar requirements.

Related Public Comments for This Document

<table>
<thead>
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<tr>
<td>Public Comment No. 532-NFPA 70-2015 [Definition: Labeled.]</td>
<td>Addressed committee concern that some listed products are marked or require markings on the smallest shipping package.</td>
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<td>Public Input No. 904-NFPA 70-2014 [Section No. 386.6]</td>
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<td>First Revision No. 2161-NFPA 70-2015 [Section No. 386.6]</td>
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Submitter Information Verification
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<tr>
<th>Committee Statement</th>
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<tbody>
<tr>
<td><strong>Committee Action:</strong> Rejected</td>
</tr>
<tr>
<td><strong>Resolution:</strong> The Correlating Committee has appointed a Task Group to address the “Listed and Labeled” Public Inputs for the 2020 NEC. This issue needs correlation throughout the Code so that there is consistency. The use of a Task Group to achieve this is necessary. It is acceptable to wait for the 2020 NEC to properly address and correlate this issue since a safety hazard has not been identified in the substantiations of either the Public Input or Comment pertaining to conduit, tubings and fittings. CMP-8 cannot accept “and labeled” until the definition of “Labeled” is addressed by the Task Group.</td>
</tr>
</tbody>
</table>
388.6 Listing Requirements.
Surface nonmetallic raceway and associated fittings shall be listed and labeled.

**Additional Proposed Changes**

<table>
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**Statement of Problem and Substantiation for Public Comment**

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**Related Public Comments for This Document**

**Related Comment**
Public Comment No. 532-NFPA 70-2015 [Definition: Labeled.]
Addressed committee concern that some listed products are marked or require markings on the smallest shipping package.

**Related Item**
Public Input No. 1072-NFPA 70-2014 [Definition: Labeled.]
Public Input No. 905-NFPA 70-2014 [Section No. 388.6]
First Revision No. 2163-NFPA 70-2015 [Section No. 388.6]
Committee Statement

Committee Action: Rejected

Resolution: The Correlating Committee has appointed a Task Group to address the “Listed and Labeled” Public Inputs for the 2020 NEC. This issue needs correlation throughout the Code so that there is consistency. The use of a Task Group to achieve this is necessary. It is acceptable to wait for the 2020 NEC to properly address and correlate this issue since a safety hazard has not been identified in the substantiations. CMP-8 cannot accept “and labeled” until the definition of “Labeled” is addressed by the Task Group.
392.10(E) Airfield Lighting Cable Tray

In airport establishments, where conditions of maintenance and supervision ensure that only qualified persons, have access, install, or service the cable, airfield lighting cable used in series circuits rated up to 5000 volts and powered by constant current regulators shall be permitted to be installed in cable tray. The cable shall be FAA L-824 Type B or Type C cable.

Informational Note to 392.10(E): Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Additional Proposed Changes

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<tr>
<th>File Name</th>
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<tr>
<td>DSCN1382.JPG</td>
<td>Photo showing L-824 cable routed from top cable tray, through conduit to S-1</td>
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<tr>
<td>L-824_cable_light_base_conduit.pdf</td>
<td>Diagram showing primary cable routing from one light base to the next light base in an airfield lighting series circuit.</td>
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<tr>
<td>Galvanized_steel_light_base.pdf</td>
<td>Galvanized steel light base denoting cable/conduit entry/exit points.</td>
</tr>
<tr>
<td>series_circuit_diagram.jpg</td>
<td>Diagram denoting wiring of an airfield lighting series circuit.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

Primary circuit L-824 cable typically enters one side of the metallic (galvanized steel) light base through a conduit entry point and exits on the opposite side of the light base through a second/different entry (exit) point.

No inductive heating occurs in this application.

Inductive heating has never been a problem in airfield lighting circuits.

Typically both L-824 conductors of the series circuit are routed together in the airfield lighting vault. Therefore no inductive heating within the cable tray would occur.

I respectfully request the CMP re-examine PI-2739 and approve the use of FAA type L-824 cables in cable tray for locations accessible to qualified persons only.

Related Item

Public Input No. 2739-NFPA 70-2014 [New Section after 392.10(D)]

Submitter Information Verification

Submitter Full Name: CARL JOHNSON II
Organization: AVCON INC
Affiliation: none
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Jul 05 16:01:32 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2107-NFPA 70-2015
Statement: The submitter has provided additional information to the CMP, along with substantiation that the proposed installation is in line with the intent of the Code, does not present a safety issue, and is consistent with industry means and methods.

Typically airfield lighting cables of the series circuit are routed together in the airfield lighting vault. Therefore no
inductive heating within the cable tray would occur.

CMP-8 re-examined PI-2739 and recognize the use of other types of cables in cable tray for locations accessible to qualified persons only.
392.10(E) Airfield Lighting Cable Tray

In airport establishments, where conditions of maintenance and supervision ensure that only qualified persons have access, install, or service the cable, airfield lighting cable used in series circuits rated up to 5000 volts and powered by constant current regulators shall be permitted to be installed in cable tray. The cable shall be FAA L-824 Type B or Type C cable.

Informational Note to 392.10(E): Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Statement of Problem and Substantiation for Public Comment

Problem statement:

FAA L-824 cable is not specifically permitted to be installed in cable tray by the NEC. Some authorities having jurisdiction do not see equivalence in permitting MV cables and L-824 cables to be installed in cable tray in locations accessible only to qualified persons.

Substantiation:

FAA L-824 Type C cable has been installed in cable trays within airfield lighting vault buildings that have controlled access to qualified personnel only, in accordance with Article 300.37, for many decades. This is an industry standard practice. With regard to the use of cable trays, single phase inductive heating is not an issue for two reasons. First of all, airfield lighting series circuits are limited to a maximum of 6.6 amperes for new designs and 20 amperes for maintenance of legacy systems that have not been updated to more efficient lighting technologies. Secondly, within airfield lighting vaults both conductors of the series circuit (feed and return conductors) are run together within raceways and cable trays from the point of entry to the constant current regulator. This mitigates any concern of single phase inductive heating.

Related Item

Public Input No. 2739-NFPA 70-2014 [New Section after 392.10(D)]

Submitter Information Verification

Submitter Full Name: Matt Szabo
Organization: Aviation Alliance, Inc.
Affiliation: none
Street Address: 
City: 
State: 
Zip: 

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2107-NFPA 70-2015
Statement: The submitter has provided additional information to the CMP, along with substantiation that the proposed installation is in line with the intent of the Code, does not present a safety issue, and is consistent with industry means and methods.

Typically airfield lighting cables of the series circuit are routed together in the airfield lighting vault. Therefore no inductive heating within the cable tray would occur.

CMP-8 re-examined PI-2739 and recognize the use of other types of cables in cable tray for locations accessible to qualified persons only.
392.10(E)  **Airfield Lighting Cable Tray**

In airport establishments, where conditions of maintenance and supervision ensure that only qualified persons, have access, install, or service the cable, airfield lighting cable used in series circuits rated up to 5000 volts and powered by constant current regulators shall be permitted to be installed in cable tray. The cable shall be FAA L-824 Type B or Type C cable.

**Informational Note to 392.10(E):** Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

### Additional Proposed Changes

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<td>DSCN1390.JPG</td>
<td>Photo 1390 – L-824 cable is in top tray and exits vault via vertical tray and UG duct bank.</td>
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<tr>
<td>DSCN1397.JPG</td>
<td>Photo 1397 – L-824 cable is in top tray and is distributed to its respective CCRs.</td>
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<td>Vault_18R_Basement_AF_Lgt_Duct_Entry.jpg</td>
<td>Duct entry to cable tray transition in 18R Airfield Lighting Vault basement</td>
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</table>

### Statement of Problem and Substantiation for Public Comment

A typical airfield lighting series circuit for a runway at a General Aviation Airport may be 20,000 feet long (made up of 20,000 linear feet of L-824 cable). The circuit would originate at the airfield lighting vault, be routed out to and around the runway and then return to the airfield lighting vault. In addition to the lights, the circuit would probably power a couple of wind cones and all the runway signs as well.

At an Air Carrier Airport the circuit could be 40,000 feet long. It would be reasonable to accept that all constant current regulators (CCR = power source for the airfield lighting series circuit) are within 50 feet of the underground circuit entry into the airfield lighting vault.

Outside the vault, all L-824 cable would be installed in underground raceways, pull boxes, manholes, light bases, etc. Assuming a maximum of 50 feet to the CCR a maximum of 100 feet of L-824 cable (less than 1%) per circuit would be installed in the cable tray. The installation of L-824 cable in cable tray is a very minimal application for the L-824 airfield lighting cable. The narrow limited application would be for use inside the airfield lighting vault. Access to the airfield lighting vault is limited to qualified persons.

L-824 cables installed in cable tray provide ready access and the necessary flexibility for troubleshooting, cable replacement, and to move the cables to the spare constant current regulator, thus expediting the repairs or cable replacement and enhancing the safety of the flying public.

I respectfully request the CMP re-examine PI-2739 and approve the use of FAA type L-824 cables in cable tray for locations accessible to qualified persons only.

### Related Item

**Public Input No. 2739-NFPA 70-2014 [New Section after 392.10(D)]**

### Submitter Information Verification

- **Submitter Full Name:** CARL JOHNSON II
- **Organization:** AVCON INC
- **Affiliation:** none
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Wed Jul 22 09:35:44 EDT 2015

### Committee Statement

- **Committee:** Rejected but see related SR
- **Action:**
- **Resolution:** SR-2107-NFPA 70-2015
| Statement: | The submitter has provided additional information to the CMP, along with substantiation that the proposed installation is in line with the intent of the Code, does not present a safety issue, and is consistent with industry means and methods. Typically airfield lighting cables of the series circuit are routed together in the airfield lighting vault. Therefore no inductive heating within the cable tray would occur. CMP-8 re-examined PI-2739 and recognize the use of other types of cables in cable tray for locations accessible to qualified persons only. |
Public Comment No. 579-NFPA 70-2015 [New Section after 392.10(D)]

392.10(E) Airfield Lighting Cable Tray
In airport establishments, where conditions of maintenance and supervision ensure that only qualified persons, have access, install, or service the cable, airfield lighting cable used in series circuits rated up to 5000 volts and powered by constant current regulators shall be permitted to be installed in cable tray. The cable shall be FAA L-824 Type B or Type C cable.

Informational Note to 392.10(E): Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Additional Proposed Changes

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<td>Inductive_Heating_Experiment_2015-09-08.pdf</td>
<td>Inductive Heating Experiment</td>
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Statement of Problem and Substantiation for Public Comment
In the response to PI 2739 the CMP expressed a concern regarding inductive heating. The attached document should alleviate the CMP's concerns regarding inductive heating. We respectfully request the CMP allow the installation of FAA Type L-824 cable in cable trays for the limited applications requested in Public Input 2739.

Related Public Comments for This Document

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<td>Public Comment No. 580-NFPA 70-2015 [Section No. 300.20(B)]</td>
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<td>Public Input No. 2739-NFPA 70-2014 [New Section after 392.10(D)]</td>
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Submitter Information Verification
Submitter Full Name: Carl Johnson II
Organization: AVCON, Inc.
Affiliation: none
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 10:43:36 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-2107-NFPA 70-2015
Statement:
The submitter has provided additional information to the CMP, along with substantiation that the proposed installation is in line with the intent of the Code, does not present a safety issue, and is consistent with industry means and methods.

Typically airfield lighting cables of the series circuit are routed together in the airfield lighting vault. Therefore no inductive heating within the cable tray would occur.

CMP-8 re-examined PI-2739 and recognize the use of other types of cables in cable tray for locations accessible to qualified persons only.
Public Comment No. 417-NFPA 70-2015 [Section No. 392.10(D)]

(D) Nonmetallic Cable Tray.

In addition to the uses permitted elsewhere in 392.10, nonmetallic cable tray shall be permitted in corrosive areas and in areas requiring voltage isolation.

Statement of Problem and Substantiation for Public Comment

Public Input No. 2739-NFPA 70-2014 (New Section after No. 392.10 (D))

- Comments to Substantiation commentary from Carl Johnson – Avcon10/28/14

Section No. 392.10(D) discusses the application and protection of L824 cables that are used to power airfield lights. The system is set up such that Edison Power, which is voltage controlled is brought into a vault on the airfield. The Edison power goes through switchgear to transform to airfield application needs and then is transformed via a plurality of constant current regulators to deliver power to airfield circuits that are current controlled in series. The constant current regulator is used to control current at specified steps or intensities to control the brightness of the lights on the airfield depending on varying visibility conditions. Each constant current regulator typically controls the lighting for a designated geographic area on the airfield (ie, Taxiway A Edge Lights, Runway 18 Centerline Lights, Runway 27 Edge Lights, Runway 9 Threshold Lights, etc.).

The airfield vault houses the switchgear and constant current regulator units and is similar to an electrical substation. It is the key area and acts as the brain of the airfield lighting system. Therefore, it is very important that the equipment is maintained and serviced to the highest quality standards to support the effective lighting of an airfield, which is critical to aircraft and personal safety.

It is a very controlled area. Only authorized personnel are allowed in the airfield vault for monitoring or maintenance needs. Carl Johnson II discusses some of those needs in his post from 10/28/14. The point I want to highlight is the criticality of timeliness of completion of those tasks. If there are issues that need to be diagnosed and tested on an airfield, the vault, regulators and their fed circuits must be accessed quickly and resolutions employed right away to prevent an unsafe airport operation.

Section No. 392.10 (D) addresses the safety of access to L824 cables throughout the airfield environment which is open to many contractors and construction personnel as they work on electrical systems. The code discusses how L824 cables are not permitted in cable trays. This is good sound practice throughout the outside airfield environment. However, access to and in the vault is more controlled and procedures are validated and audited. Further, the equipment in the vault must be readily accessible to authorized personnel to properly maintain and control with timely solutions in an effort to protect the safety of everyone in an airfield environment that uses airfield lighting to transport passengers via aircraft.

It is critically important that authorized personnel have readily available access to L824 cables and those cables should be permitted to be installed in cable trays in the airfield lighting vault only.

Related Item

Public Input No. 2739-NFPA 70-2014 [New Section after 392.10(D)]

Submitter Information Verification

Submitter Full Name: John Bogart
Organization: Integro
Affiliation: Integro - Airfield Lighting Manufacturer
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 18 10:10:55 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Public comment addresses an issue not covered in 392.10(d) – L824C cable installed in a cable tray.
Public Comment No. 1156-NFPA 70-2015 [New Section after 392.80(A)]

Informational Note:
See 110.14(C) for conductor temperature limitations due to termination provisions.

Statement of Problem and Substantiation for Public Comment

Consistency of NEC language among similar sections is critical to understanding and enforcement of the requirements. Inconsistent language results in confusion for NEC users and difficulty for the AHJ community that must enforce the NEC rules. CMP 8 received (3) identical Public Inputs yet resolved two while creating a First Revision for the third. CMP 8 resolved PI 1466 and PI 1449 with the following committee statements:

The Code is not Intended to be an instruction manual for untrained persons. The substantiation to align the wording with another section will open the door to adding this type of Note to an inordinate number of other Articles.

PI 1448 resulted in First Revision 2154 with the following committee statement:

This revision clarifies the section by informing the user of additional provisions which may be applicable. It aligns this article with similar provisions in 310.15(A)(2) and 310.60(A)(1).

The actions and committee statements by CMP 8 were inconsistent among the (3) Public Inputs. The addition of the proposed Informational Note after Section 392.80(A) does not result in creation of an instruction manual and is essential for Code users and enforcers as indicated by the committee statement for PI 1448.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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</thead>
<tbody>
<tr>
<td>Public Comment No. 1145-NFPA 70-2015 [New Section after 392.80(B)(2)]</td>
<td>Identical concept applied to cables rated 2001V and over.</td>
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<tr>
<td>Public Comment No. 1145-NFPA 70-2015 [New Section after 392.80(B)(2)]</td>
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<tr>
<td>Public Input No. 1449-NFPA 70-2014 [New Section after 392.80(A)]</td>
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<tr>
<td>First Revision No. 2154-NFPA 70-2015 [Section No. 370.80]</td>
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Submitter Information Verification

Submitter Full Name: Pete Jackson
Organization: City of Bakersfield, CA
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Sep 23 22:42:07 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7506-NFPA 70-2015
Statement: This revision clarifies the section by informing the user of additional provisions which may be applicable. It aligns this article with similar requirements in 310.15(A)(2) and 310.60(A)(1).
Public Comment No. 1145-NFPA 70-2015 [ New Section after 392.80(B)(2) ]

Informational Note:
Informational Note: See 110.40 for conductor temperature limitations due to termination provisions.

Statement of Problem and Substantiation for Public Comment

Consistency of NEC language among similar sections is critical to understanding and enforcement of the requirements. Inconsistent language results in confusion for NEC users and difficulty for the AHJ community that must enforce the NEC rules. CMP 8 received (3) identical Public Inputs yet resolved two while creating a First Revision for the third.

CMP 8 resolved PI 1466 and PI 1449 with the following committee statements:

The Code is not Intended to be an instruction manual for untrained persons. The substantiation to align the wording with another section will open the door to adding this type of Note to an inordinate number of other Articles.

PI 1448 resulted in First Revision 2154 with the following committee statement:

This revision clarifies the section by informing the user of additional provisions which may be applicable. It aligns this article with similar provisions in 310.15(A)(2) and 310.60(A)(1).

The actions and committee statements by CMP 8 were inconsistent among the (3) Public Inputs. The addition of the proposed Informational Note after Section 392.80(B) does not result in creation of an instruction manual and is essential for Code users and enforcers as indicated by the committee statement for PI 1448.

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<td>Identical concept applied to cables rated 2000v or less.</td>
</tr>
<tr>
<td>Public Comment No. 1156-NFPA 70-2015 [New Section after 392.80(A)]</td>
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<td>First Revision No. 2154-NFPA 70-2015 [Section No. 370.80]</td>
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Submitter Information Verification

Submitter Full Name: Pete Jackson
Organization: City of Bakersfield, CA
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 22:30:52 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-7507-NFPA 70-2015
Statement: This revision clarifies the section by informing the user of additional provisions which may be applicable. It aligns this article with similar requirements in 310.15(A)(2) and 310.60(A)(1).
Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL

Additional Proposed Changes

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<tr>
<th>File Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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</table>
Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL's have similar requirements.

Related Public Comments for This Document

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<tbody>
<tr>
<td>Public Comment No. 532-NFPA 70-2015 [Definition: Labeled.]</td>
<td>This will help AHJ's understand that some small parts may not actually bear a label, that the label may be permitted on the packaging of the part.</td>
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</table>

Related Item

- Public Input No. 1072-NFPA 70-2014 [Definition: Labeled.]
- Public Input No. 906-NFPA 70-2014 [Section No. 393.6]
- First Revision No. 5146-NFPA 70-2015 [Section No. 393.6]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 15:34:02 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-5103-NFPA 70-2015
Statement:
The Panel agrees with public comment clarifying certain equipment be “listed and labeled” instead of just “listed.” Qualified Electrical Testing Laboratories do not consider a product to be listed unless the label has actually been applied.

Additionally, the Article 100 definition for “labeled” includes the provision for labeling the smallest unit carton for parts which are too small to include the listing mark on the parts themselves. Labeling includes listing marks that are stamped or molded on or into the product.
Public Comment No. 144-NFPA 70-2015 [Section No. 396.2]

396.2 Definitions.

Insulated Conductor.
For the purposes of this article, an insulated conductor includes those listed in Article 310 and conductors encased in a polymeric material that has been evaluated for the applied nominal voltage.

Informational Note: Evidence of evaluation for the applied nominal voltage can be given by certification that the conductors have met the requirements of ICEA S-76-474-2004 2011, Standard for Neutral Supported Power Cable Assemblies with Weather-Resistant Extruded Insulation Rated 600 Volts.

Messenger-Supported Wiring.
An exposed wiring support system using a messenger wire to support insulated conductors by any one of the following:

1. A messenger with rings and saddles for conductor support
2. A messenger with a field-installed lashing material for conductor support
3. Factory-assembled aerial cable
4. Multiplex cables utilizing a bare conductor, factory assembled and twisted with one or more insulated conductors, such as duplex, triplex, or quadruplex type of construction

Statement of Problem and Substantiation for Public Comment

Referenced current edition of ICEA S-76-474.

Related Item
First Revision No. 1835-NFPA 70-2015 [New Definition after Definition: Messenger-Supported Wiring]

Submitter Information Verification
Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 06 15:56:14 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1814-NFPA 70-2015
Statement: Since the conductors that are not included in 310.104 do not have flame retardants, the panel revised the language to limit the application of this wiring method to overhead service conductors. Overhead service conductors are permitted to be insulated or covered in 230.22, thereby correlating the use of Article 396 with the requirements in Article 230.
396.2 Definitions.

Insulated Conductor.
For the purposes of this article, an insulated conductor includes those listed in Article 310 and conductors encased in a polymeric material that has been evaluated for the applied nominal voltage.

Informational Note: Evidence of evaluation for the applied nominal voltage can be given by certification that the conductors have met the requirements of ICEA S-76-474-2004, Standard for Neutral Supported Power Cable Assemblies with Weather-Resistant Extruded Insulation Rated 600 Volts.

Messenger-Supported Wiring.
An exposed wiring support system using a messenger wire to support insulated conductors by any one of the following:

(1) A messenger with rings and saddles for conductor support
(2) A messenger with a field-installed lashing material for conductor support
(3) Factory-assembled aerial cable
(4) Multiplex cables utilizing a bare conductor, factory assembled and twisted with one or more insulated conductors, such as duplex, triplex, or quadruplex type of construction

Statement of Problem and Substantiation for Public Comment

The proposed new definition is not appropriate for the NEC. As clearly stated in the first sentence of the substantiation for PI 2289, this is all about "service drop applications." See 90.2. The intent of the proposed new definition and informational note is to recognize messenger supported cable for use on the load side of the service point. This will create serious safety concerns.

The substantiation provided by CMP-7 is lacking in substance. The statement simply states that "This definition is necessary to recognize commonly used wiring methods for messenger-supported." CMP-7 provided no technical substantiation as required to change the code. This is most likely due to the fact that there is no technical substantiation to support this new definition and informational note. In fact, technical substantiation exists in abundance to reject this proposed revision.

The substantiation in PI 2289 stated that non-listed, uninsulated triplex and quadplex is "identified" for "the use." What "use" and how was the product "identified"? Who stood behind such a serious statement? The informational note that accompanies the definition of "identified" in Article 100 provides the code user with information on how a given product may be recognized as "identified." These products are not "listed or labeled." There are no inspection agencies or other organizations concerned with product evaluation getting behind such an effort.

As used by electric utilities for service drops these products serve an extremely useful purpose. That purpose ends at the service point. The proposed definition is in direct conflict with the existing definition of "messenger-supported wiring" which clearly requires "insulated conductors" where a multiplex cable is used. There is significant reason that these products are not listed. They have zero physical damage properties. These products cut as easily as skin in the heat of the summer and they shatter on impact in sub freezing temperatures.

See CFR 29 1926.403(a) which requires electrical products used in construction (temporary wiring) to be "approved". The term "approved" as used in this OSHA requirement follows:

Approved. Acceptable to the authority enforcing this Subpart. The authority enforcing this Subpart is the Assistant Secretary of Labor for Occupational Safety and Health. The definition of "acceptable" indicates what is acceptable to the Assistant Secretary of Labor, and therefore approved within the meaning of this Subpart.

The term acceptable is defined in this subpart as follows:
Acceptable. An installation or equipment is acceptable to the Assistant Secretary of Labor, and approved within the meaning of this Subpart:
(a) If it is accepted, or certified, or listed, or labeled, or otherwise determined to be safe by a qualified testing laboratory capable of determining the suitability of materials and equipment for installation and use in accordance with this standard; or
(b) With respect to an installation or equipment of a kind which no qualified testing laboratory accepts, certifies, lists, labels, or determines to be safe, if it is inspected or tested by another Federal agency, or by a State, municipal, or other local authority responsible for enforcing occupational safety provisions of the National Electrical Code, and found in compliance with those provisions; or
(c) With respect to custom-made equipment or related installations which are designed, fabricated for, and intended for use by a particular customer, if it is determined to be safe for its intended use by its manufacturer on the basis of test data which the employer keeps and makes available for inspection to the Assistant Secretary and his authorized representatives.

No qualified testing laboratory has accepted, certified, listed, labeled, or otherwise determined these products as safe for use in construction or otherwise.
Use of these products is not "one of a kind", nor is it custom made.
Use of these products for temporary violates the OSHA standards for good reason. Listed products such as types SE and SER are
readily available, insulated, covered and listed.

Adding a definition of "insulated" that recognizes a covered conductor as "insulated" is a slippery slope for the NEC.

There is no practical or technical reason to support such a revision. This proposed revision would seriously impact safety.

**Related Item**

First Revision No. 1835-NFPA 70-2015 [New Definition after Definition: Messenger-Supported Wiring.]
Public Input No. 2289-NFPA 70-2014 [New Definition after Definition: Messenger-Supported Wiring.]

**Submitter Information Verification**

Submitter Full Name: James Dollard
Organization: IBEW Local Union 98
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 09:23:31 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR
Resolution: SR-1814-NFPA 70-2015
Statement: Since the conductors that are not included in 310.104 do not have flame retardants, the panel revised the language to limit the application of this wiring method to overhead service conductors. Overhead service conductors are permitted to be insulated or covered in 230.22, thereby correlating the use of Article 396 with the requirements in Article 230.
Public Comment No. 1135-NFPA 70-2015 [ Definition: Insulated Conductor. ]

Insulated Conductor.
For the purposes of this article, an insulated conductor includes those listed conductors described in Article 310.104 and conductors encased in a polymeric material that has been evaluated for the applied nominal voltage.

Informational Note: Evidence of evaluation for the applied nominal voltage can be given by certification that the conductors have met the requirements of ICEA S-76-474-2004, Standard for Neutral Supported Power Cable Assemblies with Weather-Resistant Extruded Insulation Rated 600 Volts.

Statement of Problem and Substantiation for Public Comment

The NEC style manual (4.1.1) prohibits referring to an entire Article; this change would direct code users to the Section within Article 310 that contains the specific allowable insulated conductors.

Related Item
First Revision No. 1835-NFPA 70-2015 [ New Definition after Definition: Messenger-Supported Wiring. ]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 21:41:28 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1814-NFPA 70-2015
Statement: Since the conductors that are not included in 310.104 do not have flame retardants, the panel revised the language to limit the application of this wiring method to overhead service conductors. Overhead service conductors are permitted to be insulated or covered in 230.22, thereby correlating the use of Article 396 with the requirements in Article 230.
Uses Permitted.
Outdoor overhead conductors over 1000 volts, nominal, shall be permitted only for systems rated over 1000 volts, nominal, as follows:

1. Outdoors in free air
2. For service conductors, feeders, or branch circuits


Statement of Problem and Substantiation for Public Comment

Related Public Comments for This Document

<table>
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<td>Public Comment No. 43-NFPA 70-2015 [Section No. B.310.15(B)(2)]</td>
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<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
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<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
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<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
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<td>Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]</td>
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<td>Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]</td>
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<td>Public Comment No. 53-NFPA 70-2015 [Section No. 840.44(B)]</td>
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<td>Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]</td>
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<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
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<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
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<td>Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]</td>
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<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
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<td>Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]</td>
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<td>Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack.]</td>
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<td>Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]</td>
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Submitter Information Verification
Submitter Full Name: Aaron Adamczyk
## Committee Statement

**Committee Action:** Accepted  
**Resolution:** SR-1815-NFPA 70-2015  
**Statement:** The changes in this comment are consistent with the current name of the document referenced.
**Public Comment No. 446-NFPA 70-2015 [Section No. 400.1]**

400.1 Scope.
This article covers general requirements, applications, and construction specifications for flexible cords and flexible cables.

Informational Note: UL 817, Cord Sets and Power-Supply Cords, allows the use of flexible cords manufactured in accordance with UL 62, Flexible Cords and Cables. Cord sets and power-supply cords are restricted in use by the requirements in Article 400.

Statement of Problem and Substantiation for Public Comment

Informational notes are just that a note, they can't contain a NEC requirement. Clearly Article 400 applies to Flexible Cords and Cables as constructed in accordance with UL 62. If the panel wants to expand the scope of Article 400 to include Cord Sets (extension cords) and Power Supply Cords which are constructed per UL 817, then the title of Article 400 needs to read. Article 400. Flexible Cords, Flexible Cables, Cord Sets, and Power Supply Cords. In addition, the scope of Article 400 in 400.1 needs to also be revised to include UL 817 products.

The 'reach' by the panel to require extension cords and power supply cords on listed products to comply with the "installation" requirements of the NEC (via an Informational Note) will result in significant conflict in the 'use' of listed products. I feel the TCC should direct the panel to delete this Information Note as written, since it's attempts to wire a 'rule' within an Informational Note.

**Related Item**
First Revision No. 1511-NFPA 70-2015 [Section No. 400.1]

**Submitter Information Verification**

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 27 16:15:54 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR
Resolution: SR-1503-NFPA 70-2015
Statement: The code does not presently advise that cords used in listed cord sets and power supply cords need to meet the same installation requirements as flexible cords in article 400. The informational note was included to advise that flexible cords used in listed cord sets and power supply cords are covered by this article.
Statement of Problem and Substantiation for Public Comment

Milestone AV Technologies LLC and other manufacturers are supplying metal ceiling enclosures for housing AV and ITE/communications equipment. An example of AV equipment would be a HDMI scaler and of ITE/communications equipment would be an Ethernet switch/hub or a WI-FI access point and antenna.

Although these enclosures are by definition located above the surface of the suspended or dropped ceiling, if they are Listed to ANSI/UL 2043-2008 for use in Other Spaces Used for Environmental Air, they are isolated from and not in the above ceiling environmental space per se. They typically have power outlets within them and the flexible cords and cables for the equipment installed in them stay totally within the enclosure. Therefore in this application, the flexible cords and cables do not run through the above ceiling space. You could install this same enclosure in a “hard ceiling” and it would comply with 400.8(5). There is no difference with regard to flexible cords and cables in this application above a suspended or dropped ceiling.

Committee Statement
Resolution: This type of equipment is already listed for use in Other spaces Used for Environmental Air and does not require specific allowance in 400.7.

Problem

It appears that the committee thought that having the enclosure Listed for use in the environmental air space, that flexible cords inside of it shouldn’t be a problem, however this has been an ongoing enforcement issue with our products.

Even though the enclosure is a Listed enclosure for environmental air space, AHJ’s are rejecting the installation because of the wording in the NEC. This addition will help clarify this use.

Related Item
Public Input No. 1070-NFPA 70-2014 [New Section after 400.7(A)]
400.12 Uses Not Permitted.

Unless specifically permitted in 400.10, flexible cables, flexible cord sets, and power supply cords shall not be used for the following:

(1) As a substitute for the fixed wiring of a structure
(2) Where run through holes in walls, structural ceilings, suspended ceilings, dropped ceilings, or floors
(3) Where run through doorways, windows, or similar openings
(4) Where attached to building surfaces

   Exception to (4): Flexible cord and cable shall be permitted to be attached to building surfaces in accordance with 368.56(B) for branches from busways and receptacle pendants.

(5) Where concealed by walls, floors, or ceilings or located above suspended or dropped ceilings
(6) Where installed in raceways, except as otherwise permitted in this Code
(7) Where subject to physical damage

Statement of Problem and Substantiation for Public Comment

The Exception to 400.12(A)(4) (former Ex. to 400.8(B)(4)) has been a topic of discussion at many meetings and there are always mixed opinions on how to interpret “in accordance with 368.56(B).” Some read it literally and only allow it for branches from busways and others recognize the methods described in 368.56 for a cord type pendant from a wireway or junction box for a pendant receptacle outlet. The methods described in 368.56 have been used for installing cord pendant drops that do not originate from a busway for many years without incident. Therefore there is no practical reason to limit the installation methods described in 368.56 to just branches that originate at a busway.

I am aware of an industrial application where wireways were suspended using strut type frames and used for supplying cord type pendant drops for receptacle outlets. The cords were connected to the bottom of the wireways with gland type strain relief connectors. The cords then ran less than 1.8 m (6 ft.) to a suitable tension take up device and then down to the work stations below. The company was cited for violating 368.56 and instructed to remove over 100 take up devices and let the cords hang directly from the gland type strain relief connectors. If that is not the intent of the current exception, the proposed revision would add clarity. Additional clarity could be added by removing the word “receptacle” from in front of “pendants” if the desire is not to limit the application to just receptacle pendants.

Related Item
Public Input No. 1508-NFPA 70-2014 [Section No. 400.8]

Submitter Information Verification

Submitter Full Name: Mark Hilbert
Organization: MR Hilbert Electrical Insp & Training
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 11:43:16 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The exception already references section 368.56 that covers busways, however, there is no reference to receptacle pendants in section 368.56. Straight pendants are allowed by Article 400.10(A)(1). Wireways are not covered under Article 368.
400.12 Uses Not Permitted.

Unless specifically permitted in 400.10, flexible cables, flexible cord sets, and power supply cords shall not be used for the following:

1. As a substitute for the fixed wiring of a structure
2. Where run through holes in walls, structural ceilings, suspended ceilings, dropped ceilings, or floors
3. Where run through doorways, windows, or similar openings
4. Where attached to building surfaces
   
   Exception to (4): Flexible cord and cable shall be permitted to be attached to building surfaces in accordance with 368.56(B).

5. Where concealed by walls, floors, or ceilings or located above suspended or dropped ceilings
6. Where installed in raceways, except as otherwise permitted in this Code
7. Where subject to physical damage

Statement of Problem and Substantiation for Public Comment

Delete revised text and bring back to 2014. Section 400.8 applies to flexible cords [UL 62] (so add 'flexible cords' that back) and since the scope of Article 400 does not apply to cords sets (extension cords) or power supply [UL 817], delete 'flexible cord sets and power supply cords.'

The NEC is an 'installation' standard not a 'use standard. The NEC has no right to govern how I personally use extension cords or power supply cords. This is governed by the Fire Code, not the NEC.

Related Item
First Revision No. 1514-NFPA 70-2015 [Section No. 400.8]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 27 16:32:09 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Section 400.10(B) references uses permitted for cords in cord sets and power supply cords. The first revision wording of Section 400.12 is needed to advise of uses that are not permitted as it pertains to the cord within a cord set or power supply cord.
Switches Controlling Lighting Loads.

The grounded circuit conductor for the controlled lighting circuit shall be installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit for bathrooms, hallways, stairways, or a room suitable for human habitation or other occupancy as defined in the applicable building code. A grounded conductor shall not be required to be installed at lighting switch locations under any of the following conditions:

1. Where conductors enter the box enclosing the switch through a raceway, provided that the raceway is large enough for all contained conductors, including a grounded conductor

2. Where the box enclosing the switch is accessible for the installation of an additional or replacement cable without removing finish materials

3. Where snap switches with integral enclosures comply with 300.15(E)

4. Where a switch serves other than a bathroom, hallway, stairway, or a room suitable for human habitation or other occupancy as defined in the applicable building code

5. Where multiple switch locations control the same lighting load such that the entire floor area of the room or space is visible from the single or combined switch locations, the grounded circuit conductor shall only be required at one location.

6. Where lighting in the area is controlled by automatic means

7. Where a switch controls a receptacle load

Informational Note: The provision for a (future) grounded conductor is to complete a circuit path for electronic lighting control devices.

Statement of Problem and Substantiation for Public Comment

Relocating (4) into the parent rule would make it easier to apply the requirement.

Related Item

First Revision No. 2416-NFPA 70-2015 [Section No. 404.2(C)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 14:10:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2408-NFPA 70-2015
Statement: This action fully supports the concept that the grounded conductor of the lighting circuit must not only be available for connection to an electronic switch, it must be actually connected to the device. In addition, and particularly in instances wired in accordance with list item #2, it must be extended through the relevant raceway to the switch location in order to permit the required connection. This requirement has been formatted as a stand-alone paragraph in this section in order to clearly address field wiring issues that do not belong in Part II of this Article.

The principal change in this part of the Code is a new exception that addresses the circumstances under which previous switch designs and connection protocols that assumed up to 0.5 mA of neutral current could be allowed to flow over an equipment grounding return path might continue to be used safely. These switches have been used for decades with no reported loss experience, but as they continue to proliferate ever increasing current loading will be imposed on a system that is not and never will be designed for routing load current. Since the advent of the 2011 NEC, CMP 9 has been moving in a direction that limits the usage of these switches hoping to avoid an eventual problem.

At the first revision stage, CMP 9 placed a sunset date of January 1, 2020 on the use of these switches in what will be
404.22. In response, three comments (#1256, #485, #832) supported a continuing retrofit allowance under the old protocol and one (#770) asked for an immediate termination of acceptability. CMP 9 reaffirms the 2020 sunset date as the default limit, but agrees that based on the historical record some continuation of older designs is warranted.

To this end, CMP 9 agrees to a replacement/retrofit limitation on the older designs, and also to numerical limits that effectively limit the worst-case neutral current that the equipment grounding system would be expected to carry to 2.5 mA on the smaller branch circuit conductors, and 12.5 mA on feeders. Since the original first revision stage action placed an extinction date on the older style devices where there was none previously, this action, which allows numerical limits instead of none at all, therefore should not be considered new material.

This concept is being addressed here in Part I because it will be an installation limitation; the listing and marking requirement is being covered in a correlating exception in what will be 404.22. Because this location will be the principal coverage of wiring issues in this regard, CMP 9 is including language disallowing the use of older designs, which will be inherently limited to existing applications, in the event that the return path in a panelboard includes a path through a panelboard enclosure as disallowed in 200.2(B). CMP 9 notes that this defect can be readily rectified in the field. CMP 9 is also including a clarification that a busbar carrying both equipment grounding and neutral terminations, as is permitted in service equipment, can support an indefinite number of these devices just as the number of allowable neutral connections are not limited, except inherently by the number of connection provisions.

The action on this comment also addresses three editorial issues, two of which were raised in public comments (#463 and #504) with which the panel is in substantive agreement. CMP 9 has removed from the list items the habitation/occupancy text (current item #4) and the multiple switch location text (current item #5) and inserted this material into the parent text where it improves readability. In addition, the parent text location leaves the new second paragraph standing alone where it will not be confused with requirements addressing where a grounded circuit conductor must be routed for normal installations in new work.

The third issue involves a minor error introduced in the first revision stage with respect to the wording of the habitation/occupancy text. It removes the word “other” ahead of “occupancy” in what now stands as list item four. The phrase should read "human habitation or occupancy" because a reference to "other occupancy" creates the unwanted implication that a switch in any other occupancy defined in the building code wherever located gets the neutral. In effect, it creates the implication that the word is being used as a noun. When a building code refers to an occupancy, it is referring to a species of building purpose, such as an assembly occupancy or an industrial occupancy. On the contrary, for this usage it is intended as a second object of the proposition "for" and needs to be used in an exactly parallel way to "for human habitation". The simplest way to accomplish this is to simply word the phrase "suitable for human habitation or occupancy".
Switches Controlling Lighting Loads.

The grounded circuit conductor for the controlled lighting circuit shall be installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit. A grounded conductor shall not be required to be installed at lighting switch locations under any of the following conditions:

1. Where conductors enter the box enclosing the switch through a raceway, provided that the raceway is large enough for all contained conductors, including a grounded conductor.
2. Where the box enclosing the switch is accessible for the installation of an additional or replacement cable without removing finish materials.
3. Where snap switches with integral enclosures comply with 300.15(E).
4. Where a switch serves other than a bathroom, hallway, stairway, or a room that is not suitable for human habitation or other occupancy as defined in the applicable building code.
5. Where lighting in the area is controlled by automatic means.
6. Where a switch controls a receptacle load.

Where multiple switch locations control the same lighting load such that the entire floor area of the room or space is visible from the single or combined switch locations, the grounded circuit conductor shall only be required at one location.

Informational Note: The provision for a (future) grounded conductor is to complete a circuit path for electronic lighting control devices.

Statement of Problem and Substantiation for Public Comment

It seems list item 4 is a direct conflict to the intent of the section. Here's an example or two of the conflict created by double negatives:

1. A grounded conductor shall not be required to be installed at lighting switch locations under any of the following conditions:
   - Where a switch serves a living room
   - Where a switch serves a dining room
   - Where a switch serves a kitchen
   - Where a switch serves a recreation room
   - Where a switch serves a room suitable for human habitation or other occupancy as defined in the applicable building code.
   
   Also, it seems list item 5 should be a stand-alone paragraph that follows the list as it contains a special condition where a single grounded conductor IS required so this sentence does not fit in the list.

Related Item

First Revision No. 2416-NFPA 70-2015 [Section No. 404.2(C)]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 02 18:58:06 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2408-NFPA 70-2015
Statement: This action fully supports the concept that the grounded conductor of the lighting circuit must not only be available for connection to an electronic switch, it must be actually connected to the device. In addition, and particularly in instances wired in accordance with list item #2, it must be extended through the relevant raceway to the switch location in order to permit the required connection. This requirement has been formatted as a stand-alone paragraph in this section in order to clearly address field wiring issues that do not belong in Part II of this Article.
The principal change in this part of the Code is a new exception that addresses the circumstances under which previous switch designs and connection protocols that assumed up to 0.5 mA of neutral current could be allowed to flow over an equipment grounding return path might continue to be used safely. These switches have been used for decades with no reported loss experience, but as they continue to proliferate ever increasing current loading will be imposed on a system that is not and never will be designed for routing load current. Since the advent of the 2011 NEC, CMP 9 has been moving in a direction that limits the usage of these switches hoping to avoid an eventual problem.

At the first revision stage, CMP 9 placed a sunset date of January 1, 2020 on the use of these switches in what will be 404.22. In response, three comments (#1256, #485, #832) supported a continuing retrofit allowance under the old protocol and one (#770) asked for an immediate termination of acceptability. CMP 9 reaffirms the 2020 sunset date as the default limit, but agrees that based on the historical record some continuation of older designs is warranted.

To this end, CMP 9 agrees to a replacement/retrofit limitation on the older designs, and also to numerical limits that effectively limit the worst-case neutral current that the equipment grounding system would be expected to carry to 2.5 mA on the smaller branch circuit conductors, and 12.5 mA on feeders. Since the original first revision stage action placed an extinction date on the older style devices where there was none previously, this action, which allows numerical limits instead of none at all, therefore should not be considered new material.

This concept is being addressed here in Part I because it will be an installation limitation; the listing and marking requirement is being covered in a correlating exception in what will be 404.22. Because this location will be the principal coverage of wiring issues in this regard, CMP 9 is including language disallowing the use of older designs, which will be inherently limited to existing applications, in the event that the return path in a panelboard includes a path through a panelboard enclosure as disallowed in 200.2(B). CMP 9 notes that this defect can be readily rectified in the field. CMP 9 is also including a clarification that a busbar carrying both equipment grounding and neutral terminations, as is permitted in service equipment, can support an indefinite number of these devices just as the number of allowable neutral connections are not limited, except inherently by the number of connection provisions.

The action on this comment also addresses three editorial issues, two of which were raised in public comments (#463 and #504) with which the panel is in substantive agreement. CMP 9 has removed from the list items the habitation/occupancy text (current item #4) and the multiple switch location text (current item #5) and inserted this material into the parent text where it improves readability. In addition, the parent text location leaves the new second paragraph standing alone where it will not be confused with requirements addressing where a grounded circuit conductor must be routed for normal installations in new work.

The third issue involves a minor error introduced in the first revision stage with respect to the wording of the habitation/occupancy text. It removes the word “other” ahead of “occupancy” in what now stands as list item four. The phrase should read “human habitation or occupancy” because a reference to “other occupancy” creates the unwanted implication that a switch in any other occupancy defined in the building code wherever located gets the neutral. In effect, it creates the implication that the word is being used as a noun. When a building code refers to an occupancy, it is referring to a species of building purpose, such as an assembly occupancy or an industrial occupancy. On the contrary, for this usage it is intended as a second object of the proposition “for” and needs to be used in an exactly parallel way to “for human habitation”. The simplest way to accomplish this is to simply word the phrase “suitable for human habitation or occupancy”.

The National Fire Protection Association Report is available at http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
Switches Controlling Lighting Loads.

The grounded circuit conductor for the controlled lighting circuit shall be installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit. The grounded conductor shall be connected to switching devices that require line-to-neutral voltages to operate the electronics of the switch in the standby mode, and shall meet the requirements in 404.22. A grounded conductor shall not be required to be installed at lighting switch locations under any of the following conditions:

1. Where conductors enter the box enclosing the switch through a raceway, provided that the raceway is large enough for all contained conductors, including a grounded conductor.
2. Where the box enclosing the switch is accessible for the installation of an additional or replacement cable without removing finish materials.
3. Where snap switches with integral enclosures comply with 300.15(E).
4. Where a switch serves other than a bathroom, hallway, stairway, or a room suitable for human habitation or other occupancy as defined in the applicable building code.
5. Where multiple switch locations control the same lighting load such that the entire floor area of the room or space is visible from the single or combined switch locations, the grounded circuit conductor shall only be required at one location.
6. Where lighting in the area is controlled by automatic means.
7. Where a switch controls a receptacle load.

Informational Note: The provision for a (future) grounded conductor is to complete a circuit path for electronic lighting control devices.

Statement of Problem and Substantiation for Public Comment

CMP-9 did a nice job of adding new section 404.22 that prohibits current from being introduced in the equipment grounding conductor from electronic switching devices. This comments seeks to build on the additional concerns expressed in the substantiation with Public Input 1375. The substantiation pointed out that there is still no requirement for connection of the required grounded conductor. This new language will provide installers with a clear requirement that if the install an electronic device that requires a line-to-neutral voltage to run the brain of the device, that it shall be connected to the device, and not just left safe-ended in the switch box. The reference from this section to new 404.22 will provide the additional restriction of current being introduced in the equipment grounding conductor, which was the revision sought by the original public input.

Related Item
Public Input No. 1375-NFPA 70-2014 [Section No. 404.2(C)]

Submitter Information Verification
Submitter Full Name: Michael Johnston
Organization: National Electrical Contractor
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 14:23:05 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-2408-NFPA 70-2015
Statement: This action fully supports the concept that the grounded conductor of the lighting circuit must not only be available for connection to an electronic switch, it must be actually connected to the device. In addition, and particularly in instances wired in accordance with list item #2, it must be extended through the relevant raceway to the switch location in order to permit the required connection. This requirement has been formatted as a stand-alone paragraph in this section in order to clearly address field wiring issues that do not belong in Part II of this Article.

The principal change in this part of the Code is a new exception that addresses the circumstances under which previous switch designs and connection protocols that assumed up to 0.5 mA of neutral current could be allowed to flow over an...
equipment grounding return path might continue to be used safely. These switches have been used for decades with no reported loss experience, but as they continue to proliferate ever increasing current loading will be imposed on a system that is not and never will be designed for routing load current. Since the advent of the 2011 NEC, CMP 9 has been moving in a direction that limits the usage of these switches hoping to avoid an eventual problem.

At the first revision stage, CMP 9 placed a sunset date of January 1, 2020 on the use of these switches in what will be 404.22. In response, three comments (#1256, #485, #832) supported a continuing retrofit allowance under the old protocol and one (#770) asked for an immediate termination of acceptability. CMP 9 reaffirms the 2020 sunset date as the default limit, but agrees that based on the historical record some continuation of older designs is warranted.

To this end, CMP 9 agrees to a replacement/retrofit limitation on the older designs, and also to numerical limits that effectively limit the worst-case neutral current that the equipment grounding system would be expected to carry to 2.5 mA on the smaller branch circuit conductors, and 12.5 mA on feeders. Since the original first revision stage action placed an extinction date on the older style devices where there was none previously, this action, which allows numerical limits instead of none at all, therefore should not be considered new material.

This concept is being addressed here in Part I because it will be an installation limitation; the listing and marking requirement is being covered in a correlating exception in what will be 404.22. Because this location will be the principal coverage of wiring issues in this regard, CMP 9 is including language disallowing the use of older designs, which will be inherently limited to existing applications, in the event that the return path in a panelboard includes a path through a panelboard enclosure as disallowed in 200.2(B). CMP 9 notes that this defect can be readily rectified in the field. CMP 9 is also including a clarification that a busbar carrying both equipment grounding and neutral terminations, as is permitted in service equipment, can support an indefinite number of these devices just as the number of allowable neutral connections are not limited, except inherently by the number of connection provisions.

The action on this comment also addresses three editorial issues, two of which were raised in public comments (#463 and #504) with which the panel is in substantive agreement. CMP 9 has removed from the list items the habitation/occupancy text (current item #4) and the multiple switch location text (current item #5) and inserted this material into the parent text where it improves readability. In addition, the parent text location leaves the new second paragraph standing alone where it will not be confused with requirements addressing where a grounded circuit conductor must be routed for normal installations in new work.

The third issue involves a minor error introduced in the first revision stage with respect to the wording of the habitation/occupancy text. It removes the word “other” ahead of “occupancy” in what now stands as list item four. The phrase should read “human habitation or occupancy” because a reference to “other occupancy” creates the unwanted implication that a switch in any other occupancy defined in the building code wherever located gets the neutral. In effect, it creates the implication that the word is being used as a noun. When a building code refers to an occupancy, it is referring to a species of building purpose, such as an assembly occupancy or an industrial occupancy. On the contrary, for this usage it is intended as a second object of the proposition "for" and needs to be used in an exactly parallel way to "for human habitation”. The simplest way to accomplish this is to simply word the phrase “suitable for human habitation or occupancy”.
Public Comment No. 465-NFPA 70-2015 [Section No. 404.9(B)]

(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:

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 to (B): 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 nonconductive 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 to (B): 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.

Statement of Problem and Substantiation for Public Comment

Delete the text that the metal faceplate must be 'grounded' since this means that we need to run a wire from the metal plate to a ground rod or other approved electrode. The use of the terms 'ground, grounded, grounding, bond, bonded, and bonding' was fixed in in the 2008 NEC. This panel clearly doesn't understand the proper term to use. Since there is no problem as the 2014 is written, I suggest we keep this rule 'as is.'

Related Item
First Revision No. 2417-NFPA 70-2015 [Section No. 404.9(B)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 14:15:31 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CMP-9 is very familiar with terminology commonly used with grounding and bonding installations. CMP-9 used the term "grounded" as this was the term suggested by the submitter of PI 2300. The term "grounded" is the proper term here as the definition for "grounded" includes "connected (connecting) to ground or to a conductive body that extends the ground connection." In this case, the equipment grounding conductor would be this conductive body that extends the ground connection.
Public Comment No. 1256-NFPA 70-2015 [Section No. 404.22]

404.22 Electronic Lighting Control Switches.
Electronic lighting control switches shall be listed. They shall not introduce current on the equipment grounding conductor during normal operation. The requirement to not introduce current on the equipment grounding conductor shall take effect on January 1, 2020. For existing installations where the grounded conductor has not been provided in the switchbox, and where it is not practical to install a grounded conductor, electronic lighting control switches which introduce current on the equipment grounding conductor shall be permitted. These Electronic lighting control switches shall be listed and labeled for use in replacement or retrofit applications when configured such that they introduce current on the equipment grounding conductor.

Statement of Problem and Substantiation for Public Comment

Acuity Brands Lighting agrees with the comments submitted with the negative ballots from UL and NEMA. When an installation predates the required grounded conductor at switch locations, provisions should be made in the code to allow the use of energy saving products that have been evaluated and listed for this purpose. These products have been in use for years and are limited by the listing standard to no more than 0.5ma being introduced on the equipment grounding conductor. We manufacturer listed electronic lighting control switches that have a convertible design; they can be field configured for either connection to the grounded circuit conductor, or for connection to the equipment grounding conductor as shown in the attached illustration. When connected to the grounded conductor no current is introduced on the equipment grounding conductor. When connected to the equipment grounding conductor, the introduced current is less than 0.5ma.

Related Item
First Revision No. 2423-NFPA 70-2015 [New Definition after Definition: Vending Machine]

Submitter Information Verification

Submitter Full Name: FREDERICK CARPENTER
Organization: ACUITY BRANDS LIGHTING
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 16:32:32 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2409-NFPA 70-2015
Statement: This new exception correlates with language placed in 404.2(C) pursuant to SR 2408. It contains only the provisions that are appropriate for the conditions that will apply to the manufacture and listing of electronic switches. It provides relief to the default requirement to sunset the acceptability of these older-designed switches in 2020. They will continue to be acceptable for replacement/retrofit applications into the future, provided they are listed accordingly. The marking requirement will assure that such devices, although listed, will not to be permitted for new work.
Electronic Lighting Control Switches.

Electronic lighting control switches shall be listed. They shall not introduce current on the equipment grounding conductor during normal operation. The requirement to not introduce current on the equipment grounding conductor shall take effect on January 1, 2020.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be provided to the comments expressed in voting on FR 2423.

Related Item

First Revision No. 2423-NFPA 70-2015 [New Definition after Definition: Vending Machine.]
Public Comment No. 485-NFPA 70-2015 [Section No. 404.22]

404.22   Electronic Lighting Control Switches.
Electronic lighting control switches shall be listed and labeled. They shall not introduce current on the equipment grounding conductor during normal operation. The requirement to not introduce current on the equipment grounding conductor shall take effect on January 1, 2020.

Exception: For dwelling unit installations existing prior to the effective date of 404.2(C), where the grounded conductor has not been provided in the switchbox and where installing the grounded conductor would require removing finish materials, electronic lighting control switches that introduce current on the equipment grounding conductor (as part of their normal operation) shall be permitted. These electronic lighting control switches shall be listed for the purpose and marked either on the device or smallest unit container with the following: "For use where the grounded (neutral) conductor is not provided in the outlet box" or equivalent.

Statement of Problem and Substantiation for Public Comment

UL does not support First Revision No. 2423.

Prior to the 2011 edition of the National Electrical Code, a grounded (neutral) conductor was not required at the switch location intended to control lighting loads. Without a neutral connection, many electronic control switches such as occupancy sensors must pass current through the grounding conductor to operate. Safety standards limit this current to 0.5 ma maximum.

UL supports the theory that electronic lighting control devices should not intentionally introduce current on the equipment grounding conductor during normal operation. This is especially true in installations where a grounded conductor has been installed in the device box. But prohibiting the ability to conduct a small amount of current (no more than 0.5ma) through the grounding conductor when the grounded conductor is not present, will eliminate a valuable, energy efficient, and safe product from the marketplace.

UL urges the panel to re-consider and introduce a practical solution whereby the Code permits this continued practice in a dwelling unit, where the installation predates the required grounded conductor at switch locations and where the addition of a grounded conductor would involve removing finish materials (refer to 404.2(C)(2) for precedence). Although this current is limited to 0.5ma, the limitation to a dwelling unit would further address any concern with the effect of cumulative current (0.5 mA maximum per device) on the grounding conductor because the number of switching devices likely to be present in dwelling unit applications is typically less than those installed in industrial or commercial applications.

Related Item
First Revision No. 2423-NFPA 70-2015 [New Definition after Definition: Vending Machine.]

Submitter Information Verification

Submitter Full Name: Robert Osborne
Organization: UL LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 01 14:03:20 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2409-NFPA 70-2015
Statement: This new exception correlates with language placed in 404.2(C) pursuant to SR 2408. It contains only the provisions that are appropriate for the conditions that will apply to the manufacture and listing of electronic switches. It provides relief to the default requirement to sunset the acceptability of these older-designed switches in 2020. They will continue to be acceptable for replacement/retrofit applications into the future, provided they are listed accordingly. The marking requirement will assure that such devices, although listed, will not to be permitted for new work.
### Public Comment No. 770-NFPA 70-2015 [Section No. 404.22]

**404.22 Electronic Lighting Control Switches.**

Electronic lighting control switches shall be listed. They shall not introduce current on the equipment grounding conductor during normal operation. The requirement to not introduce current on the equipment grounding conductor shall take effect on January 1, 2020.

### Statement of Problem and Substantiation for Public Comment

IEC's position is to delete the last sentence in FR 2423.

IEC believes introducing current on the equipment grounding conductor during normal operation can create a very dangerous situation that has the potential of causing injury to people. Electronic lighting control switches that utilize the equipment grounding conductor as a return path should be eliminated from the market immediately.

### Related Item

First Revision No. 2423-NFPA 70-2015 [New Definition after Definition: Vending Machine.]

### Submitter Information Verification

**Submitter Full Name:** JOHN MASARICK  
**Organization:** Independent Electrical Contractors, Inc.  
**Affiliation:** Independent Electrical Contractors, Inc.  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Sat Sep 19 13:48:34 EDT 2015

### Committee Statement

**Committee Action:** Rejected  
**Resolution:** As stated in the panel statement for FR 2423, CMP-9 recognizes that there needs to be a reasonable time for manufacturers to make these devices while being able to use existing inventory.
Electronic lighting control switches shall be listed. They shall not introduce current on the equipment grounding conductor during normal operation. The requirement to not introduce current on the equipment grounding conductor shall take effect on January 1, 2020. For installations existing prior to the effective date of 404.2(C) where the grounded conductor has not been provided in the switchbox, and where it is not practical to install a grounded conductor, electronic lighting control switches which introduce current on the equipment grounding conductor shall be permitted. These electronic lighting control switches shall be listed and labeled for use in replacement or retrofit applications only.

Statement of Problem and Substantiation for Public Comment

FR2416 modifying 404.2(C), and FR2423 creating the new 404.22, have significantly changed an important aspect of the original PI1375 submitted by NECA. The intent of PI1375 was to require the installation and use of the grounded conductor and prohibit the installation of electronic controls that utilize the grounding conductor for operation where a grounded conductor has been installed in the switchbox. But in retrofit installations, where the grounded conductor is not installed, electronic controls that utilize the grounding conductor would still be permitted, but only in these applications (retrofit applications). FR 2423 appears to have eliminated any possibility to install an electronic control that utilizes the grounding conductor for operation in retrofit applications, effectively eliminating controls which utilize the grounding conductor for operation from the marketplace.

It is important to allow these devices in retrofit applications for the following reasons:

1. Eliminating these products from the marketplace will lower the level of safety with respect to current on the equipment grounding conductor. Installers, especially homeowners, will quickly realize that devices provided with a terminal or wire for a grounded conductor will work equally well when connected to the equipment grounding conductor. Since the 0.5ma limit placed on current introduced on the grounding conductor by UL standards will not exist for current introduced on the grounded conductor, much higher currents will be introduced on the equipment grounding conductor, especially in residential applications where code enforcement is less prevalent.
2. These products have been listed and in use for many years. UL standards strictly control the amount of current permitted to be introduced on the equipment grounding conductor to no more than 0.5ma.
3. The suggested change to FR 2423 (new 404.22) will require these products to be listed and labeled for use in retrofit installations only where the grounded conductor is not provided in the switch box.
4. Eliminating these products from the marketplace will severely impact the installation of important energy saving controls in existing buildings. The cost of having to run a grounded conductor to the switchbox will make the return on investment unfavorable for many, if not most projects.

The committee should make the suggested revisions to FR2423 to permit electronic controls which utilize the grounding conductor for operation to be installed where the grounded conductor has not been provided at the switchbox for retrofit applications only.

Related Item

First Revision No. 2423-NFPA 70-2015 [New Definition after Definition: Vending Machine.]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 10:43:03 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2409-NFPA 70-2015
Statement: This new exception correlates with language placed in 404.2(C) pursuant to SR 2408. It contains only the provisions that are appropriate for the conditions that will apply to the manufacture and listing of electronic switches. It provides relief to the default requirement to sunset the acceptability of these older-designed switches in 2020. They will continue to be acceptable for replacement/retrofit applications into the future, provided they are listed accordingly. The marking requirement will assure that such devices, although listed, will not to be permitted for new work.
Child Care Facility
A building or structure, or portion thereof, for educational, supervisory, or personal care services for more than four children 7 years old or less.

Statement of Problem and Substantiation for Public Comment
The definitions of Educational Occupancy (NFPA 5000-6.1.3.1) and Day Care Occupancy (NFPA 5000-6.1.4.1) and or the definitions found in International Code Council Building Code Chapter 3 definitions and Section 305 clearly describe the number of occupants. The proposed addition of 406.12(D) for Day Care and Educational Facilities clearly makes the requirement of tamper resistant receptacle required, therefore it is not necessary to include "educational" in this definition.

Related Item
Public Input No. 512-NFPA 70-2014 [Definition: Child Care Facility]

Submitter Information Verification
Submitter Full Name: Joe DuPriest
Organization: Orange County Public Schools
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 13:55:09 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The word "educational" is included to emphasis the fact that educational facilities are included in the definition of child care facilities as applied to Article 406.
Outlet Box Hood.

A housing shield intended to fit over a faceplate for flush-mounted wiring devices, or an integral component of an outlet box or of a faceplate for flush-mounted wiring devices. The hood does not serve to complete the electrical enclosure; it reduces the risk of water coming in contact with electrical components within the hood, such as attachment plugs, current taps, surge protective devices, direct plug-in transformer units, or wiring devices. It is commonly known as a "bubble cover."

Statement of Problem and Substantiation for Public Comment

The text that I suggest deleting is explanatory material and doesn't belong as part of the definition. It could be informational, although I see no real reason for that either.

Related Item

First Revision No. 5111-NFPA 70-2015 [Section No. 406.2]

Submitter Information Verification

Submitter Full Name: RYAN JACKSON
Organization: RYAN JACKSON
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:19:02 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Deletion of the identified wording does not provide clarity or improvement of the definition.
(E) Controlled Receptacle Marking.

All nonlocking-type, 125-volt, 15- and 20-ampere receptacles that are controlled by an automatic control device, or that incorporate control features that remove power from the receptacle for the purpose of energy management or building automation, shall be permanently marked with the symbol shown in Figure 406.3(E) and the wording "controlled" or automatically controlled.

For receptacles controlled by an automatic control device, the marking shall be permitted to be located on the installed receptacle or the receptacle cover plate face and visible after installation. Receptacles incorporating a control feature that remove power shall be marked on the receptacle face and be visible after installation.

In both cases when a multiple receptacle device is used, the required controlled marking and symbol shall denote which receptacle(s) are automatically controlled.

Figure 406.3(E) Controlled Receptacle Marking Symbol.

Exception: The marking shall not be required for receptacles controlled by a wall switch that provide the required room lighting outlets as permitted by 210.70.

Statement of Problem and Substantiation for Public Comment

Public Input 2805 has identified a serious problem with this requirement as it is written in the 2014 NEC. Only the Code Panel or someone familiar with the NEC understands what the marking is intended to mean. This requirement should result in an occupant clearly understanding what the marking means on the face of the receptacle. The submitter of PI 2805 got it right. The term and symbol as used are unfamiliar and inadequate in conveying to the user that the receptacle may be de-activated by an automatic means. Using the term controlled or automatically controlled better conveys to the user (public) that the receptacle outlet can be de-activated by an automatic control such as an energy management system or other means of automatic control. The other significant issue is the inconsistency with Energy Conservation Codes do not recognize the symbol in Fig.406.3(E) and it resembles a symbol for a timer function. Marking the receptacle or cover with the wording "Controlled" or "automatically controlled" will enable the user to better distinguish which receptacle is controlled. The universal power symbol does not get it done. This could be critical if the intended use cannot be interrupted. This comment is intended to benefit the occupants that will be inserting and withdrawing attachment plugs in a manner that is clear that the receptacle is not always in a powered state due to controlling means (automatic or other).

Related Item

Public Input No. 2805-NFPA 70-2014 [Section No. 406.3(E)]

Submitter Information Verification

Submitter Full Name: Michael Johnston
Organization: National Electrical Contractor
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 14:07:21 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Action:
Resolution: SR-5111-NFPA 70-2015

Statement: This revision provides necessary clarity for the identification of controlled receptacle by providing the user with information that the receptacle outlet can be activated or deactivated by an energy management system or other means of automatic control.
Receptacle with USB Charger.

A 125-volt 15- or 20-ampere receptacle that additionally provides Class 2 power shall be listed and constructed such that the Class 2 circuitry is integral with the receptacle.

Statement of Problem and Substantiation for Public Comment

IEC's position is to revise the text of FR 5101.

A 125-volt 15- or 20-ampere receptacle that additionally provides Class 2 power shall be listed. The construction of the device is determined in the product standard and not necessary to include in this section.

Related Item
First Revision No. 5101-NFPA 70-2015 [New Section after 406.3(D)(2)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 19 13:37:10 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Separable power supplies employing USB connector kits are commercially available and have been installed to any ordinary duplex receptacle’s wire binding screws and push-in terminals without any regard to safety.
(2) Non-Grounding-Type Receptacles.

Where attachment to an equipment grounding conductor does not exist in the receptacle enclosure, the installation shall comply with (D)(2)(a), (D)(2)(b), or (D)(2)(c).

(a) A non-grounding-type receptacle(s) shall be permitted to be replaced with another non-grounding-type receptacle(s).

(b) A non-grounding-type receptacle(s) shall be permitted to be replaced with a ground-fault circuit interrupter-type of receptacle(s). These receptacles or their cover plates shall be marked “No Equipment Ground.” An equipment grounding conductor shall not be connected from the ground-fault circuit-interrupter-type receptacle to any outlet supplied from the ground-fault circuit-interrupter receptacle.

(c) A non-grounding-type receptacle(s) shall be permitted to be replaced with a grounding-type receptacle(s) where supplied through a ground-fault circuit interrupter. Where supplied through the ground-fault circuit interrupter, grounding-type receptacles or their cover plates shall be marked “GFCI Protected” and “No Equipment Ground.” An equipment grounding conductor shall not be connected between the grounding-type receptacles.

Informational Note No. 1: Some equipment or appliance manufacturers require that the branch circuit to the equipment or appliance includes an equipment grounding conductor.

Informational Note No. 2: See 250.114 for a list of cord-and-plug connected equipment or appliances that require an equipment grounding conductor.

Statement of Problem and Substantiation for Public Comment

While it is true that the required marking of a GFCI receptacle that is installed under the replacement rules without an equipment grounding conductor is an indication of that condition, the user and enforcer of the NEC deserve the information that the proposed Informational Notes provide.

In reality, the vast majority of the purchasers of appliances that are supplied by a three-wire cord will simply plug them into a grounding-type receptacle if one is present with or without the informational label you mention in your Panel Statement. Do the Committee members recognize this reality?

Here’s another question for the Committee - since the replacement of non-grounding receptacles with a GFCI one is not always permitted by the NEC, why wouldn’t you want the Informational Notes? It seems you have an obligation to the users and enforcers of the NEC to provide this information.

Related Item

Public Input No. 4357-NFPA 70-2014 [Section No. 406.4(D)(2)]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 03 15:16:51 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5104-NFPA 70-2015
Statement: Section 406.4(D)(2)(c) was modified to clarify that the second sentence was applicable to grounding-type receptacles and to clarify that the markings must be visible after installation. Informational notes 1 & 2 were added to better inform user of those situations where the use of replacement Non-Grounding-Type Receptacles is not acceptable.
(2) Non-Grounding-Type Receptacles.

Where attachment to an equipment grounding conductor does not exist in the receptacle enclosure, the installation shall comply with (D)(2)(a), (D)(2)(b), or (D)(2)(c).

(a) A non-grounding-type receptacle(s) shall be permitted to be replaced with another non-grounding-type receptacle(s).

(b) A non-grounding-type receptacle(s) shall be permitted to be replaced with a ground-fault circuit interrupter-type of receptacle(s). These receptacles or their cover plates shall be marked “No Equipment Ground.” An equipment grounding conductor shall not be connected from the ground-fault circuit-interrupter-type receptacle to any outlet supplied from the ground-fault circuit-interrupter receptacle.

(c) A non-grounding-type receptacle(s) shall be permitted to be replaced with a grounding-type receptacle(s) where supplied through a ground-fault circuit interrupter. Where grounding-type receptacles are supplied through the ground-fault circuit interrupter, grounding-type receptacles or their cover plates shall be marked “GFCI Protected” and “No Equipment Ground”, visible after installation. An equipment grounding conductor shall not be connected between the grounding-type receptacles.

Statement of Problem and Substantiation for Public Comment

1. Cover plates are not typically powered (unless illuminated type) or supplied by the GFCI.

2. Public Input PI 140 and First Revision FR 5104, as worded and taken literally, could STILL allow these markings to appear on the REVERSE side of the receptacle or its cover plate, OUT OF SIGHT from the user these markings are intended to inform.

For an example of literal compliance gone wrong for issue #2, refer to http://bit.ly/1GqfRdy [Illustrated EC&M article by Russ LeBlanc, submitter of PI 140 but unmentioned in his Public Input 140 submittal or its Substantiation.]

Related Item
First Revision No. 5104-NFPA 70-2015 [Section No. 406.4(D)(2)]
Public Input No. 140-NFPA 70-2014 [Section No. 406.4(D)(2)]

Submitter Information Verification

Submitter Full Name: BRIAN ROCK
Organization: HUBBELL INCORPORATED
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jun 27 10:20:04 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5104-NFPA 70-2015
Statement: Section 406.4(D)(2)(c) was modified to clarify that the second sentence was applicable to grounding-type receptacles and to clarify that the markings must be visible after installation. Informational notes 1 & 2 were added to better inform user of those situations where the use of replacement Non-Grounding-Type Receptacles is not acceptable.
(4) Arc-Fault Circuit-Interrupter Protection.

Where a receptacle outlet is supplied by a branch circuit that requires arc-fault circuit-interrupter protection as specified elsewhere in this Code, a replacement receptacle at this outlet shall be one of the following:

1. A listed outlet branch-circuit type arc-fault circuit-interrupter receptacle
2. A receptacle protected by a listed outlet branch-circuit type arc-fault circuit-interrupter type receptacle
3. A receptacle protected by a listed combination type arc-fault circuit-interrupter type circuit breaker

Exception No. 1: Arc-fault circuit-interrupter protection shall not be required where all of the following apply:

1. The replacement complies with 406.4(D)(2) (b).
2. It is impracticable to provide an equipment grounding conductor as provided by 250.130(C).
3. A receptacle protected by a listed combination type arc-fault circuit-interrupter circuit breaker is not commercially available.
4. There is no GFCI/AFCI combination receptacle commercially available.

Exception No. 2: 210.12(B) exception does not apply to replacement of receptacles.

Statement of Problem and Substantiation for Public Comment

By adding “all of the following” would make it clear that they would have to meet all of the four conditions before not installing AFCI protection. I am not sure if that is what was intended by this or not. Even after attending the Western Section Meeting no one had mentioned that it had to follow all 4 to qualify for the exemption. I definitely feel by not adding “all of the following” it will be misinterpreted and will counterdict what the blue commentary in the NEC handbook states why it is important to get AFCI protection in the older homes. I was originally going to put in a comment to take out this exemption entirely, but there has been cases where you would have to completely rewire a house to get AFCI protection because of multiwire circuits without an equipment ground and not able to get a ground fished into the outlet.

Related Item

First Revision No. 5105-NFPA 70-2015 [Section No. 406.4(D)(4)]

Submitter Information Verification

Submitter Full Name: Brent Schoulte
Organization: South Dakota Electrical Comm
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 14:37:03 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5105-NFPA 70-2015
Statement: Reference to sections 210.12(A) or (B) was added to clarify where Arc-Fault Circuit Interruption is required. In Exception No. 1, sub-item 4, the word “combination” was replaced with “dual function” to eliminate the potential for confusion since the word “combination” when used with AFCI protection usually refers to protection against series arc and parallel arcs. The phrase “all of the following apply” was added to Exception No. 1 to clarify the application of the four sub-items. Additionally Exception No. 1, sub-item 3 was changed to clarify that it applies to the availability of the circuit breaker rather than the receptacle.
(4) Arc-Fault Circuit-Interrupter Protection.

Where a receptacle outlet is supplied by a branch circuit that requires arc-fault circuit-interrupter protection as specified elsewhere in this Code, a replacement receptacle at this outlet shall be one of the following:

1. A listed outlet branch-circuit type arc-fault circuit-interrupter receptacle
2. A receptacle protected by a listed outlet branch-circuit type arc-fault circuit-interrupter type receptacle
3. A receptacle protected by a listed combination type arc-fault circuit-interrupter type circuit breaker

Exception No. 1: Arc-fault circuit-interrupter protection shall not be required where:

1. The replacement complies with 406.4(D)(2)(b).
2. It is impracticable to provide an equipment grounding conductor as provided by 250.130(C).
3. A receptacle protected by a listed combination type arc-fault circuit-interrupter circuit breaker is not commercially available.
4. There is no GFCI/AFCI combination receptacle commercially available.

Exception No. 2: 210.12(B) exception does not apply to replacement of receptacles.

Statement of Problem and Substantiation for Public Comment

I'm sorry but I'm totally confused as to what this exception is attempting to accomplish, and if the exceptions apply to (4)(3), or just (3). I suggest that the panel attempt to rewire with more clarity.

Related Item
First Revision No. 5105-NFPA 70-2015 [Section No. 406.4(D)(4)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 14:26:58 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The exceptions are intended to assist the installer when encountering installations that cannot be met based upon installation and product limitations.
Arc-Fault Circuit-Interrupter Protection.

Where a receptacle outlet is supplied by a branch circuit that requires, would require, arc-fault circuit-interrupter protection as specified elsewhere in this Code, if being installed under this code, a replacement receptacle at this outlet shall be one of the following:

1. A listed outlet branch-circuit type arc-fault circuit-interrupter receptacle
2. A receptacle protected by a listed outlet branch-circuit type arc-fault circuit-interrupter type receptacle
3. A receptacle protected by a listed combination type arc-fault circuit-interrupter type circuit breaker

**Exception No. 1:** Arc-fault circuit-interrupter protection shall not be required where:

1. The replacement complies with 406.4(D)(2)(b).
2. It is impracticable to provide an equipment grounding conductor as provided by 250.130(C).
3. A receptacle protected by a listed combination type arc-fault circuit-interrupter circuit breaker is not commercially available.
4. There is no GFCI/AFCI combination receptacle commercially available.

**Exception No. 2:** 210.12(B) exception does not apply to replacement of receptacles.

Statement of Problem and Substantiation for Public Comment

The current wording implies that the AFCI is not needed for a replacement receptacle if the existing branch circuit did not require AFCI protection at the time the branch circuit was installed. This change makes the code clearly reflect the intent of the rule.

**Related Item**

Public Input No. 390-NFPA 70-2014 [Section No. 406.4(D)(4)]

Submitter Information Verification

**Submitter Full Name:** DON GANIERE

**Organization:** [ Not Specified ]

**Street Address:**

**City:**

**State:**

**Zip:**

**Submittal Date:** Wed Sep 09 22:28:40 EDT 2015

Committee Statement

**Committee Action:** Rejected

**Resolution:** The proposed change does not provide any further clarity.
### Public Comment No. 632-NFPA 70-2015 [Section No. 406.4(D)(4)]

(4) Arc-Fault Circuit-Interrupter Protection.

Where a receptacle outlet is supplied by a branch circuit that requires arc-fault circuit-interrupter protection as specified elsewhere in this Code and is located in any of the areas specified in sections 210.12(A) or (B), a replacement receptacle at this outlet shall be one of the following:

1. A listed outlet branch-circuit type arc-fault circuit-interrupter receptacle
2. A receptacle protected by a listed outlet branch-circuit type arc-fault circuit-interrupter type receptacle
3. A receptacle protected by a listed combination type arc-fault circuit-interrupter type circuit breaker

Exception No. 1: Arc-fault circuit-interrupter protection shall not be required where:

1. The replacement complies with 406.4(D)(2) (b).
2. It is impracticable to provide an equipment grounding conductor as provided by 250.130(C).
3. A receptacle protected by a listed combination type arc-fault circuit-interrupter circuit breaker is not commercially available.
4. There is no GFCI/AFCI combination receptacle commercially available.

Exception No. 2: 210.12(B) exception does not apply to replacement of receptacles.

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### Statement of Problem and Substantiation for Public Comment

I disagree with the Committee statement on Public input 390-NFPA70-2014. The present "literal" wording in fact DOES force the electrician to determine whether there are any other outlets on the same branch circuit since the wording states... "supplied by a branch circuit that requires AFCI protection".... For example a receptacle installed outside does not need AFCI protection since OUTSIDE is not one of the areas specified in section 210.12(A). However, if that outside receptacle is on a branch circuit that also supplies power to the bedroom outlets then AFCI protection would be needed for the outside receptacle since branch circuits supplying bedroom outlets ARE required to have AFCI protection. How would the electrician know if any other outlets are on the same branch circuit with the outside outlet unless he went through the entire building to make sure that no other outlets are on the same circuit? If the outside outlet was on an individual circuit then it would not need AFCI protection according to 210.12. But how would you know unless you went to every room in the building to make sure there was not some other receptacle hidden behind a dresser or a couch? I think my proposed wording will help simplify the process and still increase the level of safety for those receptacles installed in any areas requiring AFCI protection.

**Related Item**

Public Input No. 390-NFPA 70-2014 [Section No. 406.4(D)(4)]

### Submitter Information Verification

**Submitter Full Name:** RUSS LEBLANC  
**Organization:** EC AND M MAGAZINE

**Street Address:**  
**City:**  
**State:**  
**Zip:**

**Submittal Date:** Sun Sep 13 14:38:29 EDT 2015

### Committee Statement

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-5105-NFPA 70-2015

**Statement:** Reference to sections 210.12(A) or (B) was added to clarify where Arc-Fault Circuit Interruption is required. In Exception No. 1, sub-item 4, the word "combination" was replaced with "dual function" to eliminate the potential for confusion since the word "combination" when used with AFCI protection usually refers to protection against series arc and parallel arcs. The phrase "all of the following apply" was added to Exception No. 1 to clarify the application of the four sub-items. Additionally Exception No. 1, sub-item 3 was changed to clarify that it applies to the availability of the circuit breaker rather than the receptacle.
Public Comment No. 908-NFPA 70-2015 [Section No. 406.4(D)(4)]

(4) Arc-Fault Circuit-Interrupter Protection.

Where a receptacle outlet is supplied by a branch circuit that requires arc-fault circuit-interrupter protection as specified elsewhere in this Code, a replacement receptacle at this outlet shall be one of the following:

1. A listed outlet branch-circuit type arc-fault circuit-interrupter receptacle
2. A receptacle protected by a listed outlet branch-circuit type arc-fault circuit-interrupter type receptacle
3. A receptacle protected by a listed combination type arc-fault circuit-interrupter type circuit breaker

Exception No. 1: Arc-fault circuit-interrupter protection shall not be required where:

1. The replacement complies with 406.4(D)(2) (b).
2. It is impracticable to provide an equipment grounding conductor as provided by 250.130(C).
3. A receptacle protected by a listed combination type arc-fault circuit-interrupter circuit breaker is not commercially available.
4. There is no GFCI/AFCI combination dual function receptacle commercially available.

Exception No. 2: 210.12(B) exception does not apply to replacement of receptacles.

Statement of Problem and Substantiation for Public Comment

IEC's position is to replace the word "combination" with "dual function" in 406.4(D)(4) exception 1 item 4 - (FR 5105)

The word combination as used with AFCI protection refers to series arcs and parallel arcs. Dual function means that the device can provide more than one protection method.

Related Item
First Revision No. 5105-NFPA 70-2015 [Section No. 406.4(D)(4)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 19:40:35 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5105-NFPA 70-2015
Statement: Reference to sections 210.12(A) or (B) was added to clarify where Arc-Fault Circuit Interruption is required. In Exception No. 1, sub-item 4, the word "combination" was replaced with "dual function" to eliminate the potential for confusion since the word "combination" when used with AFCI protection usually refers to protection against series arc and parallel arcs. The phrase "all of the following apply" was added to Exception No. 1 to clarify the application of the four sub-items. Additionally Exception No. 1, sub-item 3 was changed to clarify that it applies to the availability of the circuit breaker rather than the receptacle.
406.5   Receptacle Mounting.

Receptacles shall be mounted in identified boxes or assemblies. The boxes or assemblies shall be securely fastened in place unless otherwise permitted elsewhere in this Code. Screws used for the purpose of attaching receptacles to a box shall be of the type provided with a listed receptacle, or shall be machine screws having 32 threads per inch or part of listed assemblies or systems, in accordance with the manufacturer’s instructions.

(A)   Boxes That Are Set Back.

Receptacles mounted in boxes that are set back from the finished surface as permitted in 314.20 shall be installed such that the mounting yoke or strap of the receptacle is held rigidly at the finished surface.

(B)   Boxes That Are Flush.

Receptacles mounted in boxes that are flush with the finished surface or project therefrom shall be installed such that the mounting yoke or strap of the receptacle is held rigidly against the box or box cover.

(C)   Receptacles Mounted on Covers.

Receptacles mounted to and supported by a cover shall be held rigidly against the cover by more than one screw or shall be a device assembly or box cover listed and identified for securing by a single screw.

(D)   Position of Receptacle Faces.

After installation, receptacle faces shall be flush with or project from faceplates of insulating material and shall project a minimum of 0.4 mm (0.015 in.) from metal faceplates.

Exception: Listed kits or assemblies encompassing receptacles and nonmetallic faceplates that cover the receptacle face, where the plate cannot be installed on any other receptacle, shall be permitted.

(E)   Receptacles in Countertops.

Receptacle outlets, assemblies, for installation in countertops, countertop surfaces, shall be listed for countertop applications. Where receptacle assemblies for countertop applications are required to provide ground-fault circuit-interrupter protection for personnel in accordance with 210.8, such assemblies shall be permitted to be listed as GFCI receptacle assemblies for countertop applications.

(F)   Receptacles in Work Surfaces.

Receptacle outlet assemblies and GFCI receptacle assemblies listed for use in work surfaces, or countertop applications, shall be permitted to be installed in work surfaces.

(G)   Receptacle Orientation.

Receptacles shall not be installed in a face-up position in countertops, or on countertop surfaces or work surfaces unless listed for the purpose of countertop or work surface applications.

(H)   Receptacles in Seating Areas and Other Similar Surfaces.

In seating areas or similar surfaces, receptacles shall not be installed in a face-up position unless the receptacle is any of the following:

(1) Part of an assembly listed as a furniture power distribution unit
(2) Part of an assembly listed either as household furnishings or as commercial furnishings
(3) Listed either as a receptacle assembly for countertop applications or as a GFCI receptacle assembly for countertop applications
(4) Installed in a listed floor box

(I)   Exposed Terminals.

Receptacles shall be enclosed so that live wiring terminals are not exposed to contact.

(J)   Voltage Between Adjacent Devices.

A receptacle shall not be grouped or ganged in enclosures with other receptacles, snap switches, or similar devices, unless they are arranged so that the voltage between adjacent devices does not exceed 300 volts, or unless they are installed in enclosures equipped with identified, securely installed barriers between adjacent devices.

Statement of Problem and Substantiation for Public Comment

There are differences between the terms “receptacle”, “receptacle outlet” and “receptacle assembly”. The Panel is confusing Article 100 Code-defined terms with imprecise commercial vernacular in 406.5(E) and new 406.5(F). Also FR 5108 now uses the terms inconsistently throughout these subsections of 406.5. Compare FR 5108’s new first sentence’s use of “receptacle outlets” with “receptacle assemblies” in the second sentence for 406.5(E), as an example. Compare FR 5108’s use of “receptacle outlets” in...
406.5(E) and new 406.5(F) with “receptacle assemblies” in renumbered 406.5(H)(3), as another example.

As presently written in FR5108, this imprecise use of terms could be ambiguously misinterpreted that REGULAR receptacles (i.e., “Receptacle outlets”) installed in VERTICAL backsplashes of countertops (i.e., NOT mounted face-up but face-out) would now have to be ADDITIONALLY listed as suitable for countertop applications. This ambiguity would preclude most eligible listed receptacles (installed FACE-OUT on countertop backsplashes) that are presently permitted because those would not be “listed for countertop applications”.

In accordance with NEC® Style Manual 2.1.5.2, titles are needed for new subdivisions 406.5(F) and 406.5(G). Subdivision titles should also appear consistently in boldface type.

In accordance with NEC® Style Manual 3.2.1, new 406.5(G)’s “for the purpose” is a vague and unenforceable term.

**Related Item**

First Revision No. 5108-NFPA 70-2015 [Sections 406.5(E), 406.5(F), 406.5(G), 406.5(H)]

### Submitter Information Verification

- **Submitter Full Name:** BRIAN ROCK
- **Organization:** HUBBELL INCORPORATED
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Thu Jun 25 13:31:24 EDT 2015

### Committee Statement

- **Committee Action:** Accepted
- **Resolution:** SR-5106-NFPA 70-2015
- **Statement:**
  406.5 (E) and (F) were reworded slightly to clarify that they apply only to horizontally mounted receptacle assemblies and not to assemblies mounted vertically in a counter backsplash. In accordance with NEC® Style Manual 2.1.5.2, titles were added for new subdivisions 406.5(F) and 406.5(G). Subdivision titles should also appear consistently in boldface type. In accordance with NEC® Style Manual 3.2.1, new 406.5(G)’s “for the purpose” is a vague and unenforceable term and has been replaced by “countertop or work surface applications”.


Public Comment No. 468-NFPA 70-2015 [Sections 406.5(F), 406.5(G)]

Sections 406.5(F), 406.5(G)

(F) Listed for Work Surfaces.
Receptacle outlet assemblies listed for use in work surfaces or countertops shall be permitted to be installed in work surfaces.

(G) Face-Up Placement.
Receptacles shall not be installed in a face-up position in countertops or work surfaces unless listed for the purpose.

Statement of Problem and Substantiation for Public Comment

I suggested some titles.

Related Item
First Revision No. 5108-NFPA 70-2015 [Sections 406.5(E), 406.5(F), 406.5(G), 406.5(H)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 14:31:04 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The titles suggested do not accurately reflect the content. See revision to section 406.5 (Second Revision No. 5106).
406.13 Locking Support and Mounting Receptacle and Attachment Fitting Combination.

(A) Locking support and mounting receptacle shall be listed and marked with the manufacturer's name or identification, and voltage and ampere rating.

(B) Listing locking support and mounting receptacle in combination with recognized attachment fitting shall be permitted to support and supply ceiling- or wall-luminaires and ceiling-suspended luminaires, and ceiling-suspended (paddle) fans.

(C) Locking support and mounting receptacle and attachment fitting combinations shall be of the grounding-type and shall be connected to the equipment grounding conductors in accordance with 250.130(C).

(D) Locking support and mounting receptacle and attachment fitting combinations used to connect and support ceiling-suspended (paddle) fans and luminaires shall only be permitted to be used with outlet boxes conforming to 314.27(E) installed as required by 314.23.

Informational Note: Locking support and mounting receptacles when used in conjunction with compatible attachment fitting are designed to connect, supply and support individual ceiling- or wall-mounted luminaires and ceiling-suspended (paddle) fans.

Statement of Problem and Substantiation for Public Comment

SUBSTANTIATION:
New text was proposed and approved for 314.27(E) by CMP 9 in FR 2411 that read as follows:

(E) Separable Attachment Fittings. Outlet boxes shall be permitted to support listed locking support and mounting receptacles used in combination with compatible attachment fittings designed for the support of equipment covered within and subject to all weight and orientation limits contemplated by the listing. Where such fittings are used, the equipment mounted shall comply with 314.27(A) through (D) as applicable. Where the supporting receptacle is installed within a box, it shall be included in the fill calculation covered in 314.16(B)(4).

This proposed new text in 406.13 is needed because it coordinates with the new 314.27(E), and must also be covered under the article on receptacles for clarity.

Related Item
First Revision No. 2411-NFPA 70-2015 [Section No. 314.27]
Public Input No. 4199-NFPA 70-2014 [New Section after 406.15]

Submitter Information Verification

Submitter Full Name: AMY CRONIN
Organization: STRATEGIC CODE SOLUTIONS LLC
Affiliation: Safety Quick Lighting and Fans Corp.
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 15 15:15:33 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Item (A) is unnecessary since receptacles are already required to be listed. The panel interprets the use of the word "recognized" in item (B) to refer to Qualified Testing Laboratory recognition. The Qualified Testing Laboratory component recognition programs are not acknowledged in the code. The item (D) reference to 314.27(E) is superfluous as 314.27(E) stands on its own. A new section in the code is not required since AHJ's look for the certification mark to determine suitability of product for the installation along with other requirements. As a listed or certified product there is no prohibition for its installed use. See Second Revision No. 5128.
### 406.12 Tamper-Resistant Receptacles.

Tamper-resistant receptacles shall be installed as specified in 406.12(A) through (G).

**A** Dwellings Units.

In all areas specified in 210.52 and 550.13, all nonlocking-type 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.

**B** Guest Rooms and Guest Suites of Hotels and Motels.

All nonlocking-type 15- and 20-ampere receptacles located in guest rooms and guest suites of hotels and motels shall be listed tamper-resistant receptacles.

**C** Child Care Facilities.

In all child care facilities, all nonlocking-type 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.

**D** Preschools and Elementary Education Facilities.

All nonlocking-type, 15- and 20-ampere receptacles located in preschools and elementary education facilities shall be listed tamper-resistant receptacles.

**E** Business Offices, Corridors, Waiting Rooms and the Like in Clinics, Medical and Dental Offices and Outpatient Facilities.

All nonlocking-type, 15- and 20-ampere receptacles located in business offices, corridors, waiting rooms, and the like in clinics, medical and dental offices, and outpatient facilities shall be listed tamper-resistant receptacles.

**F** Subset of Assembly Occupancies Described in Article 518.2 to Include Places of Waiting Transportation, Gymnasiums, Skating Rinks, and Auditoriums.

All nonlocking-type, 15- and 20-ampere receptacles located in places of waiting transportation, gymnasiums, skating rinks, and auditoriums shall be listed tamper-resistant receptacles.

**G** Dormitories.

All nonlocking-type, 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.

Exception to (A), (B), (C), and (D), (E), (F), and (G): Receptacles in the following locations shall not be required to be tamper resistant:

1. Receptacles located more than 1.7 m (5 1/2 ft) above the floor
2. Receptacles that are part of a luminaire or appliance
3. A single receptacle or a duplex receptacle for two appliances located within the dedicated space for each appliance that, in normal use, is not easily moved from one place to another and that is cord-and plug-connected in accordance with 400.10(A)(6), (A)(7), or (A)(8)
4. Non-grounding receptacles used for replacements as permitted in 406.4(D)(2)(a)

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**Statement of Problem and Substantiation for Public Comment**

There was no technical substantiation for these changes. Exactly how many injuries have occurred in the waiting are of ice skating rinks? Furthermore, this rule was about protecting children, so why are we installing them in dormitories? I was one of only two people in the state of Utah who argued FOR tamper resistant receptacles in 2008 when our legislature was trying to get rid of them. I am an advocate and a believer in these devices, but the creation of new rules needs to be the result of real world incidents, data, and cost benefit analysis.

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**Related Item**

First Revision No. 5112-NFPA 70-2015 [Section No. 406.12]

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**Submitter Information Verification**

**Submitter Full Name:** RYAN JACKSON  
**Organization:** RYAN JACKSON  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Fri Sep 25 15:26:05 EDT 2015
<table>
<thead>
<tr>
<th>Committee Statement</th>
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</thead>
<tbody>
<tr>
<td><strong>Committee Action:</strong> Rejected</td>
</tr>
<tr>
<td><strong>Resolution:</strong> The Panel agrees in extending the use of TR type receptacles in other locations that a child may occupy.</td>
</tr>
</tbody>
</table>
406.12  Tamper-Resistant Receptacles.

Tamper-resistant receptacles shall be installed as All 15- and 20-ampere, 125- and 250-volt nonlocking-type receptacles in the areas specified in 406.12(A) through (G) shall be listed tamper-resistant receptacles.

Informational Note: The types of receptacles covered by this requirement are identified as 5-15, 5-20, 6-15 and 6-20 in ANSI/NEMA WD 6-2012, Standard for Dimensions of Attachment Plugs and Receptacles.

(A)  Dwelling Units.
In all areas specified in 210.52 and 550.13, all nonlocking-type 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.

(B)  Guest Rooms and Guest Suites of Hotels and Motels.
All nonlocking-type 15- and 20-ampere receptacles located in guest rooms and guest suites of hotels and motels shall be listed tamper-resistant receptacles.

(C)  Child Care Facilities.
In all child care facilities, all nonlocking-type 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.

(D)  Preschools and Elementary Education Facilities.
All nonlocking-type, 15- and 20-ampere receptacles located in preschools and elementary education facilities shall be listed tamper-resistant receptacles.

(E)  Business Offices, Corridors, Waiting Rooms and the Like in Clinics, Medical and Dental Offices and Outpatient Facilities.
All nonlocking-type, 15- and 20-ampere receptacles located in business offices, corridors, waiting rooms, and the like in clinics, medical and dental offices, and outpatient facilities shall be listed tamper-resistant receptacles.

(F)  Subset of Assembly Occupancies Described in Article 518.2 to Include Places of Waiting Transportation, Gymnasiums, Skating Rinks, and Auditoriums.
All nonlocking-type, 15- and 20-ampere receptacles located in places of waiting transportation, gymnasiums, skating rinks, and auditoriums shall be listed tamper-resistant receptacles.

(G)  Dormitories.
All nonlocking-type, 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.

Exception to (A), (B), (C), (D), (E), (F), and (G): Receptacles in the following locations shall not be required to be tamper resistant:

1. Receptacles located more than 1.7 m (5 1/2 ft) above the floor
2. Receptacles that are part of a luminaire or appliance
3. A single receptacle or a duplex receptacle for two appliances located within the dedicated space for each appliance that, in normal use, is not easily moved from one place to another and that is cord-and-plug-connected in accordance with 400.10(A)(6), (A)(7), or (A)(8)
4. Nongrounding receptacles used for replacements as permitted in 406.4(D)(2)(a)

Statement of Problem and Substantiation for Public Comment

The intent is to cover the common receptacles found in these locations and not to apply this requirement to special configurations that may be required for certain dedicated equipment where tamper-resistant devices are not available. The language was also changed so as not to repeat the common requirement in each paragraph.

Related Item
First Revision No. 5112-NFPA 70-2015 [Section No. 406.12]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Committee Statement

<table>
<thead>
<tr>
<th>Committee Action:</th>
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<tbody>
<tr>
<td>Resolution:</td>
<td>SR-5107-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement:</td>
<td>The intent of 406.12 is to cover the common receptacles found in these locations and not to apply this requirement to special configurations that may be required for certain dedicated equipment where tamper-resistant devices are not available. The language was also changed so as not to repeat the common requirement in each paragraph.</td>
</tr>
</tbody>
</table>
Public Comment No. 1125-NFPA 70-2015 [Section No. 406.12(D)]

**Statement of Problem and Substantiation for Public Comment**

By specifying public and private educational facilities no ambiguous application or need for interpretation is required by either designers or inspectors what facilities tamper resistant receptacles are required. Elementary schools, typically K through 6th, encompasses children ages 5 to 11 and setting a 2nd grade cap (normally age 7) is a reasonable limit to protect children who are not necessarily aware of the dangers of placing foreign objects into receptacles.

**Related Item**

First Revision No. 5112-NFPA 70-2015 [Section No. 406.12]

**Submitter Information Verification**

Submitter Full Name: Joe DuPriest  
Organization: Orange County Public Schools  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Sep 23 20:33:40 EDT 2015

**Committee Statement**

Committee Action: Rejected  
Resolution: The NEC applies to any installation public or private. It is also based upon a child's age not educational grade (i.e. pre-K through 2nd).
Public Comment No. 308-NFPA 70-2015 [Section No. 406.12(F)]

(F) Subset of Assembly Occupancies Described in Article 518.2 to Include Places of Waiting Transportation, Gymnasiums, Skating Rinks, and Auditoriums.

All nonlocking-type, 15- and 20-ampere receptacles located in places of waiting transportation, gymnasiums, skating rinks, and where accessible to the general public in auditoriums shall be listed tamper-resistant receptacles.

Statement of Problem and Substantiation for Public Comment

This public comment relates to changes in FR 5112.

Auditoriums covered by article 518 may contain receptacles to service sound, lighting, and other presentation equipment that are not accessible to the general public. There is no reason to mandate tamper-resistant receptacles in auditorium areas that are not accessible to the general public.

In addition, though the current wording of 406.12(F) created by FR 5112 is limited to a "subset of assembly occupancies described in article 518.2", the wording of 406.12(F) has the potential to create a great deal of confusion. Theaters and similar locations covered by article 520 also include auditoriums that are the audience seating areas of theaters. Auditoriums in theaters contain numerous positions to service stage equipment that are not accessible to the general public. There is no reason to mandate tamper-resistant receptacles in auditorium areas that are not accessible to the general public, but the existing wording of 406.12(F) may result in the misapplication of these requirements to auditoriums in theaters.

Finally, the word "article" was deleted from this section because the reference is to a section, not an article.

Related Item
First Revision No. 5112-NFPA 70-2015 [Section No. 406.12]

Submitter Information Verification

Submitter Full Name: STEVEN TERRY
Organization: ELECTRONIC THEATRE CONTROLS INC
Affiliation: US Institute for Theatre Technology
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 28 12:01:10 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The utilization of TR receptacles is not limited to 'general public' areas but rather to any location. To limit TR receptacles to only general public access areas would reduce the potential safety afforded by these devices.
Public Comment No. 1133-NFPA 70-2015 [Section No. 406.12(G)]

(G) Dormitories.

All nonlocking-type, 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles.

Exception to (A), (B), (C), (D), (E), (F), and (G): Receptacles in the following locations shall not be required to be tamper resistant:

1. Receptacles located more than 1.7 m (5 1/3 ft) above the floor
2. Receptacles that are part of a luminaire or appliance
3. A single receptacle or a duplex receptacle for two appliances located within the dedicated space for each appliance that, in normal use, is not easily moved from one place to another and that is cord-and plug-connected in accordance with 400.10(A)(6), (A)(7), or (A)(8)
4. Nongrounding receptacles used for replacements as permitted in 406.4(D)(2)(a)
5. Post Secondary Educational Facilities both public and private

Statement of Problem and Substantiation for Public Comment

It is a viable expectation that dormitories for private schools who serve children contain tamper proof receptacles, but post secondary facilities house adults who are fully capable of recognizing the dangers of attempting to place a foreign objects into an electrical receptacle.

Related Item
First Revision No. 5112-NFPA 70-2015 [Section No. 406.12]

Submitter Information Verification

Submitter Full Name: Joe DuPriest
Organization: Orange County Public Schools
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 21:24:42 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel continues to extend the use of TR type receptacles in other locations that a child may occupy. Some college dormitories are dual classified as R1/R2 locations and used as summertime transient occupancy of children.
Public Comment No. 168-NFPA 70-2015 [ Section No. 408.3(A)(2) ]

(2) Service Panelboards, Switchboards, and Switchgear.

Barriers shall be placed in all service panelboards, switchboards, and switchgear such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

Exception No. 1: This provision shall not apply to service panelboards with provisions for more than one service disconnect within a single enclosure as permitted in 408.36, Exceptions 1, 2, and 3.

Exception No. 2: This provision shall not apply to service rated transfer switches that do not contain an integral panelboard.

Exception No. 3: This provision shall not apply to an individual disconnecting means that is listed as suitable for use as service equipment.

Statement of Problem and Substantiation for Public Comment

Service rated transfer switches contain overcurrent protection for the service conductors, and the overcurrent protection device is generally a circuit breaker. The barrier requirements for service rated panelboards could be improperly enforced on these types of transfer switches, when these switches do not contain integral panelboards. Adding the exception of individual service disconnects again enforces the code language that the requirements are for main breaker panelboards that are installed as the electrical service, not an individual service disconnecting means that is installed upstream of a distribution subpanel. Changing "does not" to "shall not" in the first exception brings the language in line with the requirements of 90.5(A)

Related Item

First Revision No. 2424-NFPA 70-2015 [Section No. 408.3(A)(2)]

Submitter Information Verification

Submitter Full Name: BRIAN BAUGHMAN
Organization: GENERAC POWER SYSTEMS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 07 11:40:06 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2410-NFPA 70-2015
Statement: The Panel has replaced the phrase "provision does" with the phrase "requirement shall" to be consistent with current code terminology. The proposed added Exceptions 2 & 3 in comment 168 contain language that is not subject to the provisions of 408.3(A)(2) and are therefore rejected, although the concerns of the submitter are met as the concepts included in the proposed exceptions are already excluded from the cited requirements.
(C) Used as Service Equipment.

Each switchboard, switchgear, or panelboard, if used as service equipment, shall be provided with a main bonding jumper sized in accordance with 250.28(D) or the equivalent placed within the panelboard or one of the sections of the switchboard or switchgear for connecting the grounded service conductor on its supply side to the switchboard, switchgear, or panelboard frame. All sections of a switchboard or switchgear shall be bonded together using a supply-side bonding jumper sized in accordance with 250.102 or 250.102(C)(1) as applicable.

Exception: Switchboards, switchgear, and panelboards used as service equipment on high-impedance grounded neutral systems in accordance with 250.36 shall not be required to be provided with a main bonding jumper.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 2425

Related Item

First Revision No. 2425-NFPA 70-2015 [Section No. 408.3(C)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 08:46:59 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2412-NFPA 70-2015
Statement: The terms "an equipment bonding jumper or" are added to reinstate previous language that was inadvertently removed during the First Draft process. The term "Jumper" is being inserted in place of the term "conductor" to correlate with terms commonly used and defined in Articles 100 and 250 of the NEC. The reference to 250.122 is the proper replacement for the incorrect reference to 250.102 regarding the previously mentioned omitted language.
Public Comment No. 264-NFPA 70-2015 [Section No. 408.3(C)]

(C) Used as Service Equipment.

Each switchboard, switchgear, or panelboard, if used as service equipment, shall be provided with a main bonding jumper sized in accordance with 250.28(D) or the equivalent placed within the panelboard or one of the sections of the switchboard or switchgear for connecting the grounded service conductor on its supply side to the switchboard, switchgear, or panelboard frame. All sections of a switchboard or switchgear shall be bonded together using an equipment bonding conductor or a supply-side bonding jumper sized in accordance with 250.102 or 250.102(C)(1) as applicable.

Exception: Switchboards, switchgear, and panelboards used as service equipment on high-impedance grounded neutral systems in accordance with 250.36 shall not be required to be provided with a main bonding jumper.

Statement of Problem and Substantiation for Public Comment

The original wording approved by CMP 9 is not contained in FR 2425. The mark-up above is based on the final wording that would result from the FR as written in the ballot. The above would correct to the wording in the ballot to the wording approved by CMP 9. The original wording approved by CMP 9 is as follows:

(C) Used as Service Equipment.

Each switchboard, switchgear, or panelboard, if used as service equipment, shall be provided with a main bonding jumper sized in accordance with 250.28(D) or the equivalent placed within the panelboard or one of the sections of the switchboard or switchgear for connecting the grounded service conductor on its supply side to the switchboard, switchgear, or panelboard frame. All sections of a switchboard or switchgear shall be bonded together using an equipment bonding conductor or supply-side bonding jumper sized in accordance with 250.122 or 250.102(C)(1) as applicable.

Related Item

First Revision No. 2425-NFPA 70-2015 [Section No. 408.3(C)]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 17 10:35:58 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2412-NFPA 70-2015
Statement: The terms "an equipment bonding jumper or" are added to reinstate previous language that was inadvertently removed during the First Draft process. The term "Jumper" is being inserted in place of the term "conductor" to correlate with terms commonly used and defined in Articles 100 and 250 of the NEC. The reference to 250.122 is the proper replacement for the incorrect reference to 250.102 regarding the previously mentioned omitted language.
(B) Around Switchboards and Switchgear.
Clearances around switchboards and switchgear shall comply with the provisions of 110.26 or 110.32 for up to 1000 volts as applicable.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that FR 2428 be reviewed and correlated with FR 18. Panel 1 has revised the voltage levels and distances in Table 110.26(A)(1) up to and including 1000 volts, so this reference to 110.32 in 408.18(B) is not necessary.

Related Item
First Revision No. 2428-NFPA 70-2015 [Section No. 408.18(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 08:47:58 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2411-NFPA 70-2015
Statement: The reference to 110.32 is no longer applicable due to the recent change in the scope of article 408, 1000 volts and less, and the revision of the voltage range provided for in 110.26 for 1000 volts, nominal, or less.
408.51 Busbars.
Insulated or bare busbars shall be **rigidly mounted** installed and torqued per the listing and installation requirements.

**Statement of Problem and Substantiation for Public Comment**

I feel that the term "rigidly mounted" is non-enforceable and the language I have provided is better understood to the installer and the electrical inspector.

**Related Item**
Public Input No. 1041-NFPA 70-2014 [Section No. 408.51]

**Submitter Information Verification**
- **Submitter Full Name:** Joseph Wages
- **Organization:** International Association of E
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Mon Jul 20 08:32:10 EDT 2015

**Committee Statement**
- **Committee Action:** Rejected
- **Resolution:** Use of the terms "installed and torqued per the listing and installation requirements" does not provide a better understanding of the requirement. The current language is clear and used in at least two other locations in the NEC. CMP-9 also discussed the improper use of the term "per" and previous efforts to eliminate its use.
Public Comment No. 287-NFPA 70-2015 [Section No. 408.54]

408.54 Maximum Number of Overcurrent Devices.

A panelboard or switchboard shall be provided with physical means to prevent the installation of more overcurrent devices than that number for which the panelboard was designed, rated, and listed.

For the purposes of this section, a 2-pole circuit breaker or fusible switch shall be considered two overcurrent devices; a 3-pole circuit breaker or fusible switch shall be considered three overcurrent devices.

Statement of Problem and Substantiation for Public Comment

The resolution stated "Since switchboards are generally larger than panelboards this additional requirement is not necessary or practical as switchboards are judged on adequacy of wiring space not number of circuits."

My original substantiation cited the "six-main" rule. If a main-lug-only switchboard is used for service-entrance purposes, ref. 230.71, the maximum number of disconnects allowed is six. In that case, the switchboard will be manufactured to exclude more than six sets of fuses or circuit breakers the same as would a panelboard used for a like purpose. The volume of the switchboard has nothing to do with the requirement. The mandate of the NEC, section 230.71 does. The proposed change causes 408.54 to conform to 230.71.

Additionally, it causes the section to conform to Table 450.3(B), Note 2 "2. Where secondary overcurrent protection is required, the secondary overcurrent device shall be permitted to consist of not more than six circuit breakers or six sets of fuses grouped in one location. Where multiple overcurrent devices are utilized, the total of all the device ratings shall not exceed the allowed value of a single overcurrent device."

Related Item

Public Input No. 1580-NFPA 70-2014 [Section No. 408.54]

Submitter Information Verification

Submitter Full Name: DAVID BREDHOLD
Organization: C&I Engineering
Affiliation: Employee
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 23 04:52:13 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Adding "or switchboards" at 408.54 is an inappropriate location for this proposed requirement and is not intended to address the 6 disconnect rule. Perhaps a better location for this proposed change would have been a new 408.23 in Part II of Article 408, which is titled, "Switchboards and Switchgear." Even if proposed for the appropriate location in Part II, the panel statement for PI 1580 is still applicable. Since switchboards are generally larger than panelboards this additional requirement is not necessary or practical as switchboards are judged on adequacy of wiring space not number of circuits. 230.71 addresses the maximum number of service disconnecting means and the product standards address the construction of the equipment as it leaves the factory.
Public Comment No. 1800-NFPA 70-2015 [Section No. 409.22]

409.22 Short-Circuit Current Rating.

An industrial control panel shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with 409.110(4).

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that this First Revision be reviewed by the panel with regard to similar text in 409.22. The panel shall consider reviewing the proper use of the terms “fault current” and “short circuit current”.

Related Item
First Revision No. 3002-NFPA 70-2015 [New Section after 409.22]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 08:49:03 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3003-NFPA 70-2015
Statement: “Fault” current is replaced by “short-circuit” current for improved clarity. Throughout the NEC®, “fault” current can be replaced by “short-circuit” current, without changing the intent. However, “short-circuit” current cannot be universally changed to “fault” current without causing confusion. For example, equipment short-circuit current rating could not be changed to equipment fault current rating without causing much confusion. CMP 11 asks the Correlating Committee to direct all Code Making Panels to replace “fault” current with “short-circuit” current throughout the NEC®.

In order to further improve clarity surrounding “short-circuit” current versus “fault” current, 409.22 is combined with 409.23 as has been done in the new 440.10. The previous text in 409.22 now becomes first level subdivision (A), titled “Installation”, and the text in 409.23 becomes first level subdivision (B). The title of 409.23, “Available Fault Current”, is changed to “Documentation” as the new title of first level subdivision (B).
Public Comment No. 1033-NFPA 70-2015 [Section No. 409.23]

Available Fault Current

When an industrial control panel is required to be marked with a short circuit current rating in accordance with 409.110(4), the available short circuit current at the industrial control panel and the date the short circuit current calculation was performed shall be documented and made available to those authorized to inspect the installation.

Statement of Problem and Substantiation for Public Comment

While it is certainly important for industrial control panels to have an adequate short circuit current rating, this may be said for ALL electrical equipment. This is clearly covered in Sections 110.9 and 110.10. This requirement should be in Article 110 and not proliferated throughout the Code as it is a fundamental requirement that applies to all equipment.

Related Item
First Revision No. 3002-NFPA 70-2015 [New Section after 409.22]

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 10:22:08 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The Panel reaffirms its position that documentation of the available short-circuit current and the date will increase safety. It will create safer installations by adding language to assist the installer and the Authority Having Jurisdiction (AHJ). Documentation with a date can actually reduce liability for contractors, inspectors, and manufacturers, by identifying that equipment was originally installed correctly. The extra emphasis is needed because the requirements are not being met, thereby causing issues with code compliance and inspection requirements.
Available Fault Current.

When an industrial control panel is required to be marked with a short circuit current rating in accordance with 409.110(4), the available short circuit fault current at the industrial control panel and the date the short circuit fault current calculation was performed shall be documented and made available to those authorized to inspect the installation.

**Statement of Problem and Substantiation for Public Comment**

The wording change is suggested for consistency with code language in sections 110.9, 440.10, etc and with this section's own title.

**Related Item**

Public Input No. 4421-NFPA 70-2014 [New Section after 409.22]
Public Input No. 4733-NFPA 70-2014 [New Section after 409.22]

**Submitter Information Verification**

Submitter Full Name: CHARLES POWELL
Organization: EASTMAN CHEMICAL COMPANY
Affiliation: American Chemistry Council
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 14 08:04:22 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR
Resolution: SR-3003-NFPA 70-2015
Statement: “Fault” current is replaced by “short-circuit” current for improved clarity. Throughout the NEC®, “fault” current can be replaced by “short-circuit” current, without changing the intent. However, “short-circuit” current cannot be universally changed to “fault” current without causing confusion. For example, equipment short-circuit current rating could not be changed to equipment fault current rating without causing much confusion. CMP 11 asks the Correlating Committee to direct all Code Making Panels to replace “fault” current with “short-circuit” current throughout the NEC®.

In order to further improve clarity surrounding “short-circuit” current versus “fault” current, 409.22 is combined with 409.23 as has been done in the new 440.10. The previous text in 409.22 now becomes first level subdivision (A), titled “Installation”, and the text in 409.23 becomes first level subdivision (B). The title of 409.23, “Available Fault Current”, is changed to “Documentation” as the new title of first level subdivision (B).
Statement of Problem and Substantiation for Public Comment

IEC's position is to delete 409.23 - (FR 3002)

The code already requires that equipment be installed according to available fault current, so adding this requirement is redundant. The installer/supplier already has the responsibility/liability to install the proper equipment based on the characteristics of the system. This proposal puts too much liability on the contractor/supplier because after installation various factors can change which will affect the available fault current. Feeders can be reworked, transformers can be changed with different impedance values, motor loads can be added to the existing system and similar factors that can change the available fault current. In the case of a lawsuit, the installer will have the burden of proof that the installation was done according to code and would result in unnecessary costs for defending an installation that was installed correctly, but that had variables change that are out of their control.

A better proposal would be to require the owner to relabel the equipment after any alteration to the system.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Comment No. 631-NFPA 70-2015 [Section No. 430.99]</td>
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<tr>
<td>Public Comment No. 748-NFPA 70-2015 [Section No. 620.51(D)(2)]</td>
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<tr>
<td>Public Comment No. 749-NFPA 70-2015 [Section No. 700.5(E)]</td>
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<tr>
<td>Public Comment No. 750-NFPA 70-2015 [Section No. 701.5(D)]</td>
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<td>Public Comment No. 751-NFPA 70-2015 [Section No. 702.5]</td>
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<td>Public Comment No. 752-NFPA 70-2015 [Section No. 708.24(E)]</td>
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<tr>
<td>Public Comment No. 755-NFPA 70-2015 [Section No. 670.5(2)]</td>
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<tr>
<td>Public Comment No. 754-NFPA 70-2015 [Section No. 440.10(B)]</td>
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<tr>
<td>First Revision No. 3002-NFPA 70-2015 [New Section after 409.22]</td>
<td></td>
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</table>

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 12 19:06:41 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The Panel reaffirms its position that documentation of the available short-circuit current and the date will increase safety. It will create safer installations by adding language to assist the installer and the Authority Having Jurisdiction (AHJ). Documentation with a date can actually reduce liability for contractors, inspectors, and manufacturers, by identifying that equipment was originally installed correctly. The extra emphasis is needed because the requirements are not being met, thereby causing issues with code compliance and inspection requirements.
409.110 Marking.  

An industrial control panel shall be marked with the following information that is plainly visible after installation:

1. Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified.

2. Supply voltage, number of phases, frequency, and full-load current for each incoming supply circuit.

3. Industrial control panels supplied by more than one electrical source such that more than one disconnecting means is required to disconnect all circuits within the control panel shall be marked to indicate that more than one disconnecting means is required to de-energize the equipment. The location of the means necessary to disconnect all circuits 50-volts and over shall be documented and available.

4. Short-circuit current rating of the industrial control panel based on one of the following:
   a. Short-circuit current rating of a listed and labeled assembly
   b. Short-circuit current rating established utilizing an approved method
      
      Informational Note: ANSI/UL 508A, Standard for Industrial Control Panels, Supplement SB, is an example of an approved method.
      
      Exception to (4): Short-circuit current rating markings are not required for industrial control panels containing only control circuit components.

5. If the industrial control panel is intended as service equipment, it shall be marked to identify it as being suitable for use as service equipment.

6. Electrical wiring diagram or the identification number of a separate electrical wiring diagram or a designation referenced in a separate wiring diagram.

7. An enclosure type number shall be marked on the industrial control panel enclosure.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that the phrase “50-volts and over” be changed to “50 volts or more” to correlate with other parts of the Code.

Related Item
First Revision No. 3001-NFPA 70-2015 [Section No. 409.110]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 08:49:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3004-NFPA 70-2015
Statement: The revised text clarifies that the marking requirement only applies to circuits of 50 volts or more. “50-volts and over” has been changed to “50-volts or more”, to better correlate with other parts of this Code.
409.110  Marking.

An industrial control panel shall be marked with the following information that is plainly visible after installation:

(1) Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified.

(2) Supply voltage, number of phases, frequency, and full-load current for each incoming supply circuit.

(3) Industrial control panels supplied by more than one electrical source such that more than one disconnecting means is required to disconnect all circuits 50-volts and over within the control panel shall be marked to indicate that more than one disconnecting means is required to de-energize the equipment. The location of the means necessary to disconnect all circuits 50-volts and over shall be documented and available.

(4) Short-circuit current rating of the industrial control panel based on one of the following:

   (5) Short-circuit current rating of a listed and labeled assembly

   (6) Short-circuit current rating established utilizing an approved method

   **Informational Note:** ANSI/UL 508A, *Standard for Industrial Control Panels*, Supplement SB, is an example of an approved method.

**Exception to (4):** Short-circuit current rating markings are not required for industrial control panels containing only control circuit components.

(7) If the industrial control panel is intended as service equipment, it shall be marked to identify it as being suitable for use as service equipment.

(8) Electrical wiring diagram or the identification number of a separate electrical wiring diagram or a designation referenced in a separate wiring diagram.

(9) An enclosure type number shall be marked on the industrial control panel enclosure.

**Statement of Problem and Substantiation for Public Comment**

No changes item (4)

The revised text clarifies that the marking requirement only applies to circuits 50-volts and over.

**Related Item**

First Revision No. 3001-NFPA 70-2015 [Section No. 409.110]

**Submitter Information Verification**

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 10:52:59 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR
Resolution: SR-3004-NFPA 70-2015
Statement: The revised text clarifies that the marking requirement only applies to circuits of 50 volts or more. “50-volts and over” has been changed to “50-volts or more”, to better correlate with other parts of this Code.
Public Comment No. 1247-NFPA 70-2015 [Section No. 410.6]

410.6 Listing Required.
All luminaires, lampholders, and retrofit kits shall be listed and labeled.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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</thead>
<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Comment No. 532-NFPA 70-2015 [Definition: Labeled.]</td>
<td>This PC addressed the concerns of the committee in reference to parts that are too small to be labeled. Keep in mind that the definition of labeled also includes symbols and identifying marks.</td>
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<tr>
<th>Related Item</th>
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<tbody>
<tr>
<td>Public Input No. 908-NFPA 70-2014 [Section No. 410.6]</td>
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<tr>
<td>First Revision No. 5115-NFPA 70-2015 [Section No. 410.6]</td>
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<tr>
<td>Public Input No. 1072-NFPA 70-2014 [Definition: Labeled.]</td>
<td></td>
</tr>
</tbody>
</table>
### Submitter Information Verification

**Submitter Full Name:** JEFFREY FECTEAU  
**Organization:** UNDERWRITERS LABORATORIES LLC  
**Affiliation:** UL  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Thu Sep 24 15:44:32 EDT 2015

### Committee Statement

<table>
<thead>
<tr>
<th>Committee Action</th>
<th>Accepted</th>
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<tbody>
<tr>
<td>Resolution</td>
<td>SR-5112-NFPA 70-2015</td>
</tr>
</tbody>
</table>
| Statement        | The Panel agrees with public comment clarifying certain equipment be “listed and labeled” instead of just “listed.” Qualified Electrical Testing Laboratories do not consider a product to be listed unless the label has actually been applied.  
Additionally, the Article 100 definition for “labeled” includes the provision for labeling the smallest unit carton for parts which are too small to include the listing mark on the parts themselves. Labeling includes listing marks that are stamped or molded on or into the product. |
**Public Comment No. 667-NFPA 70-2015 [ New Section after 410.30(A) ]**

**410.30(B) Locking Support and Mounting Receptacle and Attachment Fitting Combination.**

1. Locking support and mounting receptacle shall be listed and marked with the manufacturer's name or identification, and voltage and ampere rating.

2. Listed locking support and mounting receptacle in combination with recognized attachment fitting shall be permitted to support and supply ceiling- or wall-luminaires and ceiling-suspended luminaires.

3. Locking support and mounting receptacle and attachment fitting combinations shall be of the grounding-type and shall be connected to the equipment grounding conductors in accordance with 250.130(C).

4. Locking support and mounting receptacle and attachment fitting combinations used to connect and support ceiling-suspended (paddle) fans and luminaires shall only be permitted to be used with outlet boxes conforming to 314.27(E) installed as required by 314.23.

**Informational Note:** Locking support and mounting receptacles when used in conjunction with compatible attachment fitting are designed to connect, supply and support individual ceiling- or wall-mounted luminaires and ceiling-suspended (paddle) fans.

**Statement of Problem and Substantiation for Public Comment**

New text was proposed and approved for 314.27(E) by CMP 9 in FR 2411 that read as follows:

(E) Separable Attachment Fittings. Outlet boxes shall be permitted to support listed locking support and mounting receptacles used in combination with compatible attachment fittings designed for the support of equipment covered within and subject to all weight and orientation limits contemplated by the listing. Where such fittings are used, the equipment mounted shall comply with 314.27(A) through (D) as applicable. Where the supporting receptacle is installed within a box, it shall be included in the fill calculation covered in 314.16(B)(4).

This proposed new text in 410.30(B) is needed because it coordinates with the new 314.27(E), and should also be covered under the article on receptacles for clarity as it is a connection and disconnection means for luminaires.

**Related Item**

First Revision No. 2411-NFPA 70-2015 [Section No. 314.27]

Public Input No. 4388-NFPA 70-2014 [New Section after 410.30(A)]

**Submitter Information Verification**

Submitter Full Name: AMY CRONIN
Organization: STRATEGIC CODE SOLUTIONS LLC
Affiliation: Safety Quick Lighting and Fans Corp.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 15 15:41:52 EDT 2015

**Committee Statement**

Committee Action: Rejected
Resolution: Item (1) is specific to the listing of receptacles and is not appropriate for inclusion in Article 410. Article 406 already requires receptacles to be listed. The word “recognized” in item (2) refers to “UL recognized”. The “UL recognition” program is not acknowledged in the code. The item (4) reference to 314.27(E) is superfluous as 314.27 (E) stands on its own. The current text of section 410.30 is very general and only includes the minimum requirements for luminaire supports. There are numerous means of luminaire support that are not detailed in section 410.30. As mentioned during the Public Input phase, a new section in the code is not required since AHJ’s look for the certification mark to determine suitability of product for the installation along with other requirements. The Code does not preclude the use of a listed luminaire locking support and mounting receptacle and attachment fitting. As a listed product there is no prohibition for its installed use. The inclusion of this specific product in section 410.30, while other methods of mounting aren’t mentioned, may lead to an incorrect conclusion that it is a preferred method of mounting.
(D) Splices and Taps.

No unnecessary splices or taps shall be made within or on a luminaire. Splices or taps located in the interior of an enclosed
raceway, pole that is installed in an abovegrade wet location, including poles used to support luminaires, shall be listed for
damp or wet locations.

Informational Note: For approved means of making connections, see 110.14.

Statement of Problem and Substantiation for Public Comment

First Revision #5116 and Section 410.56(D) should be revised to remove the interior of an enclosed “raceway” since splicing is not
permitted in enclosed raceways without removable covers per 300.13(A) and 300.15(A). Section 300.9 states that the interior of a
raceway in a wet location is also a wet location. Therefore, the reference to “damp” is also removed.

Related Item
First Revision No. 5116-NFPA 70-2015 [Section No. 410.56(D)]

Submitter Information Verification

Submitter Full Name: David Kendall
Organization: Thomas & Betts Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 09:13:08 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5108-NFPA 70-2015 With the removal of “damp locations” from the revision, as suggested by Public Comment #595,
the entire revision is not needed since the requirement for wet location connectors is covered elsewhere in the code.
Connectors are not rated for damp locations.
Statement: First Revision #5116 anticipated the acceptance of Public Input #4367 to section 110.14(B) which would have created the
opportunity for “damp location” ratings to be defined in the product standards for connectors and splices. Since Public
Input #4367 was rejected and no subsequent comments were submitted regarding creating damp location requirements
for connectors, including them in 410.56(D) is not appropriate.
Public Comment No. 1639-NFPA 70-2015 [Section No. 410.62(C)]

(C) Electric-Discharge and LED Luminaires.

Electric-discharge and LED luminaires shall comply with (1), (2), and (3) as applicable.

(1) Cord-Connected Installation.

A luminaire or a listed assembly in compliance with any of the conditions in (a) through (c) shall be permitted to be cord connected provided all of the following conditions are met:

(1) The luminaire is located directly below the outlet or busway.
(2) The cord is not subject to strain or physical damage.
(3) The cord is visible over its entire length except at terminations.

   a. A luminaire shall be permitted to be connected with a cord terminating in a grounding-type attachment plug or busway plug.
   b. A luminaire assembly equipped with a strain relief and canopy shall be permitted to use a cord connection between the luminaire assembly and the canopy. The canopy shall be permitted to include a section of raceway not over 150 mm (6 in.) in length and intended to facilitate the connection to an outlet box mounted above a suspended ceiling.
   c. Listed luminaires connected using listed assemblies that incorporate manufactured wiring system connectors in accordance with 604.100(C) shall be permitted to be cord connected.

(2) Provided with Mogul-Base, Screw Shell Lampholders.

Electric-discharge luminaires provided with mogul-base, screw shell lampholders shall be permitted to be connected to branch circuits of 50 amperes or less by cords complying with 240.5. Receptacles and attachment plugs shall be permitted to be of a lower ampere rating than the branch circuit but not less than 125 percent of the luminaire full-load current.

(3) Equipped with Flanged Surface Inlet.

Electric-discharge luminaires equipped with a flanged surface inlet shall be permitted to be supplied by cord pendants equipped with cord connectors. Inlets and connectors shall be permitted to be of a lower ampere rating than the branch circuit but not less than 125 percent of the luminaire load current.

Statement of Problem and Substantiation for Public Comment

The numbering of this revision seems to be wrong (1,2,3 a,b,c, etc.).

Related Item

First Revision No. 5118-NFPA 70-2015 [Section No. 410.62(C)]

Submitter Information Verification

Submitter Full Name: RYAN JACKSON
Organization: RYAN JACKSON
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 15:42:44 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The comment does not comply with section 4.4.4.3(c) of the “Regulations Governing the Development of NFPA Standards” since it does not contain proposed text including the wording to be added, revised (and how revised), or deleted.
Public Comment No. 469-NFPA 70-2015 [Section No. 410.62(C)(1)]

(1) Cord-Connected Installation.
A luminaire or a listed assembly in compliance with any of the conditions in (a) through (c) shall be permitted to be cord connected provided all of the following conditions are met:

1. The luminaire is located directly below the outlet or busway.
2. The cord is not subject to strain or physical damage.
3. The cord is visible over its entire length except at terminations.
4. A luminaire shall be permitted to be connected with a cord terminating in a grounding-type attachment plug or busway plug.
5. A luminaire assembly equipped with a strain relief and canopy shall be permitted to use a cord connection between the luminaire assembly and the canopy. The canopy shall be permitted to include a section of raceway not over 150 mm (6 in.) in length and intended to facilitate the connection to an outlet box mounted above a suspended ceiling.
6. Listed luminaires connected using listed assemblies that incorporate manufactured wiring system connectors in accordance with 604.100(C) shall be permitted to be cord connected.

Statement of Problem and Substantiation for Public Comment

I suggest a., b., and c. be changed to 4, 5, and 6. since a, b, an c have nothing to do with (3).

Related Item
First Revision No. 5118-NFPA 70-2015 [Section No. 410.62(C)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Aug 30 14:39:03 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5109-NFPA 70-2015
Statement: Number and language revised to improve clarity.
(B) Combustible Low-Density Cellulose Fiberboard.

Where a surface-mounted luminaire containing a ballast, transformer, LED driver, or power supply is to be installed on combustible low-density cellulose fiberboard, it shall be marked for this condition or shall be spaced not less than 38 mm (1 ½ in.) from the surface of the fiberboard. Where such luminaires are partially or wholly recessed, the provisions of 410.110 through 410.122 shall apply.

Informational Note: Combustible low-density cellulose fiberboard includes sheets, panels, and tiles that have a density of 320 kg/m³ (20 lb/ft³) or less and that are formed of bonded plant fiber material but does not include solid or laminated wood or fiberboard that has a density in excess of 320 kg/m³ (20 lb/ft³) or is a material that has been integrally treated with fire-retarding chemicals to the degree that the flame spread index in any plane of the material will not exceed 25, determined in accordance with tests for surface burning characteristics of building materials. See ANSI/ASTM E84 UL 723-2014, Test Method for Test for Surface Burning Characteristics of Building Materials.

Statement of Problem and Substantiation for Public Comment

Every code cycle the panel updates the reference to ASTM 84 in the Informational Note with the latest revision date. When the panel met in January during the Public Input stage the reference was changed to “ANSI/ASTM E84-2014”. Since January ASTM E84 has been revised twice. The revision history for ASTM E84 shows that it has been revised 16 times since 2010. With this frequency of revisions, any revision mentioned in the code will more than likely be out of date as soon as the 2017 NEC is published.

While researching ASTM E84 I came upon a 10-year old UL White Paper that indicates that ASTM E84 and UL 723 are identical. Further research led to the guide-card information for UL category code BIKT which states, “The basic standard used to investigate building products for surface-burning characteristics is ANSI/UL 723, ‘Test for Surface Burning Characteristics of Building Materials.’ The same test method is also covered in ANSI/ASTM E84, ‘Standard Test Method for Surface Burning Characteristics of Building Materials.’ Where surface-burning characteristics are required, many model codes recognize either standard.”

Since ASTM E84 and UL 723 are the same I propose changing the reference in the Informational Note of 410.136(B) from ASTM E84 to UL 723 since UL 723 gets revised with less frequency than ASTM E84.

Related Item
First Revision No. 5120-NFPA 70-2015 [Section No. 410.136(B)]

Submitter Information Verification

Submitter Full Name: FREDERICK CARPENTER
Organization: ACUITY BRANDS LIGHTING
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 17:05:59 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5110-NFPA 70-2015
Statement: Updated ASTM standard to most recent edition. Added UL 723 as this standard is a mirror image of the ASTM standard.
Combustible Low-Density Cellulose Fiberboard.

Where a surface-mounted luminaire containing a ballast, transformer, LED driver, or power supply is to be installed on combustible low-density cellulose fiberboard, it shall be marked for this condition or shall be spaced not less than 38 mm (1 1/2 in.) from the surface of the fiberboard. Where such luminaires are partially or wholly recessed, the provisions of 410.110 through 410.122 shall apply.

Informational Note: Combustible low-density cellulose fiberboard includes sheets, panels, and tiles that have a density of 320 kg/m³ (20 lb/ft³) or less and that are formed of bonded plant fiber material but does not include solid or laminated wood or fiberboard that has a density in excess of 320 kg/m³ (20 lb/ft³) or is a material that has been integrally treated with fire-retarding chemicals to the degree that the flame spread index in any plane of the material will not exceed 25, determined in accordance with tests for surface burning characteristics of building materials. See ANSI/ASTM E84-2014, Test Method for Surface Burning Characteristics of Building Materials.

Statement of Problem and Substantiation for Public Comment

Standard date update

Related Item
Public Input No. 1729-NFPA 70-2014 [Section No. 410.136(B)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 19:40:17 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5110-NFPA 70-2015
Statement: Updated ASTM standard to most recent edition. Added UL 723 as this standard is a mirror image of the ASTM standard.
411.3 Low-Voltage Lighting Systems.

Low voltage lighting systems operating at 30 volts or less shall consist of an isolating power supply, low-voltage luminaires, and associated equipment that are all identified for the use. The output circuits of the power supply shall be rated for 25 amperes maximum under all load conditions.

Statement of Problem and Substantiation for Public Comment

Removing the 30 volt restriction allows for a higher voltage and in my opinion takes it out of the traditional low voltage category. I also believe the power supplies this would add, like landscape lighting power sources, increase the available current from 100va to 300va and propose a safety hazard in these uses where exposed conductors are allowed.

Related Item
First Revision No. 5147-NFPA 70-2015 [Article 411]

Submitter Information Verification

Submitter Full Name: Randall Wright
Organization: RKW Consulting
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:01:33 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The 30 volt limit remains for the AC systems but the 2014 NEC acknowledged that DC systems operating at 60 V or less provide for comparable levels of safety (these are identified in Tables 11(A) and (B), respectively, as the Class 2 voltage limits). Exposed conductor systems, which are addressed in 411.6(C), are permitted for indoor use only. Power levels (whether 100 VA or 300 VA) only correlate to a “safety hazard” when the associated wiring is not sized to accommodate the power level; this is precluded by the listing requirement of 411.4(A) and (B).
411.3 Low-Voltage Lighting Systems.

Low voltage lighting systems shall consist of an isolating, a listed Class 2 power supply, listed LPS power supply, low-voltage luminaires, and associated equipment that are all identified for the use. The output circuits of the power supply shall be rated for 25 amperes maximum under all load conditions.

Statement of Problem and Substantiation for Public Comment

Listed, Class 2 and LPS are safety issues that should not be deleted and would allow greater VA to be allowed when exposed conductors are permitted. Safety is paramount when exposed conductors are permitted and the number of power supplies should not be an issue.

Related Item
First Revision No. 5147-NFPA 70-2015 [Article 411]

Submitter Information Verification

Submitter Full Name: Randall Wright
Organization: RKW Consulting
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 15:45:23 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Listing requirements are covered in 411.4 so they do not need to be included in 411.3.
Public Comment No. 1330-NFPA 70-2015 [ Sections 411.4(A), 411.4(B) ]

Sections 411.4(A), 411.4(B)

(A) Listed System.

The luminaires, power supply, and luminaire fittings (including the exposed bare conductors) of an exposed bare conductor lighting system shall be listed and labeled for the use as part of the same identified lighting system.

(B) Assembly of Listed Parts.

A lighting system assembled from the following listed and labeled parts shall be permitted:

1. Low-voltage luminaires
2. Power supply
3. Low-voltage luminaire fittings
4. Suitably rated cord, cable, conductors in conduit, or other fixed Chapter 3 wiring method for the secondary circuit

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.
<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Comment No. 532-NFPA 70-2015 [Definition: Labeled.]</td>
<td>Addresses the committed concern of parts that are too small to be labeled.</td>
</tr>
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</table>

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<tr>
<th>Related Item</th>
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<tr>
<td>Public Input No. 869-NFPA 70-2014 [Section No. 411.4]</td>
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<tr>
<td>First Revision No. 5147-NFPA 70-2015 [Article 411]</td>
</tr>
<tr>
<td>Public Input No. 1072-NFPA 70-2014 [Definition: Labeled.]</td>
</tr>
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Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name: JEFFREY FECTEAU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization: UNDERWRITERS LABORATORIES LLC</td>
</tr>
<tr>
<td>Affiliation: UL</td>
</tr>
<tr>
<td>Street Address:</td>
</tr>
<tr>
<td>City:</td>
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<tr>
<td>State:</td>
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<td>Zip:</td>
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<tr>
<td>Submittal Date: Thu Sep 24 20:22:54 EDT 2015</td>
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Committee Statement

| Committee Action: Accepted                                               |
| Resolution: SR-5113-NFPA 70-2015                                        |
| Statement: The Panel agrees with public comment clarifying certain equipment be “listed and labeled” instead of just “listed.” Qualified Electrical Testing Laboratories do not consider a product to be listed unless the label has actually been applied. Additionally, the Article 100 definition for “labeled” includes the provision for labeling the smallest unit carton for parts which are too small to include the listing mark on the parts themselves. Labeling includes listing marks that are stamped or molded on or into the product. |
Public Comment No. 1619-NFPA 70-2015 [Section No. 411.4(B)]

(B) Assembly of Listed Parts or Classified Parts to form a complete assembly.

A lighting system assembled from the following listed parts or classified parts shall be permitted:

1. Low-voltage luminaires
2. Power Class 2 or LPS power supply
3. Low-voltage luminaire fittings
4. Suitably rated cord, cable, conductors in conduit, or other fixed Chapter 3 wiring method for the secondary circuit

Statement of Problem and Substantiation for Public Comment

I do not feel we can allow regular power sources in a low voltage section based on the safety of allowed exposed conductors. UL has added the word classified and since we are changing this complete section we should be able to add if appropriate.

Related Item
First Revision No. 5147-NFPA 70-2015 [Article 411]

Submitter Information Verification

Submitter Full Name: Randall Wright
Organization: RKW Consulting
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:24:48 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: UL’s classification program is not acknowledged in the code. Voltage and current limits are addressed in sections 411.1 and 411.3
Public Comment No. 1643-NFPA 70-2015 [Section No. 411.4(B)]

(B) Assembly of Listed Parts.

A lighting system assembled from the following listed parts shall be permitted:

1. Low-voltage luminaires
2. Power supply
3. Low-voltage luminaire fittings
4. Suitably rated cord, listed for the lighting system, cable, conductors in conduit, or other fixed Chapter 3 wiring method for the secondary circuit

Statement of Problem and Substantiation for Public Comment

"Suitably rated" doesn't really tell the Code user anything.

Related Item
Public Input No. 869-NFPA 70-2014 [Section No. 411.4]

Submitter Information Verification

Submitter Full Name: RYAN JACKSON
Organization: RYAN JACKSON
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:45:55 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Cords are not listed for specific use with lighting systems. Cord ratings can be found in Article 400. Including the word "listed" is not necessary since the heading of the article is "assembly of listed parts".
Statement of Problem and Substantiation for Public Comment

PI 2898 was resolved and the Panel 2 statement indicated that they were not going to delete the section and they requested that “the NEC CC forward this PI to CMP17 for consideration.” That request to forward would not/does not move it to Panel 17’s jurisdiction. However, FR No. 349 did delete 210.8 and within the statement they request “the NEC CC forward this PI to CMP17” (although it is assumed that it should have read FR not PI).

Unfortunately, it does not appear that the correlating committee caught the requests of Panel 2 to forward this information to Panel 17. The BCDC does not want Panel 17 may create a SR to add the text/requirement to Article 422. BCDC requests that this text remain out of the NEC.

Related Item
Public Input No. 2898-NFPA 70-2014 [Section No. 210.8(D)]

Submitter Information Verification

Submitter Full Name: Jim Muir
Organization: Building Safety Division, Clark County, WA
Affiliation: NFPAs Building Code Development Committee (BCDC)
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 17:57:47 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Panel accepts the referral of PI 2898-NFPA 70-2014 [Section No.210.8(D)] from Panel 2. However, it does not accept the substance of the public comment which is the text of 210.8(D) remain out of the NEC. Panel 17 first revision of 422.5 included dwelling unit dishwashers on the basis of the potential for personal hazards from specific equipment which could be associated with abnormal conditions in equipment related to intentional or unintentional physical abuse, harsh environment, or simply end of life (see Committee Statement for First Revision 4801).
422.2 Definition.

**Vending Machine.** Any self-service device that dispenses products or merchandise without the necessity of replenishing the device between each vending operation. In exchange for service, it is designed to require insertion of coin, paper currency, token, card, key, or receipt of payment by other means.

Statement of Problem and Substantiation for Public Comment

I would ask CMP-17 to reconsider the proposed deletion of the definition of a "Vending Machine." Without a proper definition of the device, due to the requirements of 422.5 (was 422.51), all kinds of things would be opened up for interpretation as to requiring GFCI protection that CMP-17 has already deemed in the past unnecessary for GFCI protection, such as a casino slot machine, ATM machines, hotel ice machines, etc. A hotel ice machine might need GFCI protection (that is another discussion for another day), due to its own shock hazards, not because an AHJ has deemed it to be a "vending machine." Contrary to what is stated in the Panel Statement for FR 4875, requiring all appliances to be listed DOES NOT eliminate the need for a definition of vending machine. It only opens up inconsistent interpretation and enforcement as to what constitutes a vending machine and what does not. A definition of a vending machine gives the AHJ a good solid starting point in enforcement of proposed 422.5(A)(7) requiring GFCI protection for "vending machines."

Please note that I have proposed to break up the long sentence that was the definition of "Vending Machine" from the 2014 NEC and add the phrase, "In exchange for service, it is designed..." in the proposed definition. This will again aid in enforcement of this requirement and interpretation of the rules pertaining to GFCI requirements for vending machines.

Related Item

First Revision No. 4875-NFPA 70-2015 [Section No. 422.2]

Submitter Information Verification

Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 18 16:27:07 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There is a virtually identical definition of vending machines in the product safety standard (ANSI/UL 751). The proposed definition is therefore duplicative and its inclusion in Article 422 only serves to increase the risk of the Code and standard being misaligned.
**Public Comment No. 810-NFPA 70-2015 [Section No. 422.5]**

**422.5 Ground-Fault Circuit-Interrupter (GFCI) Protection for Personnel.**

**(A) General.** Appliances identified in **422.5(A)(1) through (7)** rated 250 volts or less and 60 amperes or less, single- or 3-phase, shall be provided with GFCI protection for personnel within the branch circuit or outlet. Multiple GFCI protective devices shall be permitted but shall not be required.

1. Automotive vacuum machines provided for public use
2. Boat hoists
3. Drinking water coolers
4. Dwelling unit dishwashers
5. High-pressure spray washing machines — cord-and-plug-connected
6. Tire inflation machines provided for public use
7. Vending machines

**(B) Type.**

The GFCI shall be readily accessible, listed, and located in one or more of the following locations:

- Within the branch circuit overcurrent device
- A device or outlet within the supply circuit
- An integral part of the attachment plug
- Within Appliances identified in 422.5(B)(1) and (2) rated 250 volts or less and 60 amperes or less, single- or 3-phase, shall be provided with GFCI protection for personnel as integral part of the attachment plug, within the supply cord not more than 300 mm (12 in.) from the attachment plug
- Factory-installed within the appliance. Multiple GFCI protective devices shall be permitted but shall not be required.

1. Cord- and plug-connected high pressure spray washing machines
2. Vending machines

**Statement of Problem and Substantiation for Public Comment**

The intent of CMP 17 to centralize all appliance GFCI requirements from 210.8 to Article 422 is justified. But there is something inherently wrong with the wording in FR 4801. Automotive vacuum machines, boat hoists, drinking water coolers, dishwashers and tire inflation machines are typically fastened in place. There is no UL standard that requires GFCI protection for the aforementioned appliances, therefore replacements may not be provided with GFCI protection, within the supply cord, the attachment plug or factory-installed within the appliance.

High-pressure spray washing machines and some vending machines are portable and generally are not fastened in place. The requirements of providing GFCI protection for personnel within the supply cord, the attachment plug or factory-installed within the appliance should remain as CMP 17 intended.

**Related Item**

First Revision No. 4801-NFPA 70-2015 [Section No. 422.5]

**Submitter Information Verification**

**Submitter Full Name:** Edward Rodriguez  
**Organization:** IEC Texas Gulf Coast  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Sun Sep 20 20:54:16 EDT 2015
Committee Statement

<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
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</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>The public comment distinguishes equipment based on whether it is fastened in place or not. This distinction has no safety significance as long as GFCI protection is provided. The Panel is not specifying how it must be provided. The GFCI may be: • Within the branch circuit overcurrent device • A device or outlet within the supply circuit • An integral part of the attachment plug</td>
</tr>
</tbody>
</table>
Public Comment No. 1047-NFPA 70-2015 [Section No. 422.5(A)]

(A) General.
Appliances identified in 422.5(A)(1) through (7) rated 250 volts or less and 60 amperes or less, single- or 3-phase, shall be provided with GFCI protection for personnel. Multiple GFCI protective devices shall be permitted but shall not be required.

1. Automotive vacuum machines provided for public use
2. Boat hoists
3. Drinking water coolers
4. Dwelling unit dishwashers
5. High-pressure spray washing machines — cord-and-plug-connected
6. Tire inflation machines provided for public use
7. Vending machines

Statement of Problem and Substantiation for Public Comment

GFCI protection for specific, non-cord and plugged appliances is a growing contentious issue in dwellings where the concern is addressing the quality of the appliance from the manufacturer. Why the need for dishwashers in approaching protection for end of life cycle problems when there are numerous devices purchased daily for use in the kitchen without GFCI protection being required. Shouldn't all of these appliances then be considered, as well as other appliances throughout the dwelling?

The Panel substantiation is troubling to say the least in that they decided the most convenient place for the cost of the protection. Their determination that the outlet protection is best weighed against the manufacturer to protect persons from problems cause by aging of the appliance cannot be explained to the Public. One of our responsibilities as Code creators is being able to produce Codes that are enforceable for buildings that are constructed. When the entities responsible for adoption of Codes asks questions regarding this particular provision there is no response that justifies where this burden is placed.

In addition, GFCI protection requirements that originated in dwellings in the early 1970's was to protect persons from leakage current, the Panel's substantiation was directed at fire protection. This is not the characteristic of GFCI devices.

Related Item
Public Input No. 3889-NFPA 70-2014 [Section No. 210.8(D)]

Submitter Information Verification
Submitter Full Name: Ron Chilton
Organization: North Carolina Code Clearing Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 11:36:10 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Panel 17 first revision of 422.5 included dwelling unit dishwashers on the basis of the potential for personal hazards from specific equipment which could be associated with abnormal conditions in equipment related to intentional or unintentional physical abuse, harsh environment, or simply end of life (see Committee Statement for First Revision 4801). The product safety standard for dishwashers (UL STP 749) has considered that the exposure of the heating elements in dishwashing compounds, water, and thermal expansion can in rare cases lead to stress corrosion cracking (SCC) of the outer surface of the sheathed heating element. (It is believed) that the cracking of this outer sheath can lead to water penetration of the heating element and shortening of the life of the element in some cases. If this occurs, SCC can shorten the life-span of the heating element by allowing water to penetrate the sheath of the element. Water ingress into the insulating layer of the element can lead to a rupture or arcing failure.
Public Comment No. 1432-NFPA 70-2015 [Section No. 422.5(A)]

(A) General.
Appliances identified in 422.5(A)(1) through (7) rated 250 volts or less and 60 amperes or less, single- or 3-phase, shall be provided with GFCI protection for personnel. Multiple GFCI protective devices shall be permitted but shall not be required.
(1) Automotive vacuum machines provided for public use
(2) Boat hoists
(3) Drinking water coolers, unless double insulated
(4) Dwelling unit dishwashers
(5) High-pressure spray washing machines — cord-and-plug-connected
(6) Tire inflation machines provided for public use
(7) Vending machines

Statement of Problem and Substantiation for Public Comment
Drinking water coolers, unlike traditional water fountains, are often all plastic external construction and may or may not even be connected to plumbing. An alternate means of protection like double insulation should be allowed in lieu of GFCI protection, as is often the case with portable tools.

Related Item
Public Input No. 3530-NFPA 70-2014 [Section No. 422.52]

Submitter Information Verification
Submitter Full Name: Richard Holub
Organization: The DuPont Company, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 11:11:55 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Although double insulation is also allowed as an alternative for equipment grounding in many other applications (including portable tools), neither provides the enhanced personnel protection against shock which is the purpose of having GFCI for certain applications. In the specific case of drinking water coolers, double insulation may not afford protection in the event of wetting of live parts (a leak breaching the two layers of insulation).
Public Comment No. 854-NFPA 70-2015 [ Section No. 422.5(A) ]

(A) General.
Appliances identified in 422.5(A)(1) through (7) rated 250 volts or less and 60 amperes or less, single- or 3-phase, shall be provided with GFCI protection for personnel. Multiple GFCI protective devices shall be permitted but shall not be required.

1. Automotive vacuum machines provided for public use
2. Boat hoists
3. Drinking water coolers
4. Dwelling unit dishwashers
5. High-pressure spray washing machines — cord-and-plug-connected
6. Tire inflation machines provided for public use
7. Vending machines

Statement of Problem and Substantiation for Public Comment
The 2014 NEC addresses the hazard associated with boat hoists beginning with the outlet serving the boat hoist up to 240V in Section 210.8(C). Protection is not limited to just protecting the hoist. There can be cord and plug connected boat hoists. A hazard may exist when inserting or removing the plug from the receptacle, therefore the protection needs to be in the branch circuit. Since the protection needs to remain in the branch circuit the requirement in the NEC must remain in 210.8. 210.8(C) should not be moved to Article 422.

Related Item
First Revision No. 4801-NFPA 70-2015 [Section No. 422.5]

Submitter Information Verification
Submitter Full Name: Ed Larsen
Organization: Schneider Electric USA
Affiliation: Schneider Electric USA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 14:17:03 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: There is no substantiation provided that there is an increased hazard where GFCI protection is located in the plug. The listings of portable GFCI's do not restrict their use and the product safety standard (ANSI/UL 943) has provision for "wet location" types and a required instruction: "For installation in wet locations, protect the GFCI receptacle with a weatherproof cover that will keep both the receptacle and any plugs dry."
422.6 Listing Required.
All appliances shall be listed.
DELETE THIS CLAUSE

Statement of Problem and Substantiation for Public Comment

AHAM response to 3026-NFPA 7-2014 New Section 422.6

Delete this clause. The members of AHAM understand and share the commenter's concern that application of the specific requirements in Art. 422 should be applied in the same way. However, using a universal mandated of "listing" of all appliances will not solve the issues presented and will likely cause more confusion.

In the complex world of utilization equipment, there are many different products under the term "appliance." Art. 422 contains specific requirements for certain equipment but not for most types. We appreciate the desire to have all appliances safety certified, but the voluntary system of safety certification of the US has achieved virtually 100% compliance. The challenges of mandating this are many.

The current definition of "appliance" in the NEC may work for the Code but this proposal would now require all Certification Organizations (CO) to comply with this definition for all products under specific standards. The premise of the maker of the proposal that this would bring greater clarity or uniformity is unfortunately not true.

There are many problems with the insertion of so simple a phrase.
1. The addition of this language could require that AHJ's take on the role of determining if a piece of utilization equipment is an "appliance" and if the appropriate standard has been used. The AHJ may not have the necessary information on the internal technology of the product, its functions or the usage to make this determination. Examples: is an instantaneous water heater an appliance? Is this still true on the sink? Is a portable fan that operates with C cell batteries an appliance? Is a vacuum cleaner that contains a rechargeable battery an appliance?
2. To require "listing" of a product also requires under the definitions found in NFPA 70, that the product be put onto a "list." This implies that this list would be used by an AHJ for purposes of determining if the product has been evaluated properly. However, each CO may not agree and the same products could be on different lists. This proposal will not solve this confusion.
3. Many appliances are new and may have requirements under multiple safety standards (example: gas range with electric broiler). The safety certification may not list all the safety standards used in the evaluation. How will the AHJ know whether the correct standards were used?
4. Many "appliances" function on low voltage systems either through an external power supply or battery charger. Frequently, only the conversion portion of the "appliance" is listed and not what some would consider is the "appliance." The proposal would create a conflict between the Code and the listing requirements. These low voltage "appliances" will not appear on any list accessible to the AHJ.
5. Short runs of sample products may be used to gauge consumer interest and may not be certified at the time they are used for marketing purposes. This code change will cause difficulty for companies trying to bring new products to the market quickly.
6. Marking, listing, and categories of products are governed by the certification rules of the CO, may not be in the safety standards and may not agree with the specific designations within Art. 422. Between CO's there is a great deal of variability with respect to when the product must be marked with its category or classification or even the term that is used in the marking or category of a list. This proposal will not bring uniformity to the process.
7. Manufacturers may use show samples that display the product but are not working samples. Under this determination, companies could spend huge sums of money having every sales sample evaluated, just because the code now says "all appliances" must be safety certified. Does this include a demonstration, non-functional dishwasher on display at a retailer with a light bulb inside? This proposal will not solve the problems alluded to in the description and will likely cause many others. This is not the right approach.

Related Item
Public Input No. 3026-NFPA 70-2014 [New Section after 422.5]

Submitter Information Verification
Submitter Full Name: Matt Williams
Organization: Association of Home Appliance
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 10:28:32 EDT 2015

Committee Statement
Committee Rejected
| **Action:** |  |
| **Resolution:** | The public comment substantiation raises compelling reasons for qualifying the First Revision that “All appliances shall be listed.” However, the Panel does not agree to delete the 422.6 as is proposed. Instead, it has developed a Second Revision with the necessary qualifying details. See Committee Statement on Public Comment No. 1517. |
Public Comment No. 1517-NFPA 70-2015 [Section No. 422.6]

422.6 Listing Required.
All appliances that are specifically addressed in Article 422 shall be listed.

Statement of Problem and Substantiation for Public Comment

The proposal is based on concerns that an installer may not know what specific installation section to follow in Article 422 unless the appliance is listed and labeled. However, the term "appliance" is very broad, and the proposal could be interpreted as applying to appliances that have no special installation requirements, such as portable appliances. We therefore propose to narrow the application of the requirement to those appliances specifically addressed in Article 422 that require special installation requirements.

Related Item
First Revision No. 4802-NFPA 70-2015 [New Section after 422.5]

Submitter Information Verification

Submitter Full Name: Joseph Harding
Organization: Power Tool Institute
Street Address: City:  
State: Zip:
Submittal Date: Fri Sep 25 13:29:32 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4801-NFPA 70-2015
Statement: The Panel recognized the need to be more specific as to which appliances should be listed. Applied the code required protection from contact with live parts (Section 110.27) as the means to specify which appliance shall be listed.
422.6. Listing Required.
   All appliances shall be listed.

Statement of Problem and Substantiation for Public Comment

There was no technical substantiation for this change, therefore it violates regulations. Furthermore, I'm not certain that this is possible.

Related Item
First Revision No. 4802-NFPA 70-2015 [New Section after 422.5]

Submitter Information Verification

Submitter Full Name: RYAN JACKSON
Organization: RYAN JACKSON
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:49:48 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The technical substantiation was provided in public input no. 3026-NFPA 70-214 and is repeated below. "...Listing of products will properly classify the equipment and that listing will ensure application of proper installation requirements. For example, the NEC definition of vending machine is very broad and likely includes equipment not listed as appliances and probably not considered in the development of requirements in 422.51. Additionally, Article 422 includes requirements that must be included in the construction of the equipment. Listing will obviously be the best place to address those requirements."
Public Comment No. 1250-NFPA 70-2015 [Section No. 422.15(A)]

(A)
Listed and labeled central vacuum outlet assemblies shall be permitted to be connected to a branch circuit in accordance with 210.23(A).

Additional Proposed Changes

Description: ETL Essential Guide to Product Testing & Certification 2014/2015 North American Edition. Please review document pages numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Public Comments for This Document

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<tr>
<td>Public Comment No. 532-NFPA 70-2015 [Definition: Labeled.]</td>
<td>This will address parts that may be too small to bear a label, symbol or identifying mark.</td>
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<td>Public Input No. 1072-NFPA 70-2014 [Definition: Labeled.]</td>
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<tr>
<td>First Revision No. 4803-NFPA 70-2015 [Global Input]</td>
</tr>
<tr>
<td>Public Input No. 909-NFPA 70-2014 [Section No. 422.15(A)]</td>
</tr>
</tbody>
</table>
Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 16:00:14 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-4802-NFPA 70-2015
Statement: The Panel agrees with public comment clarifying certain equipment be “listed and labeled” instead of just “listed.” Listing agencies do not consider a product to be listed unless the label has actually been applied.
Public Comment No. 941-NFPA 70-2015 [Section No. 422.16(B)(1)]

(1) Electrically Operated In-Sink Waste Disposers.

Electrically operated in-sink waste disposers shall be permitted to be cord-and-plug-connected with a flexible cord identified as suitable in the installation instructions of the appliance manufacturer where all of the following conditions are met:

(1) The flexible cord shall be terminated with a grounding-type attachment plug.
    
    Exception: A listed in-sink waste disposer distinctly marked to identify it as protected by a system of double insulation,
    
    or its equivalent,
    
    shall not be required to be terminated with a grounding-type attachment plug.

(2) The length of the cord shall not be less than 450 mm (18 in.) and not over 900 mm (36 in.).

(3) Receptacles shall be located to protect against physical damage to the flexible cord.

(4) The receptacle shall be accessible.

Statement of Problem and Substantiation for Public Comment

In the context of a sink waste disposer, it is unclear in the exception what the equivalent to double insulation is. Since these appliances may either be protected by grounding or double insulation, the “or its equivalent” statement in the requirement could be deleted without affecting product design and to also avoid confusion.

Related Item

First Revision No. 4876-NFPA 70-2015 [Section No. 422.16(B)(1)]

Submitter Information Verification

Submitter Full Name: Gary Siggins
Organization: UL LLC
Street Address:
City:
State:
Zip: Submittal Date: Tue Sep 22 14:02:06 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-4803-NFPA 70-2015
Statement: In the context of a sink waste disposer, it is unclear in the exception what the equivalent to double insulation is. Since these appliances may either be protected by grounding or double insulation, the “or its equivalent” statement in the requirement could be deleted without affecting product design and to also avoid confusion.
Built-in dishwashers and trash compactors shall be permitted to be cord-and-plug-connected with a flexible cord identified as suitable for the purpose in the installation instructions of the appliance manufacturer where all of the following conditions are met:

1. The flexible cord shall be terminated with a grounding-type attachment plug.  
   **Exception:** A listed dishwasher or trash compactor distinctly marked to identify it as protected by a system of double insulation, or its equivalent, shall not be required to be terminated with a grounding-type attachment plug.

2. For a trash compactor, the length of the cord shall be 0.9 m to 1.2 m (3 ft to 4 ft) measured from the face of the attachment plug to the plane of the rear of the appliance.

3. For a built-in dishwasher, the length of the cord shall be 0.9 m to 2.0 m (3 ft to 6.5 ft) measured from the face of the attachment plug to the plane of the rear of the appliance.

4. Receptacles shall be located to protect against physical damage to the flexible cord.

5. The receptacle for a trash compactor shall be located in the space occupied by the appliance or adjacent thereto.

6. The receptacle for a built-in dishwasher shall be located in the space adjacent to the space occupied by the dishwasher.

7. The receptacle shall be accessible.

Statement of Problem and Substantiation for Public Comment

I would ask CMP-17 to reconsider the proposed requirement that the receptacle for a built-in dishwasher be located only in the space adjacent to the space occupied by the dishwasher. If anything, I would ask CMP-17 to permit the receptacle outlet for a cord-and-plug dishwasher to ONLY be allowed to be in the same space occupied by the dishwasher. By requiring the receptacle outlet in the space adjacent to the dishwasher, this would typically constitute a hole drilled in the cabinet wall and the flexible cord required to pass through said drilled hole to the receptacle in the adjacent space. With the necessity to pull and push the dishwasher in and out of the dedicated space for the dishwasher (for maintenance and repair), this action would subject the flexible cord to the possibility of MORE physical damage than if the receptacle outlet were located behind the dishwasher in the same space. I suspect that most AHJs would look at the flexible cord ran through a drilled hole in a cabinet as a violation of 400.8(2) and 400.8(7).

The submitter of the Public Input that drove this proposed change indicated in his substantiation that UL 749 forbids electrical receptacles for dishwashers to be installed in the cabinet recess where the dishwasher is installed and requires the receptacle to be installed in a location adjacent to the dishwasher. The substantiation also indicated that the discontinuity between the product safety standard and the NEC needs to be corrected. While I agree with the last statement, perhaps the product standard needs to be changed rather than the NEC changed to allow more potential physical damage to the dishwasher flexible cord. The proposed new length of said cord is a needed change regardless of the location of the receptacle outlet.

Related Item

Public Input No. 1245-NFPA 70-2014 [Section No. 422.16(B)(2)]
First Revision No. 4804-NFPA 70-2015 [Section No. 422.16(B)(2)]

Submitter Information Verification

Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 13:17:44 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>The requirement of the product safety standard (ANSI/UL 749, clause 8.3.3a): “the power-supply receptacle for the appliance shall be installed in a cabinet or on a wall adjacent to the undercounter space in which the appliance is to be installed”) has been in effect for over a decade. Since its inception, all but the longest-lived dishwashers have been replaced by units supplied with this instruction. The installation described in the problem statement is not difficult, has been common practice long before the product safety standard made it a requirement, and has an advantage whereby the plug can be more easily disconnected in the adjacent space than by having to first remove the dishwasher.</td>
</tr>
</tbody>
</table>
(2) Built-in Dishwashers and Trash Compactors.

Built-in dishwashers and trash compactors shall be permitted to be cord-and-plug-connected with a flexible cord identified as suitable for the purpose in the installation instructions of the appliance manufacturer where all of the following conditions are met:

(1) The flexible cord shall be terminated with a grounding-type attachment plug.

\textit{Exception: A listed dishwasher or trash compactor distinctly marked to identify it as protected by a system of double insulation.}

\textit{or its equivalent,}

\textit{shall not be required to be terminated with a grounding-type attachment plug.}

(2) For a trash compactor, the length of the cord shall be 0.9 m to 1.2 m (3 ft to 4 ft) measured from the face of the attachment plug to the plane of the rear of the appliance.

(3) For a built-in dishwasher, the length of the cord shall be 0.9 m to 2.0 m (3 ft to 6.5 ft) measured from the face of the attachment plug to the plane of the rear of the appliance.

(4) Receptacles shall be located to protect against physical damage to the flexible cord.

(5) The receptacle for a trash compactor shall be located in the space occupied by the appliance or adjacent thereto.

(6) The receptacle for a built-in dishwasher shall be located in the space adjacent to the space occupied by the dishwasher.

(7) The receptacle shall be accessible.

\section*{Statement of Problem and Substantiation for Public Comment}

In the context of dishwashers or trash compactors, it is unclear in the exception what the equivalent to double insulation is. Since these appliances may either be protected by grounding or double insulation, the “or its equivalent” statement in the requirement could be deleted without affecting product design and to also avoid confusion.

\section*{Related Item}

\textbf{First Revision No. 4804-NFPA 70-2015 [Section No. 422.16(B)(2)]}

\section*{Submitter Information Verification}

\textbf{Submitter Full Name:} Gary Siggins

\textbf{Organization:} UL LLC

\textbf{Street Address:}

\textbf{City:}

\textbf{State:}

\textbf{Zip:}

\textbf{Submittal Date:} Tue Sep 22 14:05:53 EDT 2015

\section*{Committee Statement}

\textbf{Committee Action:} Rejected but see related SR

\textbf{Resolution:} SR-4804-NFPA 70-2015

\textbf{Statement:} In the context of dishwashers or trash compactors, it is unclear in the exception what the equivalent to double insulation is. Since these appliances may either be protected by grounding or double insulation, the “or its equivalent” statement in the requirement could be deleted without affecting product design and to also avoid confusion.
Range hoods shall be permitted to be cord-and-plug-connected with a flexible cord identified as suitable for use on range hoods in the installation instructions of the appliance manufacturer, where all of the following conditions are met:

1. The flexible cord is terminated with a grounding-type attachment plug.
   
   **Exception:** A listed range hood distinctly marked to identify it as protected by a system of double insulation, or its equivalent, shall not be required to be terminated with a grounding-type attachment plug.

2. The length of the cord is not less than 450 mm (18 in.) and not over 1.2 m (4 ft).

3. Receptacles are located to protect against physical damage to the flexible cord.

4. The receptacle is accessible.

5. The receptacle is supplied by an individual branch circuit.

**Statement of Problem and Substantiation for Public Comment**

In the context of range hoods it is unclear in the exception what the equivalent to double insulation is. Since these appliances may either be protected by grounding or double insulation, the “or its equivalent” statement in the requirement could be deleted without affecting product design and to also avoid confusion.

**Related Item**

First Revision No. 4805-NFPA 70-2015 [Section No. 422.16(B)(4)]

**Submitter Information Verification**

**Submitter Full Name:** Gary Siggins  
**Organization:** UL LLC

**Committee Statement**

**Committee Action:** Rejected but see related SR

**Resolution:** SR-4805-NFPA 70-2015

**Statement:** In the context of range hoods it is unclear in the exception what the equivalent to double insulation is. Since these appliances may either be protected by grounding or double insulation, the “or its equivalent” statement in the requirement could be deleted without affecting product design and to also avoid confusion.
422.18 Support of Ceiling-Suspended (Paddle) Fans.

Ceiling-suspended (paddle) fans shall be supported independently of an outlet box or by one of the following:

(a) listed outlet box or
(b) outlet box systems identified for the use and installed in accordance with 314.27(C)
(c) outlet box systems identified for use utilizing listed locking support and mounting receptacle used in combination with a listed device including a compatible factory installed attachment fitting designed for support and installed in accordance with 314.27(E).

Statement of Problem and Substantiation for Public Comment

The text was editorially modified to be a list, and only item (3) was added as new text. This proposed text is not considered “new material” because it is added to coordinate with new text in 314.27(E) proposed and approved by CMP 9 in FR 2411 that reads as follows:

(E) Separable Attachment Fittings. Outlet boxes shall be permitted to support listed locking support and mounting receptacles used in combination with compatible attachment fittings designed for the support of equipment covered within and subject to all weight and orientation limits contemplated by the listing. Where such fittings are used, the equipment mounted shall comply with 314.27(A) through (D) as applicable. Where the supporting receptacle is installed within a box, it shall be included in the fill calculation covered in 314.16(B)(4).

Additionally, the “list” format of options is more user friendly.

Related Item

First Revision No. 2411-NFPA 70-2015 [Section No. 314.27]

Submitter Information Verification

Submitter Full Name: AMY CRONIN
Organization: STRATEGIC CODE SOLUTIONS LLC
Affiliation: Safety Quick Lighting and Fans Corp.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 15 13:33:18 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4806-NFPA 70-2015
Statement: The Panel agrees to adding reference to the listed device and compatible factory installed attachment fitting noting that this is predicated on Panel 9 retaining its complementary First Revision (the new 314.27(E)). Made editorial revisions for clarity.
422.33 Disconnection of Cord-and-Plug-Connected or Attachment Fitting-Connected Appliances.

(A) Separable Connector or an Attachment Plug (or Attachment Fitting) and Receptacle.

For cord-and-plug- (or attachment fitting), connected appliances, an accessible separable connector or an accessible plug (or attachment fitting) and receptacle combination shall be permitted to serve as the disconnecting means. Where the separable connector or plug (or attachment fitting) and receptacle combination are not accessible, cord-and-plug-connected or attachment fitting-and-plug-connected appliances shall be provided with disconnecting means in accordance with 422.31.

(B) Connection at the Rear Base of a Range.

For cord-and-plug-connected household electric ranges, an attachment plug and receptacle connection at the rear base of a range, accessible from the front by removal of a drawer, shall meet the intent of 422.33(A).

(C) Rating.

The rating of a receptacle or of a separable connector shall not be less than the rating of any appliance connected thereto. Exception: Demand factors authorized elsewhere in this Code shall be permitted to be applied to the rating of a receptacle or of a separable connector.

Statement of Problem and Substantiation for Public Comment

This proposed text is not considered “new material” because it is added to coordinate with new text in 314.27(E) proposed and approved by CMP 9 in FR 2411 that reads as follows:

(E) Separable Attachment Fittings. Outlet boxes shall be permitted to support listed locking support and mounting receptacles used in combination with compatible attachment fittings designed for the support of equipment covered within and subject to all weight and orientation limits contemplated by the listing. Where such fittings are used, the equipment mounted shall comply with 314.27(A) through (D) as applicable. Where the supporting receptacle is installed within a box, it shall be included in the fill calculation covered in 314.16(B) (4).

It should be noted that for user-friendliness purposes, the definition for “attachment fitting” was previously submitted as PI 4316, and is now resubmitted as a Public Comment in light of the newly added text in 314.27(E).

Related Public Comments for This Document

<table>
<thead>
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<tr>
<td>Public Comment No. 661-NFPA 70-2015 [New Definition after Definition: Associated Nonincendive Fi..]</td>
<td>Definition of “attachment fitting” is one of two definitions that should be added as a result of the new text added in FR 2411. The term must be defined.</td>
</tr>
<tr>
<td>Public Comment No. 661-NFPA 70-2015 [New Definition after Definition: Associated Nonincendive Fi..]</td>
<td>Related Item</td>
</tr>
<tr>
<td>First Revision No. 2411-NFPA 70-2015 [Section No. 314.27]</td>
<td></td>
</tr>
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</table>

Submitter Information Verification

Submitter Full Name: AMY CRONIN
Organization: STRATEGIC CODE SOLUTIONS LLC
Affiliation: Safety Quick Lighting and Fans Corp.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 15 13:41:15 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4807-NFPA 70-2015
| **Statement:** | The Panel added reference to “attachment fitting” as a means of disconnect. Because the attachment fitting must be suitable for the purpose of disconnection, the proposal was amended accordingly. |
Cord-and plug-connected pipe heating assemblies intended to prevent freezing of piping shall be listed and labeled.

Additional Proposed Changes

<table>
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<tr>
<th>File Name</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
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<td>This will address small parts.</td>
</tr>
<tr>
<td>Public Input No. 910-NFPA 70-2014 [Section No. 422.50]</td>
<td></td>
</tr>
<tr>
<td>First Revision No. 4803-NFPA 70-2015 [Global Input]</td>
<td></td>
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</table>

Submitter Information Verification
Committee Statement

Committee Action: Accepted
Resolution: SR-4808-NFPA 70-2015
Statement: The Panel agrees with public comment clarifying certain equipment be "listed and labeled" instead of just "listed." Listing agencies do not consider a product to be listed unless the label has actually been applied.
424.37 On Walls. When permitted by the manufacturer, listed and labelled heating cables shall be permitted to be installed on walls of bathrooms, tub or shower spaces. Cables shall be covered per the manufacturer’s instructions. Unless otherwise specified in the installation instructions, cables shall be spaced not less than 150 mm (6 in.) from the ceiling and not less than 50 mm (2 in.) from an adjacent wall. Cables shall not be installed within 200 mm (8 in.) of luminaires, outlets, or wall penetration. Where heating cables are installed in walls a warning label suitable for the environment shall be affixed to the surface indicating the presence of electric heating cables and that penetrations are not permitted.

Statement of Problem and Substantiation for Public Comment

NEW Substantiation: Some heating cables are now specifically designed to be installed in the walls of indoor damp locations to facilitate the evaporation of excessive moisture on wall surfaces. This also inhibits the formation of damp conditions favorable for mold and fungus growth in wall cavities. Listed cables installed on walls under ceramic or stone tile will be protected from physical damage.

Related Item

Public Input No. 3527-NFPA 70-2014 [Section No. 424.38(A)]

Submitter Information Verification

Submitter Full Name: Julia Billen
Organization: WarmlyYours
Affiliation: Submitted on behalf of Pete at NuHeat Industries LTD
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:57:55 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Allowing the installation of heating cables on walls of tubs, showers and bathrooms would expose the user to the heating cables in a wet environment. If the intent of the submitter was to allow the heating cables to be installed in the walls or under the wall covering of tubs, showers and bathrooms this would still present an installation that modifications could be made to the walls of those areas presenting an unsafe condition for the user. Simply adding a statement that requires a warning label to be installed suitable for the environment would not provide a safe environment for the user. The label would likely be distracting to the user and the user would remove the label leaving a condition in which the presence of heating cables would not be known.
424.37 On Walls. When permitted by the manufacturer, listed and labelled heating cables shall be permitted to be installed in walls of tub or shower spaces. Cables shall be covered per the manufacturer’s instructions. Unless otherwise specified in the installation instructions, cables shall be spaced not less than 150 mm (6 in.) from the ceiling and not less than 50 mm (2 in.) from an adjacent wall. Cables shall not be installed within 200 mm (8 in.) of luminaires, outlets, or wall penetration.

Where heating cables are installed in walls a warning label suitable for the environment shall be affixed to the surface indicating the presence of electric heating cables and that penetrations are not permitted.

Statement of Problem and Substantiation for Public Comment

Heating cables are now specifically designed to be installed in the walls of indoor damp locations to facilitate the evaporation of excessive moisture on wall surfaces. This also inhibits the formation of damp conditions favorable for mold and fungus growth in wall cavities. Listed cables installed on walls under ceramic or stone tile will be protected from physical damage.

Related Item

Public Input No. 3527-NFPA 70-2014 [Section No. 424.38(A)]

Submitter Information Verification

Submitter Full Name: Julia Billen
Organization: WarmlyYours
Street Address:
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 15:06:39 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Allowing the installation of heating cables on walls of tubs, showers and bathrooms would expose the user to the heating cables in a wet environment. If the intent of the submitter was to allow the heating cables to be installed in the walls or under the wall covering of tubs, showers and bathrooms this would still present an installation that modifications could be made to the walls of those areas presenting an unsafe condition for the user. Simply adding a statement that requires a warning label to be installed suitable for the environment would not provide a safe environment for the user. The label would likely be distracting to the user and the user would remove the label leaving a condition in which the presence of heating cables would not be known.
424.38 Area Restrictions.

(A) Extending Beyond the Room or Area.
Heating cables shall be permitted to extend beyond the room or area in which they originate.

(B) Uses Not Permitted.
Heating cables shall not be installed as follows:

1. In closets, other than as noted in 424.38(C) 424.38(D)
2. Over the top of walls where the wall intersects the ceiling
3. Over partitions that extend to the ceiling, unless they are isolated single runs of embedded cable
4. Under or through walls
5. Over cabinets whose clearance from the ceiling is less than the minimum horizontal dimension of the cabinet to the nearest cabinet edge that is open to the room or area
6. In tub and shower walls
7. Under cabinets or similar built-ins having no clearance to the floor

(C) In Closet Ceilings as Low-Temperature Heat Sources to Control Relative Humidity.
The provisions of 424.38(B) shall not prevent the use of cable in closet ceilings as low-temperature heat sources to control relative humidity, provided they are used only in those portions of the ceiling that are unobstructed to the floor by shelves or other permanent luminaires.

(D) Heating panels and heating panel sets shall be permitted in ceilings and floors of clothes closets when installed outside the closet storage space as defined in 410.2 and provided with independent temperature control.

Statement of Problem and Substantiation for Public Comment

The popularity of in-floor heating products has triggered the desire for warmed flooring in larger, walk-in type closets. Installing the cable only in the walkway would provide the necessary comfort without any fire risk. Using the existing definition of closet storage space from Article 410 and installing a control as specified in Canadian code would eliminate any safety concerns.

We believe we should incorporate the following recommendation according to the Canadian Electrical Code: Rule 62-212 Article 6: Heating Panels and Heating Panels Sets shall be permitted in ceilings and below floors of clothes closets if they are provided with independent temperature control.

Related Item
Public Input No. 3531-NFPA 70-2014 [New Section after 424.38(C)]

Submitter Information Verification

Submitter Full Name: Julia Billen
Organization: WarmlyYours
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:12:01 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This submission does not provide sufficient substantiation that would support that the area defined in 410.2 or the area outside of the definition in 410.2 would not be used as long term storage shielding entrapped heat. The submission lacks information on how to install an independent temperature control so as to avoid the entrapped heat hazard.
424.39 Clearance from Other Objects and Openings.

Heating elements of cables installed in ceilings shall be separated at least 200 mm (8 in.) from the edge of outlet boxes and junction boxes that are to be used for mounting surface luminaires. A clearance of not less than 50 mm (2 in.) shall be provided from recessed luminaires and their trims, ventilating openings, and other such openings in room surfaces. No heating cable shall be covered by any surface-mounted equipment.

Statement of Problem and Substantiation for Public Comment

As amended in the First Revision, the requirement no longer distinguishes between the heating and non-heating conductors of heating cables. The non-heating conductors are unnecessarily being required to be separated 8 in. from surface luminaire outlet and junction boxes and 2 in from recessed luminaires, their trim and ventilating openings. Such conductors are arguably no different from other current carrying conductors that are not similarly restricted in their location.

Committee Statement

Committee Action: Accepted
Resolution: SR-4809-NFPA 70-2015
Statement: As amended in the First Revision, the requirement no longer distinguishes between the heating and non-heating conductors of heating cables. The non-heating conductors are unnecessarily being required to be separated 8 in. from surface luminaire outlet and junction boxes and 2 in from recessed luminaires, their trim and ventilating openings. Such conductors are arguably no different from other current carrying conductors that are not similarly restricted in their location.
Public Comment No. 1805-NFPA 70-2015 [Section No. 424.66(B)]

(B) Limited Access.

Where the enclosure is located in a space above a ceiling, all of the following shall apply:

(1) The enclosure shall be accessible through a lay-in type ceiling or an access panel(s).
(2) The width of the working space shall be the width of the enclosure or a minimum of 762 mm (30 in.), whichever is greater.
(3) All doors or hinged panels shall open to at least 90 degrees.
(4) The space in front of the enclosure shall comply with the depth requirements of Table 110.26(A)(1).
   a. A horizontal ceiling T-bar shall be permitted in this space.
   b. The work space shall be otherwise unobstructed to the floor


Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that Public Input 1066 be referred to Code-Making Panel 17 for action due to the creation of First Revision 15 by CMP-1 on 110.26(A)(4).

Related Item
Public Input No. 1066-NFPA 70-2014 [Section No. 424.66]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 09:07:27 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The Panel accepts the assignment of handling the Public Input; no action is taken. It is expected that CMP-1 will address the issue. (See the panel action on Public Comment No. 777).
(B) Limited Access.

Where the enclosure is located in a space above a ceiling, all of the following shall apply:

1. The enclosure shall be accessible through a lay-in type ceiling or an access panel(s).
2. The width of the working space shall be the width of the enclosure or a minimum of 762 mm (30 in.), whichever is greater.
3. All doors or hinged panels shall open to at least 90 degrees.
4. The space in front of the enclosure shall comply with the depth requirements of Table 110.26(A)(1).
5. A horizontal ceiling T-bar shall be permitted in this space.
6. The work space shall be otherwise unobstructed to the floor, by permanently installed fixtures such as cabinets, walls or partitions.


Statement of Problem and Substantiation for Public Comment

IEC's position is to add language to 424.66(B)(4)(b) - (FR 4840)

As currently written this section would prohibit the occupant of the building from installing movable items such as tables or desks in the space beneath the ceiling.

Related Item

First Revision No. 4840-NFPA 70-2015 [Section No. 424.66(B)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 19 15:48:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4810-NFPA 70-2015
Statement: As currently written this section would prohibit the occupant of the building from installing movable items such as tables or desks in the space beneath the ceiling. Also revised text for clarification.

The Panel would like CMP-1 to address the revisions to this requirement.
Public Comment No. 1623-NFPA 70-2015 [Section No. 424.92(D)]

(D) Labels Provided by Manufacturer.

The manufacturers of heating panels or heating panel sets shall provide marking labels that indicate that the space-heating installation incorporates heating panels or heating panel sets and instructions that the labels shall be affixed to the panelboards to identify which branch circuits supply the circuits to those space-heating installations. If the heating panels and heating panel set installations are visible and distinguishable after installation, the labels shall not be required to be provided and affixed to the panelboards.

Statement of Problem and Substantiation for Public Comment

There are several reasons the panel should reconsider and accept this change. First, the rule is redundant. As the panel stated in the resolution to PI 3514 circuit identification is already adequately addressed by 408.4(A) which requires all circuits and circuit modifications to be marked at the panelboard by a suitable method determined by the installer and accepted by an AHJ. Second, this requirement is vague and unenforceable. There is no direction as to the size, shape, color or placement of the label, just that the label be affixed to the panelboard and identify the branch circuit(s). Third, it is discriminatory. The manufacturer-supplied label rule only applies to heating panels and heating panel sets but not to heating cables.

Related Item

Public Input No. 3547-NFPA 70-2014 [Section No. 424.92(D)]

Submitter Information Verification

Submitter Full Name: Julia Billen
Organization: WarmlyYours
Affiliation: Sam Sampson, Department of Labor & Industry
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 15:31:12 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-4811-NFPA 70-2015
Statement: Circuit identification is already adequately addressed by 408.4(A) which requires all circuits and circuit modifications to be marked at the panelboard by a suitable method determined by the installer and accepted by an AHJ. There is no direction as to the size, shape, color or placement of the label, just that the label be affixed to the panelboard and identify the branch circuit(s). The manufacturer-supplied label rule only applies to heating panels and heating panel sets but not to heating cables. The electrician can provide a more complete description of the location of the heating panel.
Sections 424.99(B)(5), 424.99(B)(6)

(5) — Fault Protection.
A device to open all ungrounded conductors supplying the heating panels or heating panel sets, provided by the manufacturer, shall function when a low- or high-resistance line-to-line, line-to-grounded conductor, or line-to-ground fault occurs, such as the result of a penetration of the element or element assembly.

(6) — Grounding Braid or Sheath.
Excluding nonheating leads, grounding means, such as copper braid, metal sheath, or other approved means, shall be provided with or as integral part of the heating panel or heating panel set.

When required by the manufacturer’s instructions, additional fault protection shall be installed.

Statement of Problem and Substantiation for Public Comment

Heating panels and panel sets, when suitable for installation under floor coverings, are required to be listed for this purpose. When grounded no additional safety device is needed.

In most cases, installation of a Fault Detecting Device (such as GFCI, ALCI, RCD), in an ungrounded circuit, provides adequate protection against risk of shock, and is most commonly the only protective device installed, aside from the branch circuit overcurrent device required by other sections of the code.

FPN a class 1 GFCI will trend to trip due to other phenomena such as natural leakage, capacitance etc. Therefore, the requirements are being simplified to be clear that a GFCI shall be provided in all cases and an easement on the grounding.. For specific products, if required by the listing and manufacturer’s instructions, additional fault protection may be required. When this is the case, this shall be installed and enforced by the AHJ. Therefore, item (5) is being modified to be clear for this requirement also.

Related Item
Public Input No. 3562-NFPA 70-2014 [Section No. 424.99(C)(5)]

Submitter Information Verification

Submitter Full Name: Julia Billen
Organization: WarmlyYours
Affiliation: Jonathan Willner, Heatronix
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:18:40 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4812-NFPA 70-2015
Statement: The requirements are being simplified to be clear that a GFCI shall be provided in all cases.
Public Comment No. 1806-NFPA 70-2015 [New Section after 424.99(B)(6)]

See Correlating Note below.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that all other heating related articles be reviewed and correlated with this new article. The Correlating Committee further directs that further consideration be given to the comments expressed in voting on First Revision 4841.

Related Item
First Revision No. 4841-NFPA 70-2015 [New Section after 424.99(C)(5)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Tue Sep 29 09:09:45 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The Panel has reviewed the committee comments and will maintain First Draft text.
Public Comment No. 422-NFPA 70-2015 [Section No. 425.1]

425.1 Scope.
This article covers fixed industrial process heating employing electric resistance or electrode heating technology. For the purpose of this article, heating equipment shall include boilers, electrode boilers, duct heaters, strip heaters, immersion heaters, process air heaters, or other approved fixed electric equipment used for industrial process heating. This article shall not apply to heating and room air conditioning for personnel spaces covered by Article 424, fixed heating equipment for pipelines and vessels covered by Article 427, and induction and dielectric heating equipment covered by Article 665, or specialty industrial furnaces incorporating silicon carbide, molybdenum, or graphite process heating elements.

Statement of Problem and Substantiation for Public Comment

While I applaud the efforts for the introduction of this new article the scope could be construed by AHJ's to be applied to all industrial heating applications.

There are many specialized industrial heating applications such as Vacuum Furnaces and Atmospheric Furnaces that use graphite (and others) heating element systems. Industrial heating applications can be much more complex than this article has addressed.

I have been involved in some installations that are 89 KW and 289 KW rated heating elements. The latter system was a dual three-phase heating element system operating at 90 volts and 4,000 amperes controlled by a SCR controlled transformer. These are custom designed and cannot comply with many of the requirements of this section, particularly the limit of 48 ampere heating elements which cannot be generically applied to these industrial heating systems. I refer the committee to www.spangpower.com for information on the specialized transformers and controllers that are used for these applications. At this time the scope of this article needs to exclude these applications.

I have attempted to provide appropriate wording for these applications, but the committee may find better language to exempt these large industrial heating applications until they can find ways to address them suitably.

Related Item

First Revision No. 4841-NFPA 70-2015 [New Section after 424.99(C)(5)]

Submitter Information Verification

Submitter Full Name: MARK WIRFS
Organization: R W ENGINEERING INC
Street Address:
City: 
State: 
Zip: 
Submittal Date: Thu Aug 20 11:59:54 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4813-NFPA 70-2015
Statement: The Panel has been informed there is technical complexity to these heating elements not currently being recognized by overcurrent protection requirements in Article 425.

Relevant NFPA standards that this article may apply to: NFPA 86, Standard for Ovens and Furnaces; NFPA 79 Electrical Standard for Industrial Machinery.
426.28 Ground-Fault Protection of Equipment

Ground-fault protection shall be provided for fixed outdoor electric deicing and snow-melting equipment.

Statement of Problem and Substantiation for Public Comment

Panel statement was that GFCI was allowed for the required protection. If so the reference to GFP should be more generalized and not stated as GFPE which is defined in our definitions. This change would also make the exception for GFCI in 210.8 B (3) understandable.

Related Item

Public Input No. 4485-NFPA 70-2014 [Section No. 426.28]
Public Input No. 4486-NFPA 70-2014 [Section No. 427.22]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: master
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 14:40:12 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Removing the requirement for the Ground Fault Protection of Equipment would indicate that only ground fault protection would be required. This would allow for an ineffective method of protection.
426.54 Cord-and Plug-Connected Deicing and Snow-Melting Equipment.
Cord-and plug-connected deicing and snow-melting equipment shall be listed and labeled.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
Public Input No. 911-NFPA 70-2014 [Section No. 426.54]
First Revision No. 4803-NFPA 70-2015 [Global Input]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 

11/19/2015 12:04 PM
<table>
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<td>Resolution:</td>
<td>SR-4814-NFPA 70-2015</td>
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<td>Statement:</td>
<td>The Panel agrees with public comment clarifying certain equipment be &quot;listed and labeled&quot; instead of just &quot;listed.&quot; Listing agencies do not consider a product to be listed unless the label has actually been applied.</td>
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</table>
427.1 Scope.

The requirements of this article shall apply to electrically energized heating systems and the installation of these systems used with pipelines or vessels or both.


Statement of Problem and Substantiation for Public Comment

Reference changed from ANSI/NECA 202 to read NECA NEIS 202 in the informational note.

Related Item

First Revision No. 4847-NFPA 70-2015 [Section No. 427.1]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 09 18:41:27 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The reference is correct as-is.
Scope.

This article covers motors, motor branch-circuit and feeder conductors and their protection, motor overload protection, motor control circuits, motor controllers, motor control centers and adjustable-speed drive systems.

Informational Note No. 1: Installation requirements for motor control centers are covered in 110.26(E). Air-conditioning and refrigerating equipment are covered in Article 440.

Informational Note No. 2: Figure 430.1 is for information only.

Statement of Problem and Substantiation for Public Comment

Adding adjustable-speed drive systems to the scope of Article 430. Adjustable-speed drive systems are unique to the list of other items contained in the Scope of Article 430.

Related Item

Public Input No. 1818-NFPA 70-2014 [Section No. 430.1]

Submitter Information Verification

Submitter Full Name: TIMOTHY CROUSHORE
Organization: FIRSTENERGY
Affiliation: FirstEnergy
Street Address:
City:
<table>
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<tr>
<td><strong>Submittal Date:</strong> Thu Jul 30 13:45:51 EDT 2015</td>
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**Committee Statement**

| Committee Action: | Rejected |
| Resolution: | Adjustable speed drive systems are a combination of an adjustable speed drive, its associated motor(s), and auxiliary equipment. As such this material is already covered properly in article 430. Recommended additional text does not improve clarity. Note that the scope is the responsibility of the correlating committee. |
(G) Conduits for Small Motors.

Conduits for small motors shall not be smaller than 14 AWG unless otherwise permitted in 430.22(G)(1) or (G)(2).

(1) 18 AWG Copper.

Where, 18 AWG individual copper conductors, installed in a cabinet or enclosure, 18 AWG individual copper conductors, copper conductors, that are part of a jacketed multiconductor cable assembly, or copper conductors in a flexible cord shall be permitted, under either of the following sets of conditions:

(1) The circuit supplies a motor with a full-load current rating, as determined by 430.6(A)(1), of greater than 3.5 amperes, and less than or equal to 5 amperes, and all the following conditions are met:
   (2) The circuit is protected in accordance with 430.52.
   (3) The circuit is provided with maximum Class 10 or Class 10A overload protection in accordance with 430.32.
   (4) Overcurrent protection is provided in accordance with 240.4(D)(1)(2).

(5) The circuit supplies a motor with a full-load current rating, as determined by 430.6(A)(1), of 3.5 amperes or less, and all the following conditions are met:
   (6) The circuit is protected in accordance with 430.52.
   (7) The circuit is provided with maximum Class 20 overload protection in accordance with 430.32.
   (8) Overcurrent protection is provided in accordance with 240.4(D)(1)(2).

(2) 16 AWG Copper.

Where, 16 AWG individual copper conductors, installed in a cabinet or enclosure, 16 AWG individual copper conductors, copper conductors, that are part of a jacketed multiconductor cable assembly, or copper conductors in a flexible cord shall be permitted under either of the following sets of conditions:

(1) The circuit supplies a motor with a full-load current rating, as determined by 430.6(A)(1), of greater than 5.5 amperes, and less than or equal to 8 amperes, and all the following conditions are met:
   (2) The circuit is protected in accordance with 430.52.
   (3) The circuit is provided with maximum Class 10 or Class 10A overload protection in accordance with 430.32.
   (4) Overcurrent protection is provided in accordance with 240.4(D)(2)(2).

(5) The circuit supplies a motor with a full-load current rating, as determined by 430.6(A)(1), of 5.5 amperes or less, and all the following conditions are met:
   (6) The circuit is protected in accordance with 430.52.
   (7) The circuit is provided with maximum Class 20 overload protection in accordance with 430.32.
   (8) Overcurrent protection is provided in accordance with 240.4(D)(2)(2).

Additional Proposed Changes

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<tr>
<td>430.22_G_FR1357-1is.pdf</td>
<td>430.22(G) document</td>
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</table>

Statement of Problem and Substantiation for Public Comment

No change to the other items of the sublisting.

The proposed text is identical to Public Input No. 1357 which should have been accepted as a First Revision to allow multiconductor cables and cords to leave the enclosure. The installation concerns expressed in the Code panel comment regarding potential damage to multiconductor cables and cords leaving the enclosure are adequately addressed in the construction specifications, wiring methods, and restrictions in Chapters 3 and 4.

Related Item

Public Input No. 1357-NFPA 70-2014 [Section No. 430.22(G)]
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<tbody>
<tr>
<td><strong>Submitter Full Name:</strong> VINCE BACLAWSKI</td>
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<tr>
<td><strong>Organization:</strong> NEMA</td>
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<td><strong>Street Address:</strong></td>
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<th><strong>Committee Statement</strong></th>
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<tr>
<td><strong>Committee Action:</strong> Rejected but see related SR</td>
</tr>
<tr>
<td><strong>Resolution:</strong> SR-3006-NFPA 70-2015</td>
</tr>
<tr>
<td><strong>Statement:</strong> Installation concerns regarding potential damage to multiconductor cables and cords leaving the enclosure are adequately addressed in the construction specifications, wiring methods, and restrictions in Chapters 3 and 4. See attached word document 430.22(G)_3006_CD.</td>
</tr>
</tbody>
</table>
**TITLE OF NEW CONTENT**
Type your content here ... Exception #2
Installation may comply with 240.21 (B) (5)

**Statement of Problem and Substantiation for Public Comment**

An outdoor feeder tap can be of unlimited length if it complies with all of the conditions of 240.21(B)(5) unless it is a motor short circuit and ground fault protective device as in 430.28. If the motor short circuit and ground fault protective device was in a panel containing a main it would be OK. It should be Acceptable to supply a Motor circuit with a tap conductor governed by the rules of 240.21(B)(5) when it feeds a motor short circuit and ground fault protective device.

**Related Item**
First Revision No. 3013-NFPA 70-2015 [Section No. 430.22(F)]

**Submitter Information Verification**

Submitter Full Name: GERALD DALEY  
Organization: Daley Electric Company
Street Address: 
City:  
State:  
Zip:  
Submittal Date: Mon Aug 17 17:32:49 EDT 2015

**Committee Statement**

Committee Action: Rejected  
Resolution: No substantiation was provided that there are field problems that would be addressed by this change. The overcurrent protection in a motor application could be a different type of device than those permitted in Article 240.
Public Comment No. 1807-NFPA 70-2015 [New Section after 430.90]

See Correlating Note below.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that this First Revision be reviewed by the panel with regard to similar text in 409.22. The panel shall consider reviewing the proper use of the terms “fault current” and “short circuit current”.

Related Item
First Revision No. 3016-NFPA 70-2015 [New Section after 430.98]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 09:29:23 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: “Fault” current is replaced by “short-circuit” current for improved clarity. Throughout the NEC®, “fault” current can be replaced by “short-circuit” current, without changing the intent. However, “short-circuit” current cannot be universally changed to “fault” current without causing confusion. For example, equipment short-circuit current rating could not be changed to equipment fault current rating without causing much confusion. CMP 11 asks the Correlating Committee to direct all Code Making Panels to replace “fault” current with “short-circuit” current throughout the NEC®.
Public Comment No. 1037-NFPA 70-2015 [Section No. 430.99]

The available short circuit current at the motor control center and the date the short circuit current calculation was performed shall be documented and made available to those authorized to inspect the installation.

Statement of Problem and Substantiation for Public Comment

While it is certainly important for motor control centers to have an adequate short circuit current rating, this may be said for ALL electrical equipment. This is clearly covered in Sections 110.9 and 110.10. This requirement should be in Article 110 and not proliferated throughout the Code as it is a fundamental requirement that applies to all equipment.

Related Item
First Revision No. 3016-NFPA 70-2015 [New Section after 430.98]

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 10:31:17 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Proper installation according to the equipment short circuit current rating and documentation of the available short-circuit current and the date will increase safety. It will create safer installations by adding language to assist the installer and the Authority Having Jurisdiction (AHJ). Documentation with a date can actually reduce liability for contractors, inspectors, and manufacturers, by identifying that equipment was originally installed correctly. The extra emphasis is needed because the requirements are not being met, thereby causing issues with code compliance and inspection requirements.
430.99 Available Fault Current.
The available short-circuit fault current at the motor control center and the date the short-circuit fault current calculation was performed shall be documented and made available to those authorized to inspect the installation.

Statement of Problem and Substantiation for Public Comment
The wording change is suggested for consistency with code language in sections 110.9, 440.10, etc and with this section's own title.

Related Item
Public Input No. 4712-NFPA 70-2014 [Section No. 430.98(A)]
Public Input No. 4437-NFPA 70-2014 [New Section after 430.98]

Submitter Information Verification
Submitter Full Name: CHARLES POWELL
Organization: EASTMAN CHEMICAL COMPANY
Affiliation: American Chemistry Council
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Aug 14 08:15:36 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: “Fault” current is replaced by “short-circuit” current for improved clarity. Throughout the NEC®, “fault” current can be replaced by “short-circuit” current, without changing the intent. However, “short-circuit” current cannot be universally changed to “fault” current without causing confusion. For example, equipment short-circuit current rating could not be changed to equipment fault current rating without causing much confusion. CMP 11 asks the Correlating Committee to direct all Code Making Panels to replace “fault” current with “short-circuit” current throughout the NEC®.
430.99 - Available Fault Current

The available short circuit current at the motor control center and the date the short circuit current calculation was performed shall be documented and made available to those authorized to inspect the installation.

Statement of Problem and Substantiation for Public Comment

IEC's position is to delete 430.99 - (FR 3016)

The code already requires that equipment be installed according to available fault current, so adding this requirement is redundant. The installer/supplier already has the responsibility/liability to install the proper equipment based on the characteristics of the system. This proposal puts too much liability on the contractor/supplier because after installation various factors can change which will affect the available fault current. Feeders can be reworked, transformers can be changed with different impedance values, motor loads can be added to the existing system and similar factors that can change the available fault current. In the case of a lawsuit, the installer will have the burden of proof that the installation was done according to code and would result in unnecessary costs for defending an installation that was installed correctly, but that had variables change that are out of their control. A better proposal would be to require the owner to relabel the equipment after any alteration to the system.

Related Public Comments for This Document

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<td>Public Comment No. 749-NFPA 70-2015 [Section No. 700.5(E)]</td>
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<td>Public Comment No. 750-NFPA 70-2015 [Section No. 701.5(D)]</td>
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<td>Public Comment No. 755-NFPA 70-2015 [Section No. 670.5(2)]</td>
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<tr>
<td>Public Comment No. 630-NFPA 70-2015 [Section No. 409.23]</td>
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</tbody>
</table>

Related Item

First Revision No. 3016-NFPA 70-2015 [New Section after 430.98]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 12 19:27:32 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Proper installation according to the equipment short circuit current rating and documentation of the available short-circuit current and the date will increase safety. It will create safer installations by adding language to assist the installer and the Authority Having Jurisdiction (AHJ). Documentation with a date can actually reduce liability for contractors, inspectors, and manufacturers, by identifying that equipment was originally installed correctly. The extra emphasis is needed because the requirements are not being met, thereby causing issues with code compliance and inspection requirements.
Public Comment No. 668-NFPA 70-2015 [Section No. 430.109(F)]

(F) Cord-and-Plug- or Attachment Fitting- Connected Motors.

For a cord-and-plug-connected motor, an attachment fitting-connected motor, a horsepower-rated attachment plug and receptacle, flanged surface inlet and cord connector, attachment fitting having ratings no less than the motor, or attachment plug and cord connector having ratings no less than the motor ratings shall be permitted to serve as the disconnecting means. Horsepower-rated attachment plugs or attachment fittings, flanged surface inlets, receptacles, or cord connectors shall not be required for cord-and-plug-connected appliances in accordance with 422.33, room air conditioners in accordance with 440.63, ceiling-suspended (paddle) fans in accordance with 314.27(E), or portable motors rated \( \frac{1}{3} \) hp or less.

Statement of Problem and Substantiation for Public Comment

New text was proposed and approved for 314.27(E) by CMP 9 in FR 2411 that read as follows:

(E) Separable Attachment Fittings. Outlet boxes shall be permitted to support listed locking support and mounting receptacles used in combination with compatible attachment fittings designed for the support of equipment covered within and subject to all weight and orientation limits contemplated by the listing. Where such fittings are used, the equipment mounted shall comply with 314.27(A) through (D) as applicable. Where the supporting receptacle is installed within a box, it shall be included in the fill calculation covered in 314.16(B)(4).

The text needs to be modified in 430.109(F) to assure that an attachment fitting and receptacle combination that is load-make-and-load-break rated is recognized as a suitable disconnecting means for ceiling-suspended (paddle) fan motors.

Related Item
First Revision No. 2411-NFPA 70-2015 [Section No. 314.27]
Public Input No. 4449-NFPA 70-2014 [Section No. 430.109(F)]

Submitter Information Verification

Submitter Full Name: AMY CRONIN
Organization: STRATEGIC CODE SOLUTIONS LLC
Affiliation: Safety Quick Lighting and Fans Corp.
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 15 15:45:17 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Present NEC Code language allows this device to be installed for paddle fans. No new language within this Code section is needed.
Public Comment No. 1808-NFPA 70-2015 [Section No. 440.8]

440.8 Single Machine.
An air-conditioning or refrigerating system shall be considered to be a single machine under the provisions of 430.87, Exception No. 1, and 430.112, Exception. The motors shall be permitted to be located remotely from each other.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that this First Revision be reviewed by the panel with regard to 440.10(B). The panel shall consider reviewing the proper use of the terms "fault current" and "short circuit current". This

Related Item
First Revision No. 3006-NFPA 70-2015 [New Section after 440.8]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 09:31:07 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3005-NFPA 70-2015
Statement: Reject but see SR3003 which complies with the direction of the Correlating Committee. “Fault” current is replaced by “short-circuit” current for improved clarity. Throughout the NEC®, “fault” current can be replaced by “short-circuit” current, without changing the intent. However, “short-circuit” current cannot be universally changed to “fault” current without causing confusion. For example, equipment short-circuit current rating could not be changed to equipment fault current rating without causing much confusion, CMP 11 asks the Correlating Committee to direct all Code Making Panels to replace “fault” current with “short-circuit” current throughout the NEC®.
440.9  .  Grounding and Bonding.
Where multimotor and combination-load equipment is installed outdoors on a roof, an equipment grounding conductor of the wire type shall be installed in outdoor portions of metallic raceway systems that use non-threaded fittings.

Statement of Problem and Substantiation for Public Comment

We agree with the negative comments submitted by the UL representative that “all UL certified metallic conduit, including EMT, is evaluated for its ability to bond the conduit to the connecting fittings” and that the requirement for additional grounding and bonding is a belts and suspenders approach that will not solve the issue of poor workmanship or ineffective maintenance practices. The Panel Statement that the use of non-threaded conduit systems on rooftops supplying HVACR equipment are subject to movement and damage “that results in separation of non-threaded conduit or tubing resulting in loss of equipment grounding unless a wire type equipment ground is provided” is far-reaching and inaccurate. Not all installations are subjected to the same conditions. A properly installed, code-compliant and properly maintained system will take into account code requirements for protection against physical damage, use of expansion fittings, good workmanship, etc. The installation of a supplemental grounding conductor is not a panacea for not following current code requirements.

Related Item
First Revision No. 3005-NFPA 70-2015 [New Section after 440.8]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 11:37:08 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The Panel reaffirms its position that the addition of a wire type equipment grounding conductor improves safety, by increasing the reliability of the equipment grounding conductor path.
440.10. Short-Circuit Current Rating.
(A) Installation.
Motor controllers of multimotor and combination load equipment shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with 440.4(R).
(B) Documentation.
When motor controllers or industrial control panels of multimotor and combination load equipment are required to be marked with a short circuit current rating, the available short circuit current and the date the short circuit current calculation was performed shall be documented and made available to those authorized to inspect the installation.

Statement of Problem and Substantiation for Public Comment

While it is certainly important for air conditioning and refrigerating equipment to have an adequate short circuit current rating, this may be said for ALL electrical equipment. This is clearly stated in Section 110.10. If this new section is added to the Code, it is likely that similar sections will be proposed to be added to numerous other articles. This requirement should be in Article 110 and not proliferated throughout the Code as it is a fundamental requirement that applies to all equipment. If AHJs are having difficulty determining whether or not HVAC equipment is properly rated, then they must be having the same difficulty for other equipment as well. That is the type of situation Article 110 is intended to address. The correlating committee may wish to review this language for consistency with other electrical equipment articles throughout the NEC.

Related Item
First Revision No. 3006-NFPA 70-2015 [New Section after 440.8]

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 10:27:03 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Proper installation according to the equipment short circuit current rating and documentation of the available short-circuit current and the date will increase safety. It will create safer installations by adding language to assist the installer and the Authority Having Jurisdiction (AHJ). Documentation with a date can actually reduce liability for contractors, inspectors, and manufacturers, by identifying that equipment was originally installed correctly. The extra emphasis is needed because the requirements are not being met, thereby causing issues with code compliance and inspection requirements.
Public Comment No. 754-NFPA 70-2015 [Section No. 440.10(B)]

(B) Documentation.
When motor controllers or industrial control panels of multimotor and combination load equipment are required to be marked with a short circuit current rating, the available short circuit current and the date the short circuit current calculation was performed shall be documented and made available to those authorized to inspect the installation.

Statement of Problem and Substantiation for Public Comment

IEC's position is to delete 440.10 - (FR 3006)

The code already requires that equipment be installed according to available fault current, so adding this requirement is redundant. The installer/supplier already has the responsibility/liability to install the proper equipment based on the characteristics of the system. This proposal puts too much liability on the contractor/supplier because after installation various factors can change which will affect the available fault current. Feeders can be reworked, transformers can be changed with different impedance values, motor loads can be added to the existing system and similar factors that can change the available fault current. In the case of a lawsuit, the installer will have the burden of proof that the installation was done according to code and would result in unnecessary costs for defending an installation that was installed correctly, but that had variables change that are out of their control. A better proposal would be to require the owner to relabel the equipment after any alteration to the system.

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<td>Public Comment No. 631-NFPA 70-2015 [Section No. 430.99]</td>
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Related Item
First Revision No. 3006-NFPA 70-2015 [New Section after 440.8]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 18 20:48:00 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Proper installation according to the equipment short circuit current rating and documentation of the available short-circuit current and the date will increase safety. It will create safer installations by adding language to assist the installer and the Authority Having Jurisdiction (AHJ). Documentation with a date can actually reduce liability for contractors, inspectors, and manufacturers, by identifying that equipment was originally installed correctly. The extra emphasis is needed because the requirements are not being met, thereby causing issues with code compliance and inspection requirements.
Public Comment No. 1073-NFPA 70-2015 [Section No. 440.22(A)]

<table>
<thead>
<tr>
<th>(A)</th>
<th>Rating or Setting for Individual Motor-Compressor.</th>
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<tbody>
<tr>
<td></td>
<td>The motor-compressor branch-circuit short-circuit and ground-fault protective device shall be capable of carrying the starting current of the motor, with a minimum rating of 115% of the full-load current, or in accordance with 440.12(A)(1).</td>
</tr>
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<td>A protective device having a rating or setting not exceeding 175 percent of the motor-compressor rated-load current or branch-circuit selection current, whichever is greater, shall be permitted, provided that, where the protection specified is not sufficient for the starting current of the motor, the rating or setting shall be permitted to be increased but shall not exceed 225 percent of the motor rated-load current or branch-circuit selection current, whichever is greater.</td>
</tr>
<tr>
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<td><em>Exception: The rating of the branch-circuit short-circuit and ground-fault protective device shall not be required to be less than 15 amperes.</em></td>
</tr>
</tbody>
</table>

### Statement of Problem and Substantiation for Public Comment

It was not the intent of the Public Input submitted to require the rating of the branch-circuit short-circuit and ground-fault protective device to be set at the maximum level stated on the Manufacturer's nameplate labels, as was suggested in the Panel's substantiation. Certainly smaller rated devices may start motor-compressors without damage, however, it has become increasingly the habit to install the smallest device possible. This leaves the decision as to what that minimum level permitted to carry the starting load of the equipment should be, after installation, up to the discretion of the Authority Having Jurisdiction. The minimum setting required by 440.12(A)(1) is not 175% as is generally the marked rating on the Manufacturer's nameplate.

### Related Item

Public Input No. 2724-NFPA 70-2014 [Section No. 440.22(A)]

### Submitter Information Verification

- **Submitter Full Name:** Ron Chilton
- **Organization:** North Carolina Code Clearing Committee
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Wed Sep 23 15:32:11 EDT 2015

### Committee Statement

- **Committee Action:** Rejected
- **Resolution:** The substantiation does not clearly indicate the problems encountered in the field. The branch-circuit, short-circuit, and ground fault protective device can be no smaller than the "minimum circuit ampacity" and no larger than the "maximum overcurrent protective device amperes" as marked on the nameplate.
The equipment branch-circuit short-circuit and ground-fault protective device shall be capable of carrying the starting current of the equipment with a minimum rating of 115% of the full-load current, or in accordance with 440.12(A)(1). Where the hermetic refrigerant motor-compressor is the only load on the circuit, the protection shall comply with 440.22(A). Where the equipment incorporates more than one hermetic refrigerant motor-compressor or a hermetic refrigerant motor-compressor and other motors or other loads, the equipment short-circuit and ground-fault protection shall comply with 430.53 and 440.22(B)(1) and (B)(2).

Statement of Problem and Substantiation for Public Comment

It was not the intent of the Public Input submitted to require the rating of the branch-circuit short-circuit and ground fault protective device to be set at the maximum level stated on the Manufacturer's nameplate labels, as was suggested in the Panel's substantiation. Certainly smaller rated devices may start motor-compressors without damage, however, it has become increasingly the habit to install the smallest device possible. This leaves the decision as to what that minimum level permitted to carry the starting load of the equipment should be, after installation, up to the discretion of the Authority Having Jurisdiction. The minimum setting required by 440.12(A)(1) is not 175% as is generally the marked rating on the Manufacturer's nameplate.

Committee Statement

Committee Action: Rejected
Resolution: The substantiation does not clearly indicate the problems encountered in the field. The branch-circuit, short-circuit, and ground fault protective device can be no smaller than the "minimum circuit ampacity" and no larger than the "maximum overcurrent protective device amps" as marked on the nameplate.
Public Comment No. 761-NFPA 70-2015 [ New Section after 445.1 ]

Title of New Content 445.6 Listing
Type your content here ...

All Generators under the scope of this article shall be listed.

Statement of Problem and Substantiation for Public Comment

All Generators in Article 445 should be listed just like signs, luminaries, raceways, flexible cords ETC.

Related Item
Public Input No. 3236-NFPA 70-2014 [Article 445]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: master
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 18 22:46:12 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Not all generators are listed and there are specialized generators for which listing would not be available.
445.10 Location.
Generators shall be of a type suitable for the locations in which they are installed. They shall also meet the requirements for motors in 430.14 and shall be installed so that they can be adequately maintained and serviced.

Informational Note: See NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, for information on the location of generator exhaust.

Statement of Problem and Substantiation for Public Comment
Referring the reader back to a paragraph that effectively just says “install it correctly and make sure you can also maintain it properly” seems like a waste of the user’s time—especially when it refers only to motors, which is confusing to a person not familiar with the NEC or the similarities between motors and generators. References to other sections should be limited to situations not only where there are common requirements that need to be coordinated and space savings are achieved. It should also be noted that perhaps even my words are extraneous, given that article 100 has many references to the need for proper installation requirements and maintenance.

Related Public Comments for This Document

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Submitter Information Verification
Submitter Full Name: GARY OLSON
Organization: KW RX LLC
Affiliation: none
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jul 15 19:15:04 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The panel maintains that the reference to Section 430.14 should not be deleted since it provides important information that the generator install-er should be aware of with regards to ventilation and maintenance.
445.11 Marking.

Each generator shall be provided with a nameplate giving the manufacturer’s name, the rated frequency, the number of phases if of ac, the rating in kilowatts or kilovolt-amperes, the power factor, the normal volts and amperes corresponding to the rating, and the rated ambient temperature. ac, and the rated temperature rise.

Nameplates for all stationary generators and portable generators rated more than 15 kW shall also give the power factor, the insulation system class, and if field configurable, the subtransient and transient reactances, the maximum short-circuit current, and the insulation system class. Stationary and portable generators shall be marked to indicate if the generator is protected against overload by inherent design, an overcurrent protective relay, circuit breaker, or fuse.

Marking shall be provided by the manufacturer to indicate whether or not the generator neutral is bonded to its frame. Where the bonding is modified in the field, additional marking shall be required to indicate whether the neutral is bonded to the frame.

Exception: For inverter-based generators, the maximum short circuit current shall be marked on the nameplate in lieu of the subtransient and transient reactances.

Statement of Problem and Substantiation for Public Comment

Moving power factor to the first paragraph makes more sense, and is consistent with the practice from most manufacturers.

Need both rated ambient temp and the rated temperature rise for calculations. This is not an “or” condition.

Inverter based generators will require maximum short circuit current rating on the nameplate in lieu of the subtransient and transient reactances. This is an exception for just inverter based designs, so it should not be in the main text.

Putting all possible values for subtransient and transient reactances on the nameplate for reconnectible generators is not practical or necessary. The connection that gets chosen for the specific application, however, is relevant, and should be marked at the time of installation.

Related Item

First Revision No. 3602-NFPA 70-2015 [Section No. 445.11]

Submitter Information Verification

Submitter Full Name: Timothy Windey
Organization: Cummins Power Generation
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 13:30:32 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3617-NFPA 70-2015
Statement: “Power factor” has been relocated to the first paragraph of section 445.11 since it is common practice to mark this information on generators of all sizes.

Changes were accepted in the second paragraph to allow certain gen-set information to be placed in the manufacturer’s instructions rather than the nameplate.

“Synchronous” and “zero sequence” have been added to reactances since this information is also needed when modeling electrical systems.

The term “time-rating” was removed during the first draft stage but has been reinserted and renamed to “power rating category”. This change is necessary to clarify if the gen-set is intended for Prime, Continuous, Limited Time Running, or Emergency Standby Power use.
445.11 Marking.

Each generator shall be provided with a nameplate giving the manufacturer's name, the rated frequency, the number of phases if of ac, the rating in kilowatts or kilovolt-amperes, the normal volts and amperes corresponding to the rating, and the rated ambient temperature or rated temperature rise.

Nameplates for all stationary generators and portable generators rated more than 15 kW shall also give the power factor, the subtransient and transient reactances, and the insulation system class. Stationary generators shall be marked with the maximum short-circuit current, and the insulation system class. Stationary and portable generators shall be marked to indicate if the generator is protected against overload by inherent design, an overcurrent protective relay, circuit breaker, or fuse.

Marking shall be provided by the manufacturer to indicate whether or not the generator neutral is bonded to its frame. Where the bonding is modified in the field, additional marking shall be required to indicate whether the neutral is bonded to the frame.

Statement of Problem and Substantiation for Public Comment

There is no benefit to providing the maximum short-circuit current on a portable generator. Since there is no benefit there is no need for a requirement to provide this information. The short-circuit current information is only relevant on stationary generators as it is used for coordination of downstream overcurrent protection in a permanent installation.

Related Item
First Revision No. 3602-NFPA 70-2015 [Section No. 445.11]

Submitter Information Verification

Submitter Full Name: JEFF JONAS
Organization: GENERAC POWER SYSTEMS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 12:42:10 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel maintains that short-circuit or reactance information should be provided for all portable 15 kw or larger generators as indicated in 445.11.
445.11 Marking.

Each generator shall be provided with a nameplate giving the manufacturer's name, the rated frequency, the number of phases if of ac, the rating in kilowatts or kilovolt-amperes, the power factor, the normal volts and amperes corresponding to the rating, and the rated ambient temperature or rated temperature rise.

Nameplates for all stationary generators and portable generators rated more than 15 kW shall also give the power factor, the subtransient and transient reactances, the maximum short-circuit current, and the insulation system class. Stationary and portable generators shall be marked to indicate if the generator is protected against overload by inherent design, an overcurrent protective relay, circuit breaker, or fuse.

Marking shall be provided by the manufacturer to indicate whether or not the generator neutral is bonded to its frame. Where the bonding is modified in the field, additional marking shall be required to indicate whether the neutral is bonded to the frame.

Statement of Problem and Substantiation for Public Comment

Moving the requirement to show power factor to the first paragraph corresponds with current practice from most suppliers and this parameter is common across a very broad range of products.

The following paragraphs include information that is really useful only for a consulting engineer or other technically skilled person to verify that the machine delivered actually is what was ordered.

It is not possible for a manufacturer to state what the maximum available fault current is in a specific installation because grounding provisions impact on that value. The machine reactance data is required to be used by engineers to calculate what the value is for a specific installation. The site documentation should include the results of this documentation. If the engineer states the reactance data that was used to calculate fault current levels, and the reactance data on the machine matches (or is better than stated) the inspector can see clearly whether or not equipment fault current levels will be met. Note also that reactance data is often provided based on a standard machine rating and the machine is often applied at a different rating. A qualified engineer will know how to use this “per unit” data to calculate fault current levels.

Related Public Comments for This Document

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<td>Public Comment No. 253-NFPA 70-2015 [Section No. 445.10]</td>
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<tr>
<td>Public Input No. 252-NFPA 70-2014 [Section No. 840.47(A)]</td>
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</table>

Submitter Information Verification

Submitter Full Name: GARY OLSON
Organization: KW RX LLC
Affiliation: none
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 15 18:58:27 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3617-NFPA 70-2015
Statement: “Power factor” has been relocated to the first paragraph of section 445.11 since it is common practice to mark this information on generators of all sizes.

Changes were accepted in the second paragraph to allow certain gen-set information to be placed in the manufacturer’s instructions rather than the nameplate.

“Synchronous” and “zero sequence” have been added to reactances since this information is also needed when modeling electrical systems.
The term “time-rating” was removed during the first draft stage but has been reinserted and renamed to “power rating category”. This change is necessary to clarify if the gen-set is intended for Prime, Continuous, Limited Time Running, or Emergency Standby Power use.
Marking.

Each generator shall be provided with a nameplate giving the manufacturer's name, the rated frequency, the number of phases if of ac, the rating in kilowatts or kilovolt-amperes, the normal volts and amperes corresponding to the rating, and the rated ambient temperature or rated temperature rise.

Nameplates for or manufacturer's literature for all stationary generators and portable generators rated more than 15 kW shall also give the power factor, the synchronous, transient and subtransient and transient reactances, the maximum short-circuit current, and the insulation system class and the time rating. Stationary and portable generators shall be marked to indicate if the generator is protected against overload by inherent design, an overcurrent protective relay, circuit breaker, or fuse.

Marking shall be provided by the manufacturer to indicate whether or not the generator neutral is bonded to its frame. Where the bonding is modified in the field, additional marking shall be required to indicate whether the neutral is bonded to the frame.

Statement of Problem and Substantiation for Public Comment

Manufacturer's literature or the nameplate should retain the information about each generator. The maximum short circuit rating could be either synchronous or asynchronous. Depending on the reactance values proposed in this comment, the values can be determined or calculated based on the three reactances. In addition, the removal of the time rating removes the classification of the generator. The time rating needs to be included on the nameplate or in the literature.

Related Item

First Revision No. 3602-NFPA 70-2015 [Section No. 445.11]

Submitter Information Verification

Submitter Full Name: TIMOTHY CROUSHORE
Organization: FIRSTENERGY
Affiliation: FirstEnergy
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 30 15:02:04 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3617-NFPA 70-2015
Statement: “Power factor” has been relocated to the first paragraph of section 445.11 since it is common practice to mark this information on generators of all sizes.

Changes were accepted in the second paragraph to allow certain gen-set information to be placed in the manufacturer's instructions rather than the nameplate.

“Synchronous” and “zero sequence” have been added to reactances since this information is also needed when modeling electrical systems.

The term “time-rating” was removed during the first draft stage but has been reinserted and renamed to “power rating category”. This change is necessary to clarify if the gen-set is intended for Prime, Continuous, Limited Time Running, or Emergency Standby Power use.
Public Comment No. 508-NFPA 70-2015 [Section No. 445.11]

445.11 Marking.

Each generator shall be provided with a nameplate giving the manufacturer’s name, the rated frequency, the number of phases if of ac, the rating in kilowatts or kilovolt-amperes, the normal volts and amperes corresponding to the rating, and the rated ambient temperature or rated temperature rise.

Nameplates for all stationary generators and portable generators rated more than 15 kW shall also give the power factor, the subtransient and transient reactances, the maximum short-circuit current, and the insulation system class. Stationary and portable generators rated more than 15 kW shall be marked to indicate if the generator is protected against overload by inherent design, an overcurrent protective relay, circuit breaker, or fuse.

Marking shall be provided by the manufacturer to indicate whether or not the generator neutral is bonded to its frame. Where the bonding is modified in the field, additional marking shall be required to indicate whether the neutral is bonded to the frame.

Statement of Problem and Substantiation for Public Comment

It is not clear if the requirement for marking for protection against overload applies to all stationary generators and portable generators or only those rated more than 15 kW. Since this is in the same paragraph as another requirement for stationary generators and portable generators rated more than 15 kW, it is assumed that the intention was that the protection against overload marking would only apply to units rated more than 15 kW.

If this is not the case, then the second sentence of the second paragraph should become a separate paragraph and it should be clarified that it applies to all stationary and portable generators.

PGMA members represent a significant majority of the portable generator industry. Our member companies include:

- American Honda Motor Co.
- Briggs & Stratton Power Products Group LLC
- Champion Power Equipment
- Generac Power Systems
- Kipor Power Equipment, Inc.
- Subaru Industrial Power
- Techtronic Industries North America
- Wacker Neuson Production Americas LLC
- Yamaha Motor Corp USA

Related Item
First Revision No. 3602-NFPA 70-2015 [Section No. 445.11]

Submitter Information Verification

Submitter Full Name: Joseph Harding
Affiliation: Portable Generator Manufacturers’ Association
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 03 11:04:05 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3617-NFPA 70-2015
Statement: “Power factor” has been relocated to the first paragraph of section 445.11 since it is common practice to mark this information on generators of all sizes.

Changes were accepted in the second paragraph to allow certain gen-set information to be placed in the manufacturer’s instructions rather than the nameplate.

“Synchronous” and “zero sequence” have been added to reactances since this information is also needed when modeling electrical systems.
The term “time-rating” was removed during the first draft stage but has been reinserted and renamed to “power rating category”. This change is necessary to clarify if the gen-set is intended for Prime, Continuous, Limited Time Running, or Emergency Standby Power use.
Public Comment No. 509-NFPA 70-2015 [Section No. 445.13(B)]

(B) Overcurrent Protection Provided.
Where the generator set is equipped with a listed overcurrent protective device, including a combination of a current transformer and overcurrent relay, conductors shall be permitted to be tapped from the load side of the protected terminals in accordance with 240.21(B).

Exception: This is not permitted for portable generators rated 15kW or less where field wiring connection points are not provided.

Statement of Problem and Substantiation for Public Comment

Field wiring connection points are not typically provided on portable generators rated 15 kW or less. These products are typically cord and plug-connected.

PGMA members represent a significant majority of the portable generator industry. Our member companies include:

- American Honda Motor Co.
- Briggs & Stratton Power Products Group LLC
- Champion Power Equipment
- Generac Power Systems
- Kipor Power Equipment, Inc.
- Subaru Industrial Power
- Techtronic Industries North America
- Wacker Neuson Production Americas LLC
- Yamaha Motor Corp USA

Related Item
First Revision No. 3603-NFPA 70-2015 [Section No. 445.13]

Submitter Information Verification

Submitter Full Name: Joseph Harding
Affiliation: Portable Generator Manufacturers’ Association
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 03 11:10:47 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3618-NFPA 70-2015
Statement: Field wiring connection points are not typically provided on portable generators rated 15 kW or less. These products are typically cord- and plug-connected.

Editorial revisions are made for clarity.
Public Comment No. 254-NFPA 70-2015 [Section No. 445.18(A)]

(A) Disconnecting Means.
Generators other than cord- and plug-connected portable shall have one or more disconnecting means that simultaneously disconnect all ungrounded conductors. Each disconnecting means shall be lockable in the open position in accordance with 110.25.

Exception: Disconnects for generator set in a fire pump application shall comply with 695.4.B(3)(b).

Statement of Problem and Substantiation for Public Comment

The existing statement conflicts with the requirements for fire pumps, and the suggested exception resolves that conflict.

Related Item
Public Input No. 1515-NFPA 70-2014 [Section No. 445.18]

Submitter Information Verification
Submitter Full Name: GARY OLSON
Organization: KW RX LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 16 08:48:04 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The proposed exception is unnecessary since section 695.4(B)(3)(b) supplements or modifies the text in section 445.18(A). See 90.3 code arrangement.
 disconnecting means shall be lockable in the open position in accordance with 110.25.

Statement of Problem and Substantiation for Public Comment

IEC's position is to delete the word "simultaneously" be deleted from 445.18(A) - (FR 3661)

The IEC supports the majority of the change in section 445.18. The rewrite will clear up significant confusion in the industry with regard to generator disconnects. IEC recommends that the term “simultaneously” be deleted since this language could be interpreted by the local AHJ that all disconnects that are mounted on the generator must be interlocked to operate at the same exact time. We do not think that was the intent of the change.

Related Item
First Revision No. 3661-NFPA 70-2015 [Section No. 445.18]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Sep 20 16:03:22 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3619-NFPA 70-2015
Statement: 445.18(A) has been revised to clarify that when multiple disconnects are installed on a gen-set each disconnect is only required to open its own specific set of ungrounded conductors. Interlocking is not required.
Public Comment No. 1200-NFPA 70-2015 [Section No. 445.18(B)]

(B) Shutdown of Prime Mover.
Generators shall have provisions to shut down the prime mover. This means of shutdown shall:

1. Be equipped with provisions to disable all prime mover start control circuits to render the prime mover incapable of starting
2. Initiate a shutdown mechanism that requires a mechanical reset

Generators with greater than 15 kW rating shall be provided with an additional remote requirement to shut down the prime mover. The additional shutdown means shall be located outside the equipment room or generator weatherproof housing enclosure.

The local requirement in 445.18(B) shall be permitted to satisfy the requirements of 445.18(A) where it is capable of being locked in the open position in accordance with 110.25.

Statement of Problem and Substantiation for Public Comment

Further clarity is needed in this section.

The first paragraph refers to a "local" shutdown means, and the second paragraph refers to a "remote" shutdown means. So we should add that to the text.

The third paragraph reference is ambiguous, so we should refer back to the proper specific paragraph (local shutdown).

Related Item
First Revision No. 3661-NFPA 70-2015 [Section No. 445.18]

Submitter Information Verification

Submitter Full Name: Timothy Windey
Organization: Cummins Power Generation
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 12:24:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3620-NFPA 70-2015
Statement: This revision clarifies that the general provisions to shut down the prime mover may satisfy the requirements in 445.18(A) under the given conditions. The additional means located outside the equipment room is modified to meet the requirements of 445.18(B)(1) and (B)(2).

Not all generator enclosures are weatherproof so this portion of the requirement has been removed.

Editorial revisions were made for clarity.
(B) Shutdown of Prime Mover.

Generators shall have provisions to shut down the prime mover. The means of shutdown shall:

1. Be equipped with provisions to disable all prime mover start control circuits to render the prime mover incapable of starting
2. Initiate a shutdown mechanism that requires a mechanical reset

Generators with greater than 15-25 kW rating shall be provided with an additional requirement provision to shut down the prime mover. The additional shutdown means shall be located outside the equipment room or generator weatherproof housing enclosure.

The requirement in 445.18(B) shall be permitted to satisfy the requirements of 445.18(A) where it is capable of being locked in the open position in accordance with 110.25.

Exception: Generator controllers behind lockable doors shall meet the requirements.

Statement of Problem and Substantiation for Public Comment

Changing the 15 kW to 25 kW will avoid burdening residential installations with this requirement. The risk is minimal with generators smaller than 25kw.
The use of "requirement" does not seem to fit. The code is a list of requirements making it not necessary to call it out specifically.
"Provision" indicates that an additional item needs to be provided, which is the case here.
The exception will convey that a generator controller can adequately provide the functions required in 445.18(B).

Related Item
First Revision No. 3661-NFPA 70-2015 [Section No. 445.18]

Submitter Information Verification

Submitter Full Name: JEFF JONAS
Organization: GENERAC POWER SYSTEMS
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:12:08 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel rejects the proposed limit of 25 kW. Section 445.10 and 590.6 delineate certain generator requirements at 15 kW and changing to a higher limit may have unintended consequences. The submitter did not provide adequate substantiation to support the proposed exception. See the Second Revision on section 445.18(B) for editorial changes.
Public Comment No. 510-NFPA 70-2015 [Section No. 445.18(C)]

(C) Generators Installed in Parallel.
Where a generator is installed in parallel with other generators, the provisions of 445.18(A) shall be capable of isolating the generator output terminals from the paralleling equipment. The disconnecting means shall not be required to be located at the generator.

Exception: This requirement does not apply to cord- and plug-connected portable generators.

Statement of Problem and Substantiation for Public Comment

The proposed exception clarifies that the requirement does not apply to cord- and plug-connected portable generators, since the provisions of 445.18(A) do not apply to cord- and plug-connected portable generators.

PGMA members represent a significant majority of the portable generator industry. Our member companies include:

- American Honda Motor Co.
- Briggs & Stratton Power Products Group LLC
- Champion Power Equipment
- Generac Power Systems
- Kipor Power Equipment, Inc.
- Subaru Industrial Power
- Techtronic Industries North America
- Wacker Neuson Production Americas LLC
- Yamaha Motor Corp USA

Related Item
First Revision No. 3661-NFPA 70-2015 [Section No. 445.18]

Submitter Information Verification

Submitter Full Name: Joseph Harding
Affiliation: Portable Generator Manufacturers’ Association
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 03 11:21:24 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The exception is not necessary since 445.18(A) states that the disconnecting means requirement does not apply to portable generators that are cord-and-plug connected.
**Public Comment No. 1170-NFPA 70-2015 [ Section No. 445.20 ]**

445.20 Ground-Fault Circuit-Interrupter Protection for Receptacles on 15-kW or Smaller Portable Generators.

All 125-volt, single-phase, 15- and 20-ampere receptacle outlets that are a part of a 15-kW or smaller portable generator either shall have ground-fault circuit-interrupter protection for personnel integral to the generator or receptacle; or shall not be available for use when the 125/250-volt receptacle is in use. If the generator does not have a 125/250-volt receptacle, the requirement to disable the 125-volt, single-phase, 15- and 20-ampere receptacle outlets, provide ground-fault circuit-interrupter protection, shall not apply.

Exception: If the generator was manufactured or remanufactured prior to January 1, 2015, listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.

Statement of Problem and Substantiation for Public Comment

This change will clarify which requirement shall not apply when a 125/250V receptacle is a part of the portable engine generator design. The editorial changes unfortunately did not provide clarity to this requirement.

Portable generators without 125/250V receptacles are typically lessor kW units and only supply 120V only loads directly connected to the outlets provided directly on the unit. These generators operate as a non-grounded system which is allowed by 250.34(A) and only supply 120V loads.

It is my understanding that CMP-13 agreed during the NFPA 70 2014’ code cycle that a floating neutral generator without integral GFCI protection on the 125V 15A and 20A receptacle outlets provides a perfectly safe operating condition and is acceptable as long as it does not have the capability of being connected to premises wiring by way of a 125/250V receptacle.

**Related Item**
First Revision No. 3604-NFPA 70-2015 [Section No. 445.20]

Submitter Information Verification

Submitter Full Name: JEFF JONAS
Organization: GENERAC POWER SYSTEMS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 23:38:28 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: See Second Revision on section 445.20. The panel maintains that GFCI protection is necessary for all 125-volt 15- and 20-ampere receptacles located on a bonded neutral generator and is necessary for the same receptacles located on an unbonded or floating neutral generator.
Public Comment No. 512-NFPA 70-2015 [Section No. 445.20]

445.20  Ground-Fault Circuit-Interrupter Protection for Receptacles on 15-kW or Smaller Portable Generators.

All 125-volt, single-phase, 15- and 20-ampere receptacle outlets that are a part of a 15-kW or smaller portable generator that is equipped with a 125/250 volt receptacle, either shall have ground-fault circuit-interrupter protection for personnel integral to the generator or receptacle; or shall not be available for use when the 125/250-volt receptacle is in use. If the generator does not have a 125/250-volt receptacle, the requirement to disable the 125-volt, single-phase, 15- and 20-ampere receptacle outlets shall not apply.

Exception: If the generator was manufactured or remanufactured prior to January 1, 2015, listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.

Statement of Problem and Substantiation for Public Comment

The committee statement in FR 3604 says: "This First Revision accepts the TIA language as permanent code text in the 2017 NEC version with certain editorial changes."

Unfortunately, the "editorial changes" completely change the intended requirement of 445.20. 445.20 was created during the NEC 2014 code cycle based on the acceptance of Comment 13-16 by CMP-13. The submitter's intention was made clear in the substantiation of Comment 13-16, which is copied below:

"GFCI protection is not necessary on systems that are not grounded for the reasons given in my comment to reject this proposal. However, when the generator is connected to a premises wiring system, whether it has a floating or bonded neutral, it becomes part of a bonded and grounded system. This has not been a safety problem because nobody uses the duplex receptacles when powering their house because they want as much power to the house as possible through the locking 125/250 volt receptacle which is the one they use to power their house. If the panel is still concerned, then protecting the duplex receptacles with a GFCI is one way to improve the situation but is not the only way. The generator could be built with a simple system to make the duplex receptacles unavailable when the 125/250 volt locking receptacle is being used. This would be more effective and economical than GFCI protection. If the panel is going to force a change in the design of a portable generator, the panel should allow the manufacturers the freedom to create better solutions. They are the ones that are familiar with the applications and will ultimately be responsible for product liability, not the code making panel."

It is recognized that the text of 445.20 as published in NEC 2014 is not clear. The last sentence says: "If the generator does not have a 125/250-volt locking-type receptacle, this requirement shall not apply." "This requirement" could be taken to mean either all of 445.20 does not apply or the requirement to disable the 125-volt, single-phase 15- and 20-ampere receptacle outlets does not apply. Clearly, the submitter of Comment 13-16 for NEC 2014 meant that all of 445.20 should not apply if there is no 125/250-volt receptacle.

Furthermore, it is my understanding that CMP-13 agreed during the NEC 2014 Code cycle that a floating neutral generator without integral GFCI protection on the 125-volt 15- and 20-ampere receptacle outlets is perfectly safe and acceptable as long as it does not have the capability of being connected to premises wiring by way of a 125/250-volt receptacle.

With the "editorial change" proposed for 445.20 in FR 3604, a portable generator sitting in the middle of a field (i.e. an ungrounded system) and no 125/250-volt receptacle will require GFCI's on all 125-volt, single-phase 15- and 20-ampere receptacle outlets. The GFCI's may not function as intended in this scenario if the portable generator is floating neutral or bonded neutral.

PGMA requests that CMP-13 carefully consider the ramifications of this "editorial change".

PGMA members represent a significant majority of the portable generator industry. Our member companies include:

- American Honda Motor Co.
- Briggs & Stratton Power Products Group LLC
- Champion Power Equipment
- Generac Power Systems
- Kipor Power Equipment, Inc.
- Subaru Industrial Power
- Techtronic Industries North America
- Wacker Neuson Production Americas LLC
- Yamaha Motor Corp USA

Related Item
First Revision No. 3604-NFPA 70-2015 [Section No. 445.20]

Submitter Information Verification

Submitter Full Name: Joseph Harding
Organization: Thomas Asociates, Inc.
Committee Statement

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<td>Resolution:</td>
<td>See Second Revision on section 445.20. The panel maintains that GFCI protection is necessary for all 125-volt 15- and 20-ampere receptacles located on a bonded neutral generator and is necessary for the same receptacles located on an unbonded or floating neutral generator.</td>
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</table>
445.20 Ground-Fault Circuit-Interrupter Protection for Receptacles on 15-kW or Smaller Portable Generators.

All 125-volt, single-phase, 15- and 20-ampere receptacle outlets that are a part of a 15-kW or smaller portable generator either shall have ground-fault circuit-interrupter protection for personnel integral to the generator or receptacle; or shall not be allowed to be available for use when the 125/250-volt receptacle is in use. If the generator, a floating neutral generator, does not have a 125/250-volt receptacle, the requirement to disable the 125-volt, single-phase, 15- and 20-ampere receptacle outlets, clause 445.20 shall not apply.

Exception: If the generator was manufactured or remanufactured prior to January 1, 2015, listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.

Statement of Problem and Substantiation for Public Comment

CMP 13 agreed during the previous Code cycle that a floating neutral generator without integral GFCI protection on the 125-volt 15- and 20-ampere receptacles is perfectly safe and acceptable as long as it does not have capability of being connected to premises wiring by way of a 125/250-volt locking receptacle, by virtue of the fact that it is not so equipped. This position was also supported by Underwriters Laboratories representatives. During the current Code cycle, CMP 13 reversed their position, but gave no technical substantiation for the reversal. A floating neutral generator as described here has no ability to generate a ground fault, and so does not need to contain integral GFCI protection. The proposed wording modification to Art 445.20 clarifies the conditions under which integral GFCI is necessary and those conditions under which it is not.

Related Item
First Revision No. 3604-NFPA 70-2015 [Section No. 445.20]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 11:42:22 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: See Second Revision on section 445.20. The panel maintains that GFCI protection is necessary for all 125-volt 15- and 20-ampere receptacles located on a bonded neutral generator and is necessary for the same receptacles located on an unbonded or floating neutral generator.
445.20  Ground-Fault Circuit-Interrupter Protection for Receptacles on 15-kW or Smaller Portable Generators.

All 125-volt, single-phase, 15- and 20-ampere receptacle outlets that are a part of a 15-kW or smaller portable generator either shall have listed ground-fault circuit-interrupter protection (GFCI) for personnel integral to the generator or receptacle, or shall not be, as indicated in either (A) or (B):

(A) Unbonded (Floating Neutral) Generators. Unbonded generators with 125-volt and 125/250-volt receptacle outlets shall have listed GFCI protection for personnel, integral to the generator or receptacle, on all, 125-volt, 15 and 20-ampere receptacle outlets.

Exception: GFCI protection shall not be required where the 125-volt receptacle outlets(s) are interlocked such that they are not available for use when any 125/250-volt receptacle is in use.

(B) Bonded Neutral Generators. Bonded generators shall be provided with GFCI protection on all 125-volt, 15 and 20-ampere receptacle outlets.

shall not apply

Informational Note: Refer to 590.6(A)(3) for GFCI requirements for 15-kW or smaller portable generators used for temporary electric power and lighting.

Exception

- to (A) and (B): If the generator was manufactured or remanufactured prior to January 1, 2015, listed cord sets or devices incorporating listed ground-fault circuit interrupter protection for personnel identified for portable use shall be permitted.

Statement of Problem and Substantiation for Public Comment

CMP-13 rolled PI 2572 into the cart when they accepted the action on the previous TIA to revise 445.20. I agree with the action to support the TIA. However clarity is needed and this proposed revision gets that done.

All GFCI protection should be listed.

It is necessary to separate the requirements for both bonded and unbonded generators. The requirements are different. Clarity is provided in new first level subdivision (A) to clearly require GFCI's at 125v, 15 and 20 amp only where both 125v and 125/250v receptacles exist on the generator. The exception for GFCI's at 125v is maintained for unbonded generators that are interlocked to disable the 125v receptacles when the 125/250v receptacles are in use. Significant clarity is provided in (B) to require that 125v, 15/20 amp receptacles outlets in bonded generators are always required to be GFCI protected. The present text misses that and must be corrected.

The new IN provides clarity by referring the code user to Article 590 for generators used in temporary power under the purview of Article 590.

The exception is editorially modified to apply to both first level subdivisions.

Related Item

Public Input No. 2572-NFPA 70-2014 [Section No. 445.20]

Submitter Verification

Submitter Full Name: James Dollard
Organization: IBEW Local Union 98
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 15:19:34 EDT 2015
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(B) Over 112 ½ kVA.

Individual dry-type transformers of more than 112 ½ kVA rating shall be installed in a transformer room of fire-resistant construction. Unless specified otherwise in this article, the term fire resistant means a construction having a minimum fire rating of 1 hour.

Exception No. 1: Transformers with Class 155 or higher insulation systems and separated from combustible material by a fire-resistant, heat-insulating barrier or by not less than 1.83 m (6 ft) horizontally and 3.7 m (12 ft) vertically.

Exception No. 2: Transformers with Class 155 or higher insulation systems and completely enclosed except for ventilating openings.


Statement of Problem and Substantiation for Public Comment

Standard date update

Related Public Comments for This Document

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<tr>
<td>Public Comment No. 804-NFPA 70-2015 [Section No. 450.42]</td>
<td></td>
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</table>

Related Item

Public Input No. 1728-NFPA 70-2014 [Section No. 110.31(A)(5)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address: 
City: 
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Submittal Date: Sun Sep 20 19:42:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2414-NFPA 70-2015
Statement: This Informational Note is updated to reflect the latest version and title of the standard being referenced.
Public Comment No. 1802-NFPA 70-2015 [Section No. 450.23(A)]

(A) Indoor Installations.
Indoor installations shall be permitted in accordance with one of the following:

(1) In Type I or Type II buildings, in areas where all of the following requirements are met:
   a. The transformer is rated 35,000 volts or less.
   b. No combustible materials are stored.
   c. A liquid confinement area is provided.
   d. The installation complies with all the restrictions provided for in the listing of the liquid.
      Informational Note: Such restrictions may include, but are not limited to: maximum pressure of the tank, use
      of a pressure relief valve, appropriate fuse types and proper sizing of overcurrent protection.
   e. With an automatic fire extinguishing system and a liquid confinement area, provided the transformer is rated 35,000
      volts or less.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be provided to the comments expressed in voting on FR 2432.

Related Item
First Revision No. 2432-NFPA 70-2015 [Section No. 450.23(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
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City: 
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Zip: 
Submittal Date: Tue Sep 29 08:56:13 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The text in the First Revision is consistent with CMP 9’s revisions from the First Draft meeting; therefore, no
additional modifications are needed.
(B) Outdoor Installations.

Less-flammable liquid-filled transformers shall be permitted to be installed outdoors, attached to, adjacent to, or on the roof of buildings, where installed in accordance with 450.27.

Informational Note No. 1: Installations adjacent to combustible material, fire escapes, or door and window openings may require additional safeguards such as those listed in 450.27.

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

Informational Note No. 3: As used in this section, Type I and Type II buildings refers to Type I and Type II building construction as defined in NFPA 220-2015, Standard on Types of Building Construction. Combustible materials refers to those materials not classified as noncombustible or limited-combustible as defined in NFPA 220-2015, Standard on Types of Building Construction.

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

Statement of Problem and Substantiation for Public Comment

The CC directs that further consideration be provided to the comments expressed in voting on FR 7515.

Related Item

First Revision No. 7515-NFPA 70-2015 [Section No. 450.23(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
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City: 
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Submittal Date: Tue Sep 29 09:04:34 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2415-NFPA 70-2015
Statement: The panel statement on the First Draft ballot was in error, as it recapitulates the original substantiation of PI 4666 and is not the statement voted by the panel. Based on comments submitted by CMP members during the Balloting, the correct statement is as follows:

"Transformer fluids are evaluated in accordance with the Standard for Test for Comparative Flammability of Liquids, UL 340. These liquids are evaluated for characteristics such as Flash Point, Fire Point and Dielectric Strength. Many of these liquids also have restrictions, such as maximum tank pressure, use of pressure relief valves, appropriate fuse types and proper sizing of overcurrent protection, which should be part of the installation considerations."

Additionally, the First Revision that is noted in the record has incorrectly renumbered/reformatted this Subsection. This change in the Second Draft restores the work done by Panel 9 at the First Draft meeting.

This revision also addresses the comments from the Correlating Committee expressed in PC #429.
Public Comment No. 429-NFPA 70-2015 [Section No. 450.23(B)]

(B) Outdoor Installations.

Less-flammable liquid-filled transformers shall be permitted to be installed outdoors, attached to, adjacent to, or on the roof of buildings, where installed in accordance with 450.27.

(1) or (2):

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

Informational Note No. 1: Installations adjacent to combustible material, fire escapes, or door and window openings may require additional safeguards such as those listed in 450.27.

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

(2) In accordance with 450.27

Informational Note No. 3: As used in this section, Type I and Type II buildings refers to Type I and Type II building construction as defined in NFPA 220-2015, Standard on Types of Building Construction. Combustible materials refers to those materials not classified as noncombustible or limited-combustible as defined in NFPA 220-2015, Standard on Types of Building Construction.

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

Statement of Problem and Substantiation for Public Comment

The panel statement on the ballot is in error, as it recapitulates the original substantiation of PI 4666 and is not the statement voted by the panel. Based on comments submitted by CMP members during the Balloting, the correct statement is as follows:

“Transformer fluids are evaluated in accordance with the Standard for Test for Comparative Flammability of Liquids, UL 340. These liquids are evaluated for characteristics such as Flash Point, Fire Point and Dielectric Strength. Many of these liquids also have restrictions, such as maximum tank pressure, use of pressure relief valves, appropriate fuse types and proper sizing of overcurrent protection, which should be part of the installation considerations.”

Additionally, the First Revision that is noted in the record has incorrectly renumbered/reformatted this Subsection. Note that this Comment appears to miss the formatting required to make the requirements as subsections (1) and (2) of 450.23(B).

Related Item
First Revision No. 7515-NFPA 70-2015 [Section No. 450.23(B)]

Submitter Information Verification

Submitter Full Name: ROBERT OSBORNE
Organization: UL LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Aug 24 14:08:34 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2415-NFPA 70-2015
Statement: The panel statement on the First Draft ballot was in error, as it recapitulates the original substantiation of PI 4666 and is not the statement voted by the panel. Based on comments submitted by CMP members during the Balloting, the correct statement is as follows:

“Transformer fluids are evaluated in accordance with the Standard for Test for Comparative Flammability of Liquids, UL 340. These liquids are evaluated for characteristics such as Flash Point, Fire Point and Dielectric Strength. Many of these liquids also have restrictions, such as maximum tank pressure, use of pressure relief valves, appropriate fuse types and
proper sizing of overcurrent protection, which should be part of the installation considerations."

Additionally, the First Revision that is noted in the record has incorrectly renumbered/reformatted this Subsection. This change in the Second Draft restores the work done by Panel 9 at the First Draft meeting.

This revision also addresses the comments from the Correlating Committee expressed in PC #429.
450.42 Walls, Roofs, and Floors.

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

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

Informational Note No. 1: For additional information, see ANSI/ASTM E119-2012a Method for Fire Tests of Building Construction and Materials.

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

Statement of Problem and Substantiation for Public Comment

Standard date update

Related Public Comments for This Document

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<tr>
<td>Public Comment No. 801-NFPA 70-2015 [Section No. 300.11(B)(1)]</td>
<td></td>
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<tr>
<td>Public Comment No. 803-NFPA 70-2015 [Section No. 450.21(B)]</td>
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</table>

Related Item

Public Input No. 1728-NFPA 70-2014 [Section No. 110.31(A)(5)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address: 
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Zip:  
Submittal Date: Sun Sep 20 19:44:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-2416-NFPA 70-2015
Statement: This Informational Note is updated to reflect the latest version and title of the standard being referenced.
Article 480 - Storage Batteries

480.1 - Scope.
This article applies to all stationary installations of storage batteries.

Informational Note: The following standards are frequently referenced for the installation of stationary batteries:

1. IEEE 484-2008, Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications

2. IEEE 485-1997, Recommended Practice for Sizing Vented Lead-Acid Storage Batteries for Stationary Applications

3. IEEE 1145-2007, Recommended Practice for Installation and Maintenance of Nickel-Cadmium Batteries for Photovoltaic (PV) Systems

4. IEEE 1187-2007, Recommended Practice for Installation Design, and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications


6. IEEE 1578-2007, Recommended Practice for Stationary Battery Spill Containment and Management


8. UL 1973, Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications

9. UL Subject 2436, Spill Containment for Stationary Lead Acid Battery Systems

10. UL 1989, Standby Batteries

480.2 - Definitions.

Cell.
The basic electrochemical unit, characterized by an anode and a cathode, used to receive, store, and deliver electrical energy.

Container.
A vessel that holds the plates, electrolyte, and other elements of a single unit in a battery.

Informational Note: A container may be single-cell or multi-cell and is sometimes referred to in the industry as a “jar.”

Electrolyte.
The medium that provides the ion transport mechanism between the positive and negative electrodes of a cell.

Intercell Connector.
An electrically conductive bar or cable used to connect adjacent cells.

Intertier Connector.
An electrical conductor used to connect two cells on different tiers of the same rack or different shelves of the same rack.

Nominal Voltage (Battery or Cell).
The value assigned to a cell or battery of a given voltage class for the purpose of convenient designation. The operating voltage of the cell or battery may vary above or below this value.

Informational Note: The most common nominal cell voltages are 2 volts per cell for the lead-acid systems, 1.2 volts per cell for alkaline systems, and 3.6 to 3.8 volts per cell for Li-ion systems. Nominal voltages might vary with different chemistries.

Sealed Cell or Battery.
A cell or battery that has no provision for the routine addition of water or electrolyte or for external measurement of electrolyte specific gravity and might contain pressure relief venting.

Storage Battery.
A battery comprised of one or more rechargeable cells of the lead-acid, nickel-cadmium, or other rechargeable electrochemical types.

Terminal.
That part of a cell, container, or battery to which an external connection is made (commonly identified as post, pillar, pole, or terminal post).
480.3 - Battery and Cell Terminations.

(A) - Corrosion Prevention.
Where mating dissimilar metals, antioxidant material suitable for the battery connection shall be used where recommended by
the battery manufacturer.

Informational Note: The battery manufacturer's installation and instruction manual can be used for guidance for
acceptable materials.

(B) - Intercell and Intertier Conductors and Connections.
The ampacity of field-assembled intercell and intertier connectors and conductors shall be of such cross-sectional area that the
temperature rise under maximum load conditions and at maximum ambient temperature shall not exceed the safe operating
temperature of the conductor insulation or of the material of the conductor supports.

Informational Note: Conductors sized to prevent a voltage drop exceeding 3 percent of maximum anticipated load, and
where the maximum total voltage drop to the furthest point of connection does not exceed 5 percent, may not be
appropriate for all battery applications. IEEE 1375-2003, Guide for the Protection of Stationary Battery Systems,
provides guidance for overcurrent protection and associated cable sizing.

(C) - Battery Terminals.
Electrical connections to the battery, and the cable(s) between cells on separate levels or racks, shall not put mechanical strain
on the battery terminals. Terminal plates shall be used where practicable.

Informational Note: Conductors are commonly pre-formed to eliminate stress on battery terminations. Fine stranded
cables may also eliminate the stress on battery terminations. See the manufacturer's instructions for guidance.

480.4 - Wiring and Equipment Supplied from Batteries.
Wiring and equipment supplied from storage batteries shall be subject to the applicable provisions of this Code
applying to wiring and equipment operating at the same voltage, unless otherwise permitted by 480.5.

480.5 - Overcurrent Protection for Prime Movers.
Overcurrent protection shall not be required for conductors from a battery with a nominal voltage of 50 volts or less if the battery
provides power for starting, ignition, or control of prime movers. Section 300.3 shall not apply to these conductors.

480.6 - DC Disconnect Methods.

(A) - Disconnecting Means.
A disconnecting means shall be provided for all ungrounded conductors derived from a stationary battery system with a nominal
voltage over 50 volts. A disconnecting means shall be readily accessible and located within sight of the battery system.

Informational Note: See 240.21(H) for information on the location of the overcurrent device for battery conductors.

(B) - Remote Actuation.
Where a disconnecting means, located in accordance with 480.6(A), is provided with remote controls to activate the
disconnect means and the controls for the disconnecting means are not located within sight of the stationary battery system,
the disconnecting means shall be capable of being locked in the open position, in accordance with 110.25, and the location of
the controls shall be field marked on the disconnecting means.

(C) - Busway.
Where a DC busway system is installed, the disconnecting means shall be permitted to be incorporated into the busway.

(D) - Notification.
The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location
near the battery if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the
environment involved and shall include the following:

(1) Nominal battery voltage
(2) Maximum available fault current derived from the stationary battery system
(3) Date the fault current calculation was performed
(4) The battery disconnecting means shall be marked in accordance with 110.16.

Informational Note No. 1: Battery equipment suppliers can provide information about short-circuit current on any
particular battery model.

Informational Note No. 2: The available fault-current marking(s) addressed in 480.6(D)(2) is related to required short
circuit current ratings of equipment. NFPA 70E-2015, Standard for Electrical Safety in the Workplace, provides
assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal
protective equipment.

480.7 - Insulation of Batteries.
Batteries constructed of an electrically conductive container shall have insulating support if a voltage is present between the
container and ground.
480.8 - Battery Support Systems.

For battery chemistries with corrosive electrolyte, the structure that supports the battery shall be resistant to deteriorating action by the electrolyte. Metallic structures shall be provided with nonconducting support members for the cells, or shall be constructed with a continuous insulating material. Paint alone shall not be considered as an insulating material.

The terminals of all cells or multi-cell units shall be readily accessible for readings, inspection, and cleaning where required by the equipment design. One side of transparent battery containers shall be readily accessible for inspection of the internal components.

480.9 - Battery Locations.

Battery locations shall conform to 480.9(A), (B), and (C).

(A) - Ventilation.

Provisions appropriate to the battery technology shall be made for sufficient diffusion and ventilation of gases from the battery, if present, to prevent the accumulation of an explosive mixture.

Informational Note No. 1: See NFPA 1-2015, Fire Code, Chapter 52, for ventilation considerations for specific battery chemistries.

Informational Note No. 2: Some battery technologies do not require ventilation.


(B) - Live Parts.

Guarding of live parts shall comply with 110.27.

(C) - Spaces About Battery Systems.

Spaces about battery systems shall comply with 110.26. Working space shall be measured from the edge of the battery cabinet, racks, or trays.

For battery racks, there shall be a minimum clearance of 25 mm (1 in.) between a cell container and any wall or structure on the side not requiring access for maintenance. Battery stands shall be permitted to contact adjacent walls or structures, provided that the battery shelf has a free air space for not less than 90 percent of its length.

Informational Note: Additional space is often needed to accommodate battery hoisting equipment, tray removal, or spill containment.

(D) - Top Terminal Batteries.

Where top terminal batteries are installed on tiered racks or on shelves of battery cabinets, working space in accordance with the battery manufacturer’s instructions shall be provided between the highest point on a cell and the row, shelf, or ceiling above that point.

Informational Note: IEEE 1187-2013, IEEE Recommended Practice for Installation Design and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications, provides guidance for top clearance of valve-regulated lead-acid batteries, which are commonly used in battery cabinets.

(E) - Egress.

A personnel door(s) intended for entrance to, and egress from, rooms designated as battery rooms shall open in the direction of egress and shall be equipped with listed panic hardware.

(F) - Piping in Battery Rooms.

Gas piping shall not be permitted in dedicated battery rooms.

(G) - Illumination.

Illumination shall be provided for working spaces containing battery systems. The lighting outlets shall not be controlled by automatic means only. Additional lighting outlets shall not be required where the work space is illuminated by an adjacent light source. The location of luminaires shall not:

1. Expose personnel to energized battery components while performing maintenance on the luminaires in the battery space; or

2. Create a hazard to the battery upon failure of the luminaire.

480.10 - Vents.

(A) - Vented Cells.

Each vented cell shall be equipped with a flame arrester.

Informational Note: A flame arrester prevents destruction of the cell due to ignition of gases within the cell by an external spark or flame.

(B) - Sealed Cells.

Where the battery is constructed such that an excessive accumulation of pressure could occur within the cell during operation, a pressure-release vent shall be provided.
Statement of Problem and Substantiation for Public Comment

This proposal is related to the new Article 706, Energy Storage Systems (FR 3662). Currently batteries are addressed in numerous places in the NEC such as Articles 480 and 690, which has been appropriate over time with the former article historically covering lead-acid batteries and the latter recently added to address the application of batteries in general, not just lead acid, to PV systems. The current state of energy storage technology, which includes batteries, and anticipated evolution of energy storage supports the need for a singular set of requirements in the NEC covering such systems. If this is not accomplished in the 2017 NEC and available to serve as a singular foundation for needed changes in the future, the provisions covering such systems will continue to reside in different places within the NEC and likely evolve to attach themselves as parts to existing criteria throughout the NEC. To foster the safe application of energy storage systems and facilitate the application and use of the NEC by technology proponents as well as those who install and inspect such systems there should be a singular article in the NEC on energy storage systems.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
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Submittal Date: Wed Sep 23 22:25:07 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The removal of Article 480 has broad implications to the industry and the correlation of content with Article 706 should be reviewed by a Correlating Committee task group for recommendations next cycle. Chapter 4 requirements for electrical equipment provide necessary coverage for general utilization equipment and may not be completely encompassed in the Article 706 scope.
480.1 Scope.

This article applies to all stationary installations of storage batteries.

Informational Note: The following standards are frequently referenced for the installation of stationary batteries:

1. IEEE 484-2008, *Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications*


6. IEEE 1578-2007, *Recommended Practice for Stationary Battery Spill Containment and Management*


8. UL 1973-2013, *Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications*

9. UL Subject 2436, *Outline*, *Spill Containment for Stationary Lead Acid Battery Systems*

10. UL 1989, *Standby Batteries*

Statement of Problem and Substantiation for Public Comment

Referenced current edition of standards.

Related Item

First Revision No. 3639-NFPA 70-2015 [Section No. 480.1]

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
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Submittal Date: Mon Jul 06 23:51:37 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3628-NFPA 70-2015
Statement: The documents referenced within the informational note provide common resources for stationary battery systems. The document titles were corrected and the inclusion of a particular edition or publication date for these documents is removed since the applicability of this information is determined by the user.
Statement of Problem and Substantiation for Public Comment

The new text proposed by Public Input No. 3550-NFPA 70-2014 should be accepted. This Public Input (PI) sought to add a new section requiring listing of storage batteries for chemistries other than lead-acid, and for battery management systems. The proposal clearly sought to exclude installations addressing traditional lead-acid technology, which has been used for many years and is well understood.

However, new advanced battery technologies are not your father’s lead-acid auto batteries. As energy density has continued to increase in advanced batteries, driving more energy into smaller physical packages, the consequences of battery failure modes have increased significantly. Advanced battery technologies can be placed into unsafe operating modes, which can lead to thermal runaway, fires and explosions. This is particularly applicable to battery chemistries such as lithium-ion which have flammable electrolytes. A fault event within a single battery can quickly be driven by the chemistry to cascade to an event that consumes the battery; similarly, an event within a single battery can cascade to a large scale event. Rigorous validation of the battery design for safety is especially critical for these advanced technologies. Further, the manufacturing process of advanced batteries is critical to their safety; small contaminants in the manufacturing process can lead to the formation of dendrites over the life of the battery, which can cause catastrophic consequences.

The significant consequences from battery failures have been seen in the many advanced technology battery-related events in the news involving unlisted batteries, from the total destruction of a battery energy storage facility in Hawaii from fire in 2012, to the impacts of a Tesla automotive battery forcing the battery into a dramatic failure more, to the events involving the Boeing 787 Dreamliner. In the latter case, the intensive investigation by the US National Transportation Safety Board (NTSB), which UL supported through extensive scientific testing and analysis, led to NTSB making specific recommendations (http://www.ntsb.gov/investigations/Pages/boeing_787.aspx, “Auxiliary Power Unit Battery Fire Japan Airlines Boeing 787-8, JA829J”, Section 4, pp 81-83) to better address testing and compliance of advanced batteries. The same technical issues that drove those battery incidents in different sectors are also applicable within the electrical infrastructure for advanced batteries. For the electrical infrastructure, we already have the benefit of existing and proven American National Standards to proactively address safety – we just have to use them.

The PI Committee statement that resolved the PI in the First Draft stage indicates “Battery systems other than lead-acid are often field constructed and may contain unlisted components. Requiring listing of such systems is not practical due to numerous variations in the system type. Many new technologies precede the development of standards requirements in order to provide a listed product.” The statement illustrates several issues that require further consideration by the Panel.

First, this proposal does not seek to require listing of battery systems in Article 480 – it only addresses listing of the batteries themselves and battery management systems. Battery management systems are specific functional elements that use electronics to manage the charging and operation of batteries in such a way that the battery is not put into an unsafe mode. They are typically incorporated into stationary batteries and in this case are addressed by the listing of the battery to ANSI/UL 1973 or other applicable standards. If battery management systems are provided separate from the batteries, they should be required to be listed as they play a critical role in mitigating the fire and explosions hazards associated with the battery installation; in this case, compliance to the applicable safety standards verified through listing is a measure of due diligence to address the safety of the installation and validate that the battery management system electronics can adequately and reliably fulfill their functional safety role.

Second, American National Standards have been developed to address battery safety. These include ANSI/UL 1642 for lithium batteries and ANSI/UL 1973 for stationary batteries of all chemistries. These standards contain fundamental safety requirements to assess proper measures of mitigation of the inherent hazards presented by batteries. Leverage the safety afforded by compliance with the established American National Standards is a reasonable and appropriate safety measure. It is not clear what new battery technologies are envisioned, but ANSI/UL 1973 is chemistry agnostic and provides an appropriate measure of diligence for different technologies. Further, introducing an unknown and unlisted technology, that has not been shown to comply with any safety standards, truly presents significant risk. Based on the complexity of the battery design, manufacturing, validation, and integration processes, listing is a reasonable and important measure to support approval of the advanced battery installation by AHJs.

As energy demands grow rapidly, many stationary batteries will be introduced into our electrical infrastructure in the next several years. American National Standards exist for stationary batteries to support a practical and reasonable implementation of this technology within the electrical infrastructure in the safest way. I urge the Panel to be proactive in supporting a safe energy storage infrastructure, and add the proposed new requirements to Article 480.

Related Item

Public Input No. 3550-NFPA 70-2014 [New Section after 480.2]

Submitter Information Verification

Submitter Full Name: Kenneth Boyce
<table>
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Public Comment No. 1421-NFPA 70-2015 [Section No. 480.6(D)]

(D) Notification.

The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the battery if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

1. Nominal battery voltage
2. Maximum available fault current, short circuit current, derived from the stationary battery system
3. Date the fault current calculation was performed of the short circuit current determination
4. The battery disconnecting means shall be marked in accordance with 110.16.

Informational Note No. 1: Battery equipment suppliers can provide information about short-circuit current on any particular battery model.

Informational Note No. 2: The available fault-current marking(s) addressed in 480.6(D)(2) is related to required short circuit current ratings of equipment. NFPA 70E-2015, Standard for Electrical Safety in the Workplace, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment.

Statement of Problem and Substantiation for Public Comment

Battery systems are unique when it comes to short circuit current. One cannot approach a rack of batteries and calculate available fault current. Only the battery manufacturer has that information, and they will provide "available short circuit current" not "available fault current."

It is imperative to understand the reason for this marking. When working on batteries, several hazards may exist including shock, arc flash and chemical hazards. When determining the necessary PPE for exposure to the arc flash hazard, the table method is the most widely used method as labeled systems are not a requirement of federal regulation or installation codes. When using the table method in 130.7(C)(15)(B), the user needs the "available short circuit current."

The NEC Correlating Committee has appointed a task group to address the use of the terms "available short circuit current" and "available fault current." That work will be submitted for the 2020 edition of the NEC. In this case, the correct term is "available short circuit current." Ask any battery manufacturer what value they supply. We need to get this right.

Related Item
First Revision No. 3643-NFPA 70-2015 [Section No. 480.6(D)]

Submitter Information Verification

Submitter Full Name: James Dollard
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Street Address:
City:
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Submittal Date: Fri Sep 25 10:54:44 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3630-NFPA 70-2015
Statement: CMP 13 agrees that the term short-circuit current is appropriate.
Public Comment No. 1476-NFPA 70-2015 [Section No. 480.6(D)]

(D) Notification. The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the battery if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

1. Nominal battery voltage
2. Maximum available fault short-circuit current derived from the stationary battery system
3. Date the fault short-circuit current calculation was performed
4. The battery disconnecting means shall be marked in accordance with 110.16.

Informational Note No. 1: Battery equipment suppliers can provide information about short-circuit current on any particular battery model.

Informational Note No. 2: The available fault short-circuit current marking(s) addressed in 480.6(D)(2) is related to required short circuit current ratings of equipment. NFPA 70E-2015, Standard for Electrical Safety in the Workplace, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment.

Statement of Problem and Substantiation for Public Comment

The term short-circuit current is typically more suitable for the intended use in this section. Battery manufacturers commonly use the term short-circuit current for the information needed in this section.

Related Item
First Revision No. 3643-NFPA 70-2015 [Section No. 480.6(D)]

Submitter Information Verification
Submitter Full Name: TIMOTHY CRNKO
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State:
Zip:
Submittal Date: Fri Sep 25 12:58:39 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3630-NFPA 70-2015
Statement: CMP 13 agrees that the term short-circuit current is appropriate.
Public Comment No. 1263-NFPA 70-2015 [Section No. 480.9(E)]

(E) Egress.
A personnel door(s) intended for entrance to, and egress from, rooms designated as battery rooms shall open in the direction of egress and shall be equipped with listed and labeled panic hardware.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
First Revision No. 3648-NFPA 70-2015 [Section No. 480.9(E)]
Public Input No. 912-NFPA 70-2014 [Section No. 480.9(E)]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Committee Statement

Committee Action: Rejected

Resolution: The panel recognizes that the correlating committee reversed actions to add "listed and labeled" in all cases and a task group is reviewing this issue for the next NEC cycle.
Article 490  Equipment Over 1000, 1500 Volts, Nominal

Part I.  General

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

Informational Note No. 1: See NFPA 70E-2015, Standard for Electrical Safety in the Workplace, for electrical safety requirements for employee workplaces.

Informational Note No. 2: For further information on hazard signs and labels, see ANSI Z535.4-1998, Product Signs and Safety Labels.

490.2  Definition.

High Voltage.
For the purposes of this article, more than 1000, 1500 volts, nominal.

490.3  Other Articles.

(A)  Oil-Filled Equipment.
Installation of electrical equipment, other than transformers covered in Article 450, containing more than 38 L (10 gal) of flammable oil per unit shall meet the requirements of Parts II and III of Article 450.

(B)  Enclosures in Damp or Wet Locations.
Enclosures in damp or wet locations shall meet the requirements of 312.2.

Part II.  Equipment — Specific Provisions

490.21  Circuit-Interrupting Devices.

(A)  Circuit Breakers.

(1)  Location.

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

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

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

(2)  Operating Characteristics.
Circuit breakers shall have the following equipment or operating characteristics:

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

(2)  Be release free (trip free)

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

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

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

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

Circuit breakers shall have the following ratings:

1. The continuous current rating of a circuit breaker shall not be less than the maximum continuous current through the circuit breaker.
2. The interrupting rating of a circuit breaker shall not be less than the maximum fault current the circuit breaker will be required to interrupt, including contributions from all connected sources of energy.
3. The closing rating of a circuit breaker shall not be less than the maximum asymmetrical fault current into which the circuit breaker can be closed.
4. The momentary rating of a circuit breaker shall not be less than the maximum asymmetrical fault current at the point of installation.
5. The rated maximum voltage of a circuit breaker shall not be less than the maximum circuit voltage.

(B) Power Fuses and Fuseholders.

1. Use.

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

2. Interrupting Rating.

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


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

4. Identification of Fuse Mountings and Fuse Units.

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

5. Fuses.

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

6. Fuseholders.

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

DANGER — DISCONNECT CIRCUIT BEFORE REPLACING FUSES.

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

7. High-Voltage Fuses.

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

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

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

1. Installation.

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

2. Operation.

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

3. Interrupting Rating.

The interrupting rating of distribution cutouts shall not be less than the maximum fault current the cutout is required to interrupt, including contributions from all connected sources of energy.
<table>
<thead>
<tr>
<th>Voltage Rating.</th>
<th>The maximum voltage rating of cutouts shall not be less than the maximum circuit voltage.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification.</td>
<td>Distribution cutouts shall have on their body, door, or fuse tube a permanent and legible nameplate or identification showing the manufacturer’s type or designation, continuous current rating, maximum voltage rating, and interrupting rating.</td>
</tr>
<tr>
<td>Fuse Links.</td>
<td>Fuse links shall have a permanent and legible identification showing continuous current rating and type.</td>
</tr>
<tr>
<td>Structure Mounted Outdoors.</td>
<td>The height of cutouts mounted outdoors on structures shall provide safe clearance between lowest energized parts (open or closed position) and standing surfaces, in accordance with 110.34(E).</td>
</tr>
<tr>
<td>Oil-Filled Cutouts.</td>
<td>Continuous Current Rating.</td>
</tr>
<tr>
<td></td>
<td>The continuous current rating of oil-filled cutouts shall not be less than the maximum continuous current through the cutout.</td>
</tr>
<tr>
<td></td>
<td>Interrupting Rating.</td>
</tr>
<tr>
<td></td>
<td>The interrupting rating of oil-filled cutouts shall not be less than the maximum fault current the oil-filled cutout is required to interrupt, including contributions from all connected sources of energy.</td>
</tr>
<tr>
<td></td>
<td>Voltage Rating.</td>
</tr>
<tr>
<td></td>
<td>The maximum voltage rating of oil-filled cutouts shall not be less than the maximum circuit voltage.</td>
</tr>
<tr>
<td></td>
<td>Fault Closing Rating.</td>
</tr>
<tr>
<td></td>
<td>Oil-filled cutouts shall have a fault closing rating not less than the maximum asymmetrical fault current that can occur at the cutout location, unless suitable interlocks or operating procedures preclude the possibility of closing into a fault.</td>
</tr>
<tr>
<td></td>
<td>Identification.</td>
</tr>
<tr>
<td></td>
<td>Oil-filled cutouts shall have a permanent and legible nameplate showing the rated continuous current, rated maximum voltage, and rated interrupting current.</td>
</tr>
<tr>
<td></td>
<td>Fuse Links.</td>
</tr>
<tr>
<td></td>
<td>Fuse links shall have a permanent and legible identification showing the rated continuous current.</td>
</tr>
<tr>
<td></td>
<td>Location.</td>
</tr>
<tr>
<td></td>
<td>Cutouts shall be located so that they are readily and safely accessible for re-fusing, with the top of the cutout not over 1.5 m (5 ft) above the floor or platform.</td>
</tr>
<tr>
<td></td>
<td>Enclosure.</td>
</tr>
<tr>
<td></td>
<td>Suitable barriers or enclosures shall be provided to prevent contact with nonshielded cables or energized parts of oil-filled cutouts.</td>
</tr>
<tr>
<td>Load Interrupters.</td>
<td>Load-interrupter switches shall be permitted if suitable fuses or circuit breakers are used in conjunction with these devices to interrupt fault currents. Where these devices are used in combination, they shall be coordinated electrically so that they will safely withstand the effects of closing, carrying, or interrupting all possible currents up to the assigned maximum short-circuit rating. Where more than one switch is installed with interconnected load terminals to provide for alternate connection to different supply conductors, each switch shall be provided with a conspicuous sign identifying this hazard.</td>
</tr>
<tr>
<td></td>
<td>Continuous Current Rating.</td>
</tr>
<tr>
<td></td>
<td>The continuous current rating of interrupter switches shall equal or exceed the maximum continuous current at the point of installation.</td>
</tr>
<tr>
<td></td>
<td>Voltage Rating.</td>
</tr>
<tr>
<td></td>
<td>The maximum voltage rating of interrupter switches shall equal or exceed the maximum circuit voltage.</td>
</tr>
<tr>
<td></td>
<td>Identification.</td>
</tr>
<tr>
<td></td>
<td>Interrupter switches shall have a permanent and legible nameplate including the following information: manufacturer’s type or designation, continuous current rating, interrupting current rating, fault closing rating, maximum voltage rating.</td>
</tr>
<tr>
<td></td>
<td>Switching of Conductors.</td>
</tr>
<tr>
<td></td>
<td>The switching mechanism shall be arranged to be operated from a location where the operator is not exposed to energized parts and shall be arranged to open all ungrounded conductors of the circuit simultaneously with one operation. Switches shall be arranged to be locked in the open position. Metal-enclosed switches shall be operable from outside the enclosure.</td>
</tr>
<tr>
<td></td>
<td>Stored Energy for Opening.</td>
</tr>
<tr>
<td></td>
<td>The stored-energy operator shall be permitted to be left in the uncharged position after the switch has been closed if a single movement of the operating handle charges the operator and opens the switch.</td>
</tr>
</tbody>
</table>
(6) Supply Terminals.

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

490.22 Isolating Means.

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

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

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

490.23 Voltage Regulators.

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

1. Mechanically sequenced regulator bypass switch(es)
2. Mechanical interlocks
3. Switching procedure prominently displayed at the switching location

490.24 Minimum Space Separation.

In field-fabricated installations, the minimum air separation between bare live conductors and between such conductors and adjacent grounded surfaces shall not be less than the values given in Table 490.24. These values shall not apply to interior portions or exterior terminals of equipment designed, manufactured, and tested in accordance with accepted national standards.

Table 490.24 Minimum Clearance of Live Parts

<table>
<thead>
<tr>
<th>Nominal Voltage Rating (kV)</th>
<th>Impulse Withstand, Basic Impulse Level B.I.L (kV)</th>
<th>Minimum Clearance of Live Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Induction: Phase-to-Phase</td>
<td>Induction: Phase-to-Ground</td>
</tr>
<tr>
<td></td>
<td>Indoors</td>
<td>Outdoors</td>
</tr>
<tr>
<td>2.4–4.16</td>
<td>60</td>
<td>95</td>
</tr>
<tr>
<td>7.2</td>
<td>75</td>
<td>95</td>
</tr>
<tr>
<td>13.8</td>
<td>95</td>
<td>110</td>
</tr>
<tr>
<td>14.4</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>23</td>
<td>125</td>
<td>150</td>
</tr>
<tr>
<td>34.5</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>46</td>
<td>200</td>
<td>—</td>
</tr>
<tr>
<td>69</td>
<td>250</td>
<td>—</td>
</tr>
<tr>
<td>115</td>
<td>250</td>
<td>—</td>
</tr>
<tr>
<td>138</td>
<td>350</td>
<td>—</td>
</tr>
<tr>
<td>161</td>
<td>550</td>
<td>—</td>
</tr>
<tr>
<td>161</td>
<td>550</td>
<td>—</td>
</tr>
<tr>
<td>230</td>
<td>650</td>
<td>—</td>
</tr>
<tr>
<td>161</td>
<td>650</td>
<td>—</td>
</tr>
<tr>
<td>230</td>
<td>750</td>
<td>—</td>
</tr>
<tr>
<td>230</td>
<td>750</td>
<td>—</td>
</tr>
<tr>
<td>900</td>
<td>900</td>
<td>—</td>
</tr>
<tr>
<td>1050</td>
<td>1050</td>
<td>—</td>
</tr>
</tbody>
</table>

Note: The values given are the minimum clearance for rigid parts and bare conductors under favorable service conditions. They shall be increased for conductor movement or under unfavorable service conditions or wherever space limitations permit. The selection of the associated impulse withstand voltage for a particular system voltage is determined by the characteristics of the surge protective equipment.
490.25 Backfeed.
Installations where the possibility of backfeed exists shall comply with (a) and (b), which follow.

(a) A permanent sign in accordance with 110.21(B) shall be installed on the disconnecting means enclosure or immediately adjacent to open disconnecting means with the following words or equivalent: DANGER — CONTACTS ON EITHER SIDE OF THIS DEVICE MAY BE ENERGIZED BY BACKFEED.

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

Part III. Equipment — Switchgear and Industrial Control Assemblies

490.30 General.
Part III covers assemblies of switchgear and industrial control equipment including, but not limited to, switches and interrupting devices and their control, metering, protection, and regulating equipment where they are an integral part of the assembly, with associated interconnections and supporting structures. Part III also includes switchgear assemblies that form a part of unit substations, power centers, or similar equipment.

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

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

490.33 Guarding of Energized Parts Operating at 1000 Volts, Nominal, or Less Within Compartments.
Energized bare parts mounted on doors shall be guarded where the door must be opened for maintenance of equipment or removal of draw-out equipment.

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

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

(B) Control Equipment.
Where operating at 1000 volts, nominal, or less, control equipment, relays, motors, and the like shall not be installed in compartments with exposed high-voltage energized parts or high-voltage wiring, unless either of the following conditions is met:

1. The access means is interlocked with the high-voltage switch or disconnecting means to prevent the access means from being opened or removed.

2. The high-voltage switch or disconnecting means is in the isolating position.

(C) High-Voltage Instruments or Control Transformers and Space Heaters.
High-voltage instrument or control transformers and space heaters shall be permitted to be installed in the high-voltage compartment without access restrictions beyond those that apply to the high-voltage compartment generally.

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

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

490.38 Door Stops and Cover Plates.
External hinged doors or covers shall be provided with stops to hold them in the open position. Cover plates intended to be removed for inspection of energized parts or wiring shall be equipped with lifting handles and shall not exceed 1.1 m² (12 ft²) in area or 27 kg (60 lb) in weight, unless they are hinged and bolted or locked.

490.39 Gas Discharge from Interrupting Devices.
Gas discharged during operating of interrupting devices shall be directed so as not to endanger personnel.
490.40 Visual Inspection Windows.
Windows intended for visual inspection of disconnecting switches or other devices shall be of suitable transparent material.

490.41 Location of Industrial Control Equipment.
Routinely operated industrial control equipment shall meet the requirements of (A) unless infrequently operated, as covered in 490.41(B).

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

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

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

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

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

490.44 Fused Interrupter Switches.

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

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

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

490.45 Circuit Breakers — Interlocks.

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

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

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

490.47 Switchgear Used as Service Equipment.
Switchgear installed as high-voltage service equipment shall include a ground bus for the connection of service cable shields and to facilitate the attachment of safety grounds for personnel protection. This bus shall be extended into the compartment where the service conductors are terminated. Where the compartment door or panel provides access to parts that can only be de-energized and visibly isolated by the serving utility, the warning sign required by 490.35(A) shall include a notice that access is limited to the serving utility or is permitted only following an authorization of the serving utility.

490.48 Substation Design, Documentation, and Required Diagram.
Design and Documentation.

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

1. Clearances and exits
2. Electrical enclosures
3. Securing and support of electrical equipment
4. Fire protection
5. Safety ground connection provisions
6. Guarding live parts
7. Transformers and voltage regulation equipment
8. Conductor insulation, electrical and mechanical protection, isolation, and terminations
9. Application, arrangement, and disconnection of circuit breakers, switches, and fuses
10. Provisions for oil filled equipment
11. Switchgear
12. Surge arresters

Diagram.

A permanent, single-line diagram of the switchgear shall be provided in a readily visible location within the same room or enclosed area with the switchgear, and this diagram shall clearly identify interlocks, isolation means, and all possible sources of voltage to the installation under normal or emergency conditions and the marking on the switchgear shall cross-reference the diagram.

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

Part IV. Mobile and Portable Equipment

490.51 General.
(A) Covered.
The provisions of this part shall apply to installations and use of high-voltage power distribution and utilization equipment that is portable, mobile, or both, such as substations and switch houses mounted on skids, trailers, or cars; mobile shovels; draglines; cranes; hoists; drills; dredges; compressors; pumps; conveyors; underground excavators; and the like.
(B) Other Requirements.
The requirements of this part shall be additional to, or amendatory of, those prescribed in Articles 100 through 725 of this Code. Special attention shall be paid to Article 250.
(C) Protection.
Approved enclosures or guarding, or both, shall be provided to protect portable and mobile equipment from physical damage.
(D) Disconnecting Means.
Disconnecting means shall be installed for mobile and portable high-voltage equipment according to the requirements of Part VIII of Article 230 and shall disconnect all ungrounded conductors.

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

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

490.54 Collector Rings.
The collector ring assemblies on revolving-type machines (shovels, draglines, etc.) shall be guarded to prevent accidental contact with energized parts by personnel on or off the machine.
490.55  Power Cable Connections to Mobile Machines.

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

DANGER — HIGH VOLTAGE — KEEP OUT.

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

490.56  High-Voltage Portable Cable for Main Power Supply.

Flexible high-voltage cable supplying power to portable or mobile equipment shall comply with Article 250 and Article 400, Part III.

Part V.  Electrode-Type Boilers

490.70  General.

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

490.71  Electrical Supply System.

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

490.72  Branch-Circuit Requirements.

(A)  Rating.

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

(B)  Common-Trip Fault-Interrupting Device.

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

(C)  Phase-Fault Protection.

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

(D)  Ground Current Detection.

Means shall be provided for detection of the sum of the neutral conductor and equipment grounding conductor currents and shall trip the circuit-interrupting device if the sum of those currents exceeds the greater of 5 amperes or 7 1/2 percent of the boiler full-load current for 10 seconds or exceeds an instantaneous value of 25 percent of the boiler full-load current.

(E)  Grounded Neutral Conductor.

The grounded neutral conductor shall be as follows:

1. Connected to the pressure vessel containing the electrodes
2. Insulated for not less than 1000 volts
3. Have not less than the ampacity of the largest ungrounded branch-circuit conductor
4. Installed with the ungrounded conductors in the same raceway, cable, or cable tray, or, where installed as open conductors, in close proximity to the ungrounded conductors
5. Not used for any other circuit

490.73  Pressure and Temperature Limit Control.

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

490.74  Bonding.

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

Statement of Problem and Substantiation for Public Comment

The construction and requirements in this article appropriately describe installations of systems and equipment rated 2500 volts and above. Setting the scope at 1000 volts is inappropriate and constrains the extension of general low voltage product standards to higher voltages since the standards requirements intend to facilitate compliance with the NEC. The development of 1500 volt rated equipment such as circuit breakers and switches for photovoltaic systems demonstrate that the product standards can address the safety aspects...


associated with extending the voltage ratings to this level.

**Related Item**

Public Input No. 3181-NFPA 70-2014 [Article 490]

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**Submitter Information Verification**

Submitter Full Name: Chad Kennedy  
Organization: Schneider Electric  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Sep 23 10:58:57 EDT 2015

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**Committee Statement**

Committee Action: Rejected  
Resolution: “High Voltage” is presently defined in Section 490.2 as “more than 1000 volts, nominal” as recommended by the Task Group on Over 600 Volts for the 2014 edition of the NEC. CMP 9 is not prepared to increase the level to 1500 volts which would further increase the upper limit of the “low voltage” range to 1500 volts. No technical substantiation has been provided in this Public Comment to warrant increasing the voltage level to “over 1500 volts”.

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490.1 Scope.
This article covers the general requirements for equipment operating at more than 1000 volts, nominal.

Informational Note No. 1: See NFPA 70E-2015, Standard for Electrical Safety in the Workplace, for electrical safety requirements for employee workplaces.

Informational Note No. 2: For further information on hazard signs and labels, see ANSI Z535.4-2008, Product Signs and Safety Labels.

Statement of Problem and Substantiation for Public Comment

Related Item
Public Input No. 3176-NFPA 70-2014 [Section No. 490.1]

Submitter Information Verification
Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jul 09 20:12:39 EDT 2015

Committee Statement
Committee Action: Accepted
Resolution: SR-2417-NFPA 70-2015
Statement: This Informational Note is updated to reflect the latest version and title of the standard being referenced.
Statement of Problem and Substantiation for Public Comment

This Public Comment was developed by a Task Group assigned by the NEC Correlating Committee to: (1) resolve issues with actions taken by Code-making Panels 1 and 8 on proposals and comments in the 2014 NEC cycle relative to changing the voltage threshold in articles under their purview from 600 volts to 1000 volts, (2) address indoor and outdoor electrical substations, and (3) evaluate other higher voltage threshold requirements to be included relative to present trends. Members of the Task Group on Over 600 volts for this Public Comment included: Alan Manche; Donny Cook; Vince Saporita; Paul Barnhart; Eddie Guidry; Alan Peterson; David Kendall; Dave Mercier; Tim Pope; Roger McDaniel and Neil F. LaBrake, Jr.

PI-1535 was resolved with the following panel statement: “Submitter’s substantiation does not address removing the term “unit” from substation. Unit substations are understood to be an integrated line up of electrical equipment including a disconnect and optional overcurrent device rated above 1,000 Volts, a transformer with primary windings rated over 1,000 Volts and secondary windings rated less than or equal to or greater than 1,000 Volts, and secondary switchgear rated at the transformer’s secondary voltage. The substation is “unitized” as a single line up of metal enclosures, close coupled, with bus or insulated cable connections that are within the metal enclosures.”

It is acknowledged by the Task Group that the previously submitted substantiation lacked a thorough explanation of why the present term “unit substation” should read “substation” only. The High Voltage Task Group requests that Panel 9 reconsider the previous resolution based on the following additional information.

The term “unit substation” is currently found in four sections of the 2014 NEC: 110.31(B)(1), 490.30, 490.48(B)(5)Exception to (1), 490.48(C)Exception. The term “substation” is found in Art. 100 and was revised and moved to Part II (over 1000V) for the 2017 Code cycle.

The terms “substation” and “unit substation” can mean different things to different people depending on the voltage level, application and installation. And, since the term “unit substation” is not defined in Art. 100 or 490, but “substation” is, it is believed that removing the word “unit” would clarify the meaning of this term.

The Task Group requests that CMP 9 consider that product certification encompasses a much broader scope of the term “unit substation” than the description included in the panel statement in response to PI-1535. Without a separate, clear NEC definition in Article 490, that excludes other equipment which are currently listed by product certification bodies as “unit substations”, use of the term “unit substation” could lead to confusion for the user or inspection authority.

Please consider that UL Information Guide YEFR contains information for unit substations less than 600V. And, UL 1062 is the standard for low voltage unit substations, and contains the following definition: UNIT SUBSTATION - A transformer in combination with primary or secondary protective devices or devices used in a single enclosure.

Also consider, UL Information Guide YEFV contains information for unit substations for medium voltage applications. With respect to unit substations over 600V, the YEFV guide information discusses articulated and integral unit substations. The definitions of these two types of unit substations are included in the guide information as follows:

Articulated Unit Substations consist of a transformer section(s) together with an input section(s), an output section(s), or both. Transition sections may also be provided. These unit substations are designed, coordinated and assembled as multiple self-enclosed pieces of equipment intended for connection in the field.

Integral Unit Substations consist of a transformer section(s) together with an input section(s), an output section(s), or both. Transition sections may also be provided. These unit substations are designed, coordinated and assembled as a single self-enclosed piece of equipment. Sections may be shipped separately.

Note that the definition of articulated units does not state that they are a line-up of equipment that is close-coupled, but because it says “designed, coordinated, and assembled...” one might believe this means a line-up. But, conceivably they could be assembled in some other format (such as back to back, with a busway between them, or other configuration).

Integral unit substations are in a single enclosure or a single piece of equipment that may be multiple sections.

In addition to product certification misunderstandings, the term “unit substation” is used widely throughout the petrochemical industry to indicate that the substation is part of a process unit further adding to the confusion as to what the term “unit substation” means in Art. 490.

Removing the word “unit” will result in clearer and more accurate Code language for the user.
Related Item
Public Input No. 1535-NFPA 70-2014 [Section No. 490.30]

Submitter Information Verification
Submitter Full Name: ALAN MANCHE
Organization: Schneider Electric
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 01:01:17 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-2418-NFPA 70-2015
Statement: The last sentence in 490.30 is redundant. The requirements in Part III apply as noted in the first sentence, and should not be modified for substations, power centers, or similar equipment of any design.
Statement of Problem and Substantiation for Public Comment

This Public Comment was developed by a Task Group assigned by the NEC Correlating Committee to: (1) resolve issues with actions taken by Code-making Panels 1 and 8 on proposals and comments in the 2014 NEC cycle relative to changing the voltage threshold in articles under their purview from 600 volts to 1000 volts, (2) address indoor and outdoor electrical substations, and (3) evaluate other higher voltage threshold requirements to be included relative to present trends. Members of the Task Group on Over 600 volts for this Public Comment included: Alan Manche; Donny Cook; Vince Saporita; Paul Barnhart; Eddie Guidry; Alan Peterson; David Kendall; Dave Mercier; Tim Pope; Roger McDaniel and Neil F. LaBrake, Jr.

The Task Group requests that Panel 9 reconsider the previous resolution based on the following additional information.

PI-1541 was resolved with the following panel statement: “Unit substations are understood to be an integrated line up of electrical equipment including a disconnect and optional overcurrent device rated above 1,000 Volts, a transformer with primary windings rated over 1,000 Volts and secondary windings rated less than or equal to or greater than 1,000 Volts, and secondary switchgear rated at the transformer’s secondary voltage. The substation is “unitized” as a single line up of metal enclosures, close coupled, with bus or insulated cable connections that are within the metal enclosures.”

The term “unit substation” is currently found in four sections of the 2014 NEC: 110.31(B)(1), 490.30, 490.48(B)(5)Exception to (1), 490.48(C)Exception. The term “substation” is found in Art. 100 and was revised and was moved to Part II (over 1000V) for the 2017 Code cycle.

The terms “substation” and “unit substation” can mean different things to different people depending on the voltage level, application and installation. And, since the term “unit substation” is not defined in Art. 100 or 490, but “substation” is, it is believed that removing the word “unit” would clarify the meaning of this term.

The Task Group requests that CMP 9 consider that product certification encompasses a much broader of the term “unit substation” than the description included in the panel statement in response to PI-1535. Without a separate, clear NEC definition in Article 490, that excludes other equipment which are currently listed by product certification bodies as “unit substations”, use of the term “unit substation” could lead to confusion for the user or inspection authority.

Please consider that UL Information Guide YEFR contains information for unit substations less than 600V. And, UL 1062 is the standard for low voltage unit substations, and contains the following definition: UNIT SUBSTATION - A transformer in combination with primary or secondary overcurrent protective devices or switching devices housed in a single enclosure.

Also consider, UL Information Guide YEFV contains information for unit substations for medium voltage applications. With respect to unit substations over 600V, the YEFV guide information discusses articulated and integral unit substations. The definitions of these two types of unit substations are included in the guide information as follows:

Articulated Unit Substations consist of a transformer section(s) together with an input section(s), an output section(s), or both. Transition sections may also be provided. These unit substations are designed, coordinated and assembled as multiple self-enclosed pieces of equipment intended for connection in the field.

Integral Unit Substations consist of a transformer section(s) together with an input section(s), an output section(s), or both. Transition sections may also be provided. These unit substations are designed, coordinated and assembled as a single self-enclosed piece of equipment. Sections may be shipped separately.

Note that the definition of articulated units does not state that they are a line-up of equipment that is close-coupled, but because it says “designed, coordinated, and assembled… one might believe this means a line-up. But, conceivably they could be assembled in some other format (such as back to back, with a busway between them, or other configuration).

Integral unit substations are in a single enclosure or a single piece of equipment that may be multiple sections.

In addition to product certification misunderstandings, the term “unit substation” is used widely throughout the petrochemical industry to indicate that the substation is part of a process unit further adding to the confusion as to what the term “unit substation” means in Art. 490.

Removing the word “unit” will result in clearer and more accurate Code language for the user.

Related Item
Public Input No. 1541-NFPA 70-2014 [Section No. 490.48(B)]

Submitter Information Verification

Submitter Full Name: ALAN MANCHE
Organization: Schneider Electric
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 01:11:37 EDT 2015

Committee Statement

Committee Action: Rejected but held
Resolution: This exception is relying on the aspects of the unit substation to relieve the requirement for a single line diagram. The integral line up of metal enclosed equipment with a single primary disconnect, optional overcurrent device, transformer, and switching and overcurrent protection for the secondary side switchgear eliminates the need for interlocked switching, as there is only one primary power source available to the substation. Two unit substations in an electrical room are not the same as two standalone primary switches, transformers, and secondary switchgear assemblies that are cable connected. There is no guarantee as to how the stand alone devices are connected. A definition of "unit substation" should be considered in the next code cycle. To this end, CMP 9 has elected to hold this comment which guarantees its resubmittal in the next cycle. Furthermore, CMP 9 has created a task group to examine this issue.
**Public Comment No. 215-NFPA 70-2015 [New Section after 500.4(B)]**

Add Informational Note No. 7

Informational Note No. 7: For further information on ignition risks for other non-electrical hot surfaces that may be present and may need consideration for hazardous (classified) locations, see ANSI/API RP 2216-2010, *Ignition Risk of Hydrocarbon Liquids and Vapors by Hot Surfaces in the Open Air.*

**Statement of Problem and Substantiation for Public Comment**

PI 1503 was rejected with the following committee statement:

"Resolution: This informational note does not add value to the Code, and furthermore points to one of any number of documents that could be added and there is no higher value of this reference above any others."

I'm not sure if the panel realized at the time this was considered that, ISO 80079-36 Ed. 1.0: Explosive atmospheres - Part 36: Non-electrical equipment for explosive atmospheres — Basic method and requirements [6], and ISO 80079-37 Ed. 1.0: Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres — Non electrical type of protection constructional safety ‘c’, control of ignition source ‘b’, liquid immersion ‘k’ [7], have been revised and are in the process of being voted into acceptance.

These ISO standards will require a T-Code for ALL equipment, whether electrical or not. I realize ISO is an international document. But, given this issue, I feel like this PI was important. I ask the panel respectfully to reconsider the value of adding this reference.

**Related Item**

Public Input No. 1503-NFPA 70-2014 [New Section after 500.4(B)]

**Submitter Information Verification**

Submitter Full Name: PAUL GUIDRY  
Organization: FLUOR ENTERPRISES INC  
Affiliation: Associated Builders and Contractors, Inc.

**Committee Statement**

Committee Action: Rejected  
Resolution: No new information from PI 1503. Same statement to resolve still applies. Resolution: This informational note does not add value to the Code, and furthermore points to one of any number of documents that could be added and there is no higher value of this reference above any others." Additionally, 500.4(B) states "Important information relating to topics covered in Chapter 5 may be found in other publications." This new informational note is not related to anything for the NEC, Chapter 5. Other mechanical topics/hazards are not addressed either.
Public Comment No. 249-NFPA 70-2015 [Section No. 500.4(B)]

(B) Reference Standards.

Important information relating to topics covered in Chapter 5 may be found in other publications.

Informational Note No. 1: Familiarity with the standards of the National Fire Protection Association (NFPA), the American Petroleum Institute (API), and the International Society of Automation (ISA), as well as relevant industrial experience, may be of use in the classification of various locations, the determination of adequate ventilation, and the protection against static electricity and lightning hazards.


Informational Note No. 3: For further information on protection against static electricity and lightning hazards in hazardous (classified) locations, see NFPA 77-2014, Recommended Practice on Static Electricity; NFPA 780-2014, Standard for the Installation of Lightning Protection Systems; and API RP 2003-2008, Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

Informational Note No. 4: For further information on ventilation, see NFPA 30-2015, Flammable and Combustible Liquids Code; and ANSI/API RP 500-2012, Recommended Practice for Classification of Locations of Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2.

Informational Note No. 5: For further information on electrical systems for hazardous (classified) locations on offshore oil and gas producing platforms, oil and gas well drilling land rigs, and skid mounted offiield equipment, see ANSI/API RP 14F-2013, Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Division 1 and Division 2 Locations.

Informational Note No. 6: Portable or transportable equipment having self-contained power supplies, such as battery-operated equipment, could potentially become an ignition source in hazardous (classified) locations. See ANSI/ISA-12.12.03-2011, Standard for Portable Electronic Products Suitable for Use in Class I and II, Class I Zone 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations.

Statement of Problem and Substantiation for Public Comment

The Oil and Gas Well Drilling Land Rig Industry faces unique challenges as a result of their need for quick and easy mobility when rigging up and rigging down as the drilling land rig is transported overland between drill sites. In addition, the drilling rigs and the machines on them are subjected to significant movement, shaking, and vibration while drilling. Therefore these conditions require special consideration with regards to the selection and installation of electrical cables in hazardous (classified) locations.

Rigid conduit and Type MC-HL cable are not suitable for the application and in the absence of a consensus standard or recommended practice addressing the unique requirements for installing electric cables in hazardous (classified) locations on land rigs, the Oil and Gas Well Drilling Land Rig Industry has historically looked to consensus standards and practices in the Oil and Gas Well Drilling Offshore Industry for guidance; specifically API RP 14F entitled “Recommended Practice for Design, Installation, and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Division 1 and Division 2 Locations” and API RP 14FZ entitled “Recommended Practice for Design, Installation, and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Zone 0, Zone 1, and Zone 2 Locations.”

Adopting wiring methods from API RP 14F and API RP 14FZ, the Oil and Gas Well Drilling Land Rig Industry has historically and for over 30 years used IEEE-1580, Type P, marine shipboard cable to cable-up and interconnect the various machines and equipment that make up the drilling land rig. These cables may also be listed as UL-1309 Marine Shipboard Cable. The flexible and rugged IEEE-1580, Type P, marine shipboard cable is highly suitable for the oil and gas well drilling land rig application because of its ability to resist drilling muds that contain various chemicals, abrasives, and petroleum based additives as well as its ability to resist damage from vibration, shaking, and movement that occurs during the drilling process, and the rigors of rig-up and rig-down. They are also highly suited because of their ability to perform in extreme cold weather conditions in that they can pass a -40°F C cold bend test and a -35°C cold impact test. In addition to their flexibility and mechanical ruggedness as just described, the IEEE-1580, Type P, marine shipboard cable is rated 600/1000 volts or 2000 volts which makes it suitable for use on both AC and DC powered drilling rigs, has a maximum conductor temperature rating of 110°C, has a flexible tinned-copper stranded conductor that resists oxidation, and passes an IEEE 1202 vertical cable tray flame test. In addition, these flexible tinned-copper conductors are available in sizes like 444 Kcmil, 535 Kcmil,
646 Kcmil, and 777 Kcmil that are currently not recognized in NFPA 70. These cables are also available with a metallic basket-weave braided armor that effectively enhances their durability, provides crush, impact, and cut-through resistance, and is not prone to failure due to fatigue and cracking; properties that are very important in the drilling environment. Collectively, all of these properties and features which are required of both single-conductor and multi-conductor cable used on an oil and gas well drilling land rig are not available on any one cable type included in NFPA 70.

More specifically and per API RP 14F and API RP 14FZ; in Class 1, Division 1 and Class 1, Zone 1 hazardous (classified) locations, the Oil and Gas Well Drilling Land Rig Industry uses IEEE-1580, Type P, marine shipboard cable with a metallic basket-weave braided armor and outer polymeric sheath. The metallic basket-weave braided armor with outer polymeric sheath mechanically protects the cable from damage and yet provides the flexibility required for the application.

In addition, recommendations in API RP 14F and API RP 14FZ allow the use of unarmored IEEE-1580, Type P, marine shipboard cable in Class 1, Division 2 and Class 1, Zone 2 hazardous areas. Regardless, the specific location on the land rig is given engineering consideration relative to the cable’s vulnerability to mechanical damage. If the location in itself does not provide suitable mechanical protection or the addition of steel guards is not practical for the location, then armored and sheathed IEEE-1580, Type P, marine shipboard cable may be used.

Committee Statement

Committee Action: Rejected

Resolution: ANSI/API RP 14F-2013 is specific to fixed and floating off shore platforms and not relevant to “Oil and Gas Well Drilling Land Rigs”. Wiring methods on land based drilling rigs and related skid mounted equipment in the current NEC does not reflect the current practices utilizing flexible methods such as Type P cable. Panel recommends consideration of a task group consisting of CMP 14, CMP 6 and CMP 7 to allow wiring methods utilizing Type P cable (UL 1309) for this application.
Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]

(A) General.
Locations shall be classified depending on the properties of the flammable gas, flammable liquid–produced vapor, combustible liquid–produced vapors, combustible dusts, or fibers/flyings that may be present, and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section, or area shall be considered individually in determining its classification. Where pyrophoric materials are the only materials used or handled, these locations are outside the scope of this article.

Informational Note No. 1: Through the exercise of ingenuity in the layout of electrical installations for hazardous (classified) locations, it is frequently possible to locate much of the equipment in a reduced level of classification or in an unclassified location and, thus, to reduce the amount of special equipment required.

Refrigerant machinery rooms containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm may be classified as “unclassified” locations.

Rooms and refrigerated areas containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm may be classified as “unclassified” locations.

Informational Note No. 2: For further information regarding classification and ventilation of areas involving ammonia, see ANSI/ASHRAE 15 & 34 -2013, Safety Standard for Refrigeration Systems.

Statement of Problem and Substantiation for Public Comment

Correctly referenced ASHRAE 15 & 34 which an combined standard in informational note 2.

Related Public Comments for This Document

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Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack.]
Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]
Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]
Public Comment No. 111-NFPA 70-2015 [Section No. 505.2]
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Related Item
First Revision No. 3934-NFPA 70-2015 [Section No. 500.5(A)]

Submitter Information Verification
Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jul 02 16:23:04 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The standard reviewed for the first revision was ASHRAE 15. While the standards organization in question offers a packaged set of ASHRAE 15 and 34, combined, that is not justification to include a reference to ASHRAE 34.
Public Comment No. 1331-NFPA 70-2015 [Section No. 500.5(A)]

(A) General.
Locations shall be classified depending on the properties of the flammable gas, flammable liquid–produced vapor, combustible liquid–produced vapors, combustible dusts, or fibers/flyings that may be present, and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section, or area shall be considered individually in determining its classification. Where pyrophoric materials are the only materials used or handled, these locations are outside the scope of this article.

Informational Note No. 1: Through the exercise of ingenuity in the layout of electrical installations for hazardous (classified) locations, it is frequently possible to locate much of the equipment in a reduced level of classification or in an unclassified location and, thus, to reduce the amount of special equipment required.

Refrigerant machinery rooms containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm may be classified as “unclassified” locations.

Rooms and refrigerated areas containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm may be classified as “unclassified” locations.

Informational Note No. 2: For further information regarding classification and ventilation of areas involving ammonia, see ANSI/ASHRAE 15-2013, Safety Standard for Refrigeration Systems.

Statement of Problem and Substantiation for Public Comment

Informational Note No. 1 provides a recommendation and design criteria. The NEC is not a design manual. Section 3.1.3 of the 2011 NEC Manual of Style states that Informational Notes shall not make recommendations, which this note does. Informational Note No. 2 is separated from other informational notes and should not be numbered.

Related Item
First Revision No. 3934-NFPA 70-2015 [Section No. 500.5(A)]

Submitter Information Verification

Submitter Full Name: John Simmons
Organization: Florida East Coast JATC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 20:24:18 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The committee disagrees that Informational Note No. 1 provides a recommendation or design criteria. The wording “…it is frequently possible…” is not a recommendation, it is information only.
Public Comment No. 1580-NFPA 70-2015 [Section No. 500.5(A)]

(A) General.

Locations shall be classified depending on the properties of the flammable gas, flammable liquid–produced vapor, combustible liquid–produced vapors, combustible dusts, or fibers/flyings that may be present, and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section, or area shall be considered individually in determining its classification. Where pyrophoric materials are the only materials used or handled, these locations are outside the scope of this article.

Informational Note No. 1: Through the exercise of ingenuity in the layout of electrical installations for hazardous (classified) locations, it is frequently possible to locate much of the equipment in a reduced level of classification or in an unclassified location and, thus, to reduce the amount of special equipment required.

Refrigerant machinery rooms containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm may be classified as “unclassified” locations.

Rooms and refrigerated areas containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm may be classified as “unclassified” locations.


Statement of Problem and Substantiation for Public Comment

There is no logical reason for NFPA 70 to uniquely include specific provisions to regulate ammonia refrigeration in Section 500.5, given that there is no other material or application similarly regulated by this section. Any other material or application is governed by the general requirement. With the proposed change, classification of an area containing ammonia refrigeration equipment will be done in the same manner as any other material or application. The risk and mitigation measures must be evaluated using the NEC, NFPA 497 and other applicable codes/standards; and the area classification must established based on that evaluation, as stated in the first paragraph of 500.5. In the case of ammonia refrigeration, ANSI/ASHRAE 15 and ANSI/IIAR 2 provide detailed requirements covering the use of leak detection and ventilation systems that are too complex to duplicate into the NEC.

By approving this change, the NEC will eliminate overlap and conflict with these other ANSI standards, and by retaining the Informational Note pointing to these standards, users will be made aware of the special requirements and not be left with the impression that requirements for ammonia were simply dropped.

Related Item
First Revision No. 3934-NFPA 70-2015 [Section No. 500.5(A)]

Submitter Information Verification

Submitter Full Name: Jeffrey Shapiro
Organization: International Code Consultants
Affiliation: International Institute of Ammonia Refrigeration
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 14:42:09 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3916-NFPA 70-2015
Statement: This change will correlate the NEC® with applicable ANSI standards that govern ammonia refrigeration systems, ANSI/IIAR 2 and ANSI/ASHRAE 15. Ammonia refrigeration machinery rooms are always required by these standards to have leak detection and ventilation systems and are designated as unclassified locations based on these mitigations. The NEC® is therefore being updated to reflect IIAR 2’s more restrictive 150 ppm ventilation trigger. Other areas where ammonia refrigeration equipment may be present, such as freezers, may have detection, alarms, ventilation or other mitigation measures approved by the AHJ, in accordance with ANSI/ASHRAE 15 and ANSI/IIAR 2 as a basis of assigning
an unclassified area designation. The provisions in these standards are too lengthy to warrant duplication in the NEC® for such a special situation. Informational Note 2 provides an appropriate pointer directing NEC® users to ANSI/ASHRAE 15 and ANSI/IAR 2 for guidance, and these are legally mandated reference standards in adopted fire and mechanical codes.
(4) Group D.
Flammable gas, flammable liquid–produced vapor, or combustible liquid–produced vapor mixed with air that may burn or explode, having either a maximum experimental safe gap (MESG) value greater than 0.75 mm or a minimum igniting current (MIC) ratio greater than 0.80. [497:3.3.5.1.4]

Informational Note No. 1: A typical Class I, Group D material is propane. [497:3.3.5.1.4]

Informational Note No. 2: For classification of areas involving ammonia atmospheres, see ANSI/ASHRAE 15 & 34 -2013, Safety Standard for Refrigeration Systems.

Statement of Problem and Substantiation for Public Comment
Referenced ASHRAE 15 & 34 which now a combined standard.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
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<tr>
<td>Public Comment No. 39-NFPA 70-2015 [Section No. 110.31]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<tr>
<td>Public Comment No. 41-NFPA 70-2015 [Section No. 399.10]</td>
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<td>Public Comment No. 42-NFPA 70-2015 [Section No. Table]</td>
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<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
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<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
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<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
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<td>Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]</td>
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<td>Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]</td>
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<td>Public Comment No. 53-NFPA 70-2015 [Section No. 840.44(B)]</td>
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<td>Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]</td>
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<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
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<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
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<td>Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
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<td>Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]</td>
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<td>Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]</td>
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<td>Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]</td>
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Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]

Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]

Public Comment No. 95-NFPA 70-2015 [Section No. 620.1]

Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack]

Public Comment No. 111-NFPA 70-2015 [Section No. 505.2]

Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]

Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]

**Related Item**

First Revision No. 3935-NFPA 70-2015 [Section No. 500.6(A)(4)]

**Submitter Information Verification**

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 04 02:02:03 EDT 2015

**Committee Statement**

Committee Action: Rejected
Resolution: The standard reviewed for the first revision was ASHRAE 15. While the standards organization in question offers a packaged set of ASHRAE 15 and 34, combined, that is not justification to include a reference to ASHRAE 34.
Public Comment No. 1415-NFPA 70-2015 [New Section after 500.6(B)(3)]

**Informational Note to (B)**
Insert the contents of 2013 NFPA 499, Table 5.2.2 here with appropriate abstract designations.

**Statement of Problem and Substantiation for Public Comment**

Table 5.2.2 used to be included in the NEC® Handbook but it was removed during the publication in the 2014 NEC(r) cycle, making the document less usable. Now, users have to have multiple documents open to do their work. During the First Draft meetings, the panel felt the material should be included in the next handbook and indicated as such but since the NFPA staff controls what is included in the handbook, there is no guarantee that this will occur. As such, I again ask that the panel just extract the table as recommended and restore the usability of the code. With the deletion of the duplicated definitions from this article, we can clearly allow space for this needed information.

**Related Item**
Public Input No. 4227-NFPA 70-2014 [New Section after 500.6(B)]

**Submitter Information Verification**

Submitter Full Name: Richard Holub  
Organization: The DuPont Company, Inc.
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Fri Sep 25 10:39:45 EDT 2015

**Committee Statement**

Committee Action: Rejected
Resolution: The public input adds into the code additional information that is already found in NFPA 499. Including information to be available in one document, versus multiple documents, however beneficial, will only add to the size of the NEC and there is not enough of justification to include this text versus any other useful text already published in other referenced documents. The committee further agrees that this is useful information and should be reinstated in the handbook.
(3) Group G.
Atmospheres containing combustible dusts not included in Group E or Group F, including flour, grain, wood, plastic, and chemicals. [499:3.3.4.3]

Informational Note No. 1: For additional information on group classification of Class II materials, see NFPA 499-2013, Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.

Informational Note No. 2: The explosion characteristics of air mixtures of dust vary with the materials involved. For Class II locations, Groups E, F, and G, the classification involves the tightness of the joints of assembly and shaft openings to prevent the entrance of dust in the dust-ignitionproof enclosure, the blanketing effect of layers of dust on the equipment that may cause overheating, and the ignition temperature of the dust. It is necessary, therefore, that equipment be identified not only for the class but also for the specific group of dust that will be present.

Informational Note No. 3: Certain dusts may require additional precautions due to chemical phenomena that can result in the generation of ignitable gases. See ANSI/IEEE C2-2012, National Electrical Safety Code, Section 127A, Coal Handling Areas.

Statement of Problem and Substantiation for Public Comment

Referenced correct SDO in informational note 3.

Related Item
Public Input No. 1619-NFPA 70-2014 [Section No. 500.6]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 06 10:02:13 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This is an ANSI approved standard.
Public Comment No. 214-NFPA 70-2015 [New Section after 500.7(J)]

**Factory-Sealed.**
Add new definition for "Factory-Sealed" equipment to existing section 500.2

**Factory-sealed.** Equipment such as contacts, ballasts, etc. encased from the factory with a molded casing that is explosionproof.

Informational note: Factory-sealed equipment is not hermetically sealed.

Statement of Problem and Substantiation for Public Comment

The committee resolution stated there is no need to define "factory sealed". I respectfully disagree. There are more engineers and designers in the petrochemical business that don't know the difference between a factory sealed contact and a hermetically sealed contact then you might imagine.

This situation is very similar to the one we had several code cycles back on CMP 11. There was a lot of confusion then between a Motor Circuit Protector vs. a Motor Short-Circuit protector. We added an informational note and clarified text that had been existent in the Code for many years and I still get comments today about how people didn't know the difference. I'd like to make the Code as user friendly as possible. I believe accepting this PI would help a lot of users and inspectors.

Please reconsider the PI referenced and this comment.

**Related Item**

Public Input No. 1501-NFPA 70-2014 [New Definition after Definition: Dusttight]

Submitter Information Verification

Submitter Full Name: PAUL GUIDRY
Organization: FLUOR ENTERPRISES INC
Affiliation: Associated Builders and Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 13 14:40:27 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3922-NFPA 70-2015
Statement: The exception in 501.15(A)(1), Exception, item (c) was confusing and not clear that the users of the code should be looking for markings on identified equipment to confirm if a conduit seal is needed. The revised text clarifies what should be done. A definition for factory sealed equipment is thus not needed and adds no additional value.
(1) Equipment Provided with Threaded Entries for NPT-Threaded Conduit or Fittings.

For equipment provided with threaded entries for NPT-threaded conduit or fittings, listed conduit, listed conduit fittings, or listed cable fittings shall be used. All NPT-threaded conduit and fittings shall be threaded with a National (American) Standard Pipe Taper (NPT) thread.

NPT-threaded entries into explosionproof equipment shall be made up with at least five threads fully engaged.

Exception: For listed explosionproof equipment, joints with factory-threaded NPT entries shall be made up with at least four and one-half threads fully engaged.

Informational Note No. 1: Thread specifications for male NPT threads are located in ANSI/ASME B1.20.1-1983 2013, Pipe Threads, General Purpose (Inch).


Statement of Problem and Substantiation for Public Comment


Related Item
First Revision No. 3983-NFPA 70-2015 [Section No. 500.8(E)(2)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 27 20:29:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3920-NFPA 70-2015
Public Comment No. 567-NFPA 70-2015 [Section No. 500.8(E)(2)]

(2) Equipment Provided with Threaded Entries for Metric-Threaded Fittings.
For equipment with metric-threaded entries, listed conduit fittings or listed cable fittings shall be used. Such entries shall be identified as being metric, or listed adapters to permit connection to conduit or NPT-threaded fittings shall be provided with the equipment and shall be used for connection to conduit or NPT-threaded fittings.

Metric-threaded fittings installed into explosionproof equipment shall have a class of fit of at least 6g/6H and shall be made up with at least five threads fully engaged and wrenchtight.


Statement of Problem and Substantiation for Public Comment

To provide consistency with 500.8(E)(1) statement which reads: "NPT-threaded entries into explosionproof equipment shall be made up with at least five threads fully engaged."

Related Item

First Revision No. 3983-NFPA 70-2015 [Section No. 500.8(E)(2)]
Public Input No. 1613-NFPA 70-2014 [Section No. 500.8(E)(2)]

Submitter Information Verification

Submitter Full Name: David Wechsler
Organization: [Not Specified]
Affiliation: ACC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 05 13:41:57 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3921-NFPA 70-2015
Statement: The requirement to be wrenchtight is already contained in 500.8(E).
(1) General.
In Class I, Division 1 locations, the wiring methods in (a) through (f) shall be permitted.
(a) Threaded rigid metal conduit or threaded steel intermediate metal conduit.
Exception: Type PVC conduit, Type RTRC conduit, and Type HDPE conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. The concrete encasement shall be permitted to be omitted where subject to the provisions of 514.8, Exception No. 2, or 515.8(A). Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding of non–current-carrying metal parts.
(b) Type MI cable terminated with fittings listed for the location. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.
(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application.
Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.
(d) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application, and installed in accordance with the provisions of Article 727.
(e) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 501.10(A). These optical fiber cables shall be sealed in accordance with 501.15.
(f) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts, nominal, or less, and where protected from damage by location or a suitable guard, listed Type TC-ER-HL cable with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122 that is terminated with fittings listed for the location. Type TC-ER-HL cables shall be installed in accordance with the provisions of Article 336.10, including the restrictions of 336.10(7). For circuits over 150 volts to ground, nominal or 30 amps or more, the TC-ER-HL cables shall have a metallic shield encompassing the current carrying conductors to provide a reliable ground fault path that will ensure the operation of a ground fault protection device.

Statement of Problem and Substantiation for Public Comment
The introduction of TC-ER-HL Cable was new in 2014, but only for small diameter cables. The original problem was the fragile nature of MC-HL Cables less than 1 inch diameter for instrument connections. The metallic shield shall assure the activation of ground fault protection for circuits over 190 volts or 30 amps.

Related Item
First Revision No. 3941-NFPA 70-2015 [Section No. 501.10(B)(1)]

Submitter Information Verification
Submitter Full Name: WILLIAM MCBRIDE
Organization: NORTHERN ELECTRIC COMPANY
Affiliation: IEEE
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 14:21:51 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: There is no substantiation presented as to why the wiring method is "unsafe". If the TC-ER-HL has been installed in accordance with Article 336, it will be predominantly in a cable tray. Any extended run out of the tray is required to be protected by the location. If the cable is being damaged by the location, Section 110.11 may not have been correctly applied. There is no requirement that this wiring method be used in all installations. It provides another option. The restriction to industrial facilities, limitation on public access, and conditions of maintenance ensure that this will not be used in areas like filling stations that have public access. The shielded construction described is already permitted by UL 1277 and UL 2225, and in fact is often used for the twisted pair constructions.
(1) General.
In Class I, Division 1 locations, the wiring methods in (a) through (f) shall be permitted.

(a) Threaded rigid metal conduit or threaded steel intermediate metal conduit.
Exception: Type PVC conduit, Type RTRC conduit, and Type HDPE conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. The concrete encasement shall be permitted to be omitted where subject to the provisions of 514.8, Exception No. 2, or 515.8(A). Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding of non–current-carrying metal parts.

(b) Type MI cable terminated with fittings listed for the location. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application.
Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

(d) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vapor tight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application, and installed in accordance with the provisions of Article 727.

(e) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 501.10(A). These optical fiber cables shall be sealed in accordance with 501.15.

(f) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type TC-ER-HL cable with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, that is terminated with fittings listed for the location. Type TC-ER-HL cables shall be installed in accordance with the provisions of Article 336.10, including the restrictions of 336.10(7).

Additional Proposed Changes

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<th>Description</th>
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<td>Penetration of TC vs MC-HL cable for NEC Proposal</td>
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Statement of Problem and Substantiation for Public Comment

Remove section (f) in its entirety. No data was submitted to conclusively prove that a TC type cable is suitable for HL locations. Type MC-HL have served the industry well and have a proven track record for safety. The acceptance of a TC cable is a serious safety and fire concern.

Related Item

Public Input No. 1892-NFPA 70-2014 [Section No. 501.10(A)(1)]

Submitter Information Verification

Submitter Full Name: Joseph Zimnoch
Organization: The Okonite Company
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 15:59:24 EDT 2015

Committee Statement

Committee: Rejected
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<th>Resolution:</th>
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Public Comment No. 1334-NFPA 70-2015 [Section No. 501.10(A)(1)]

(1) General.
In Class I, Division 1 locations, the wiring methods in (a) through (f) shall be permitted.

(a) Threaded rigid metal conduit or threaded steel intermediate metal conduit.
Exception: Type PVC conduit, Type RTRC conduit, and Type HDPE conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. The concrete encasement shall be permitted to be omitted where subject to the provisions of 514.8, Exception No. 2, or 515.8(A). Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding of non–current-carrying metal parts.

(b) Type MI cable terminated with fittings listed for the location. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application.

Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

(d) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application, and installed in accordance with the provisions of Article 727.

(e) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 501.10(A). These optical fiber cables shall be sealed in accordance with 501.15.

(f) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts, nominal, or less, and where protected from damage by location or a suitable guard, listed Type TC-ER-HL cable with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, that is terminated with fittings listed for the location. Type TC-ER-HL cables shall be installed in accordance with the provisions of Article 336.10, including the restrictions of 336.10(7).

Statement of Problem and Substantiation for Public Comment

Each revision cycle eases the requirements deemed necessary to ensure safe electrical installations in hazardous (classified) locations for industrial locations. The NEC does not define what is considered to be an industrial location. The proposed text does nothing to ensure that the installation is safe. Accidents can happen no matter who maintains the equipment. What ensures that electrical installations in an undefined "industrial" location is safer than in other facilities? Restricting public access does nothing to create a safer installation. A wiring method is either safe or it is unsafe; the type of facility makes no difference.

Related Item
First Revision No. 3940-NFPA 70-2015 [Sections 501.10(A)(1), 501.10(A)(2)]

Submitter Information Verification

Submitter Full Name: John Simmons
Organization: Florida East Coast JATC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 20:44:50 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There is no substantiation presented as to why the wiring method is "unsafe". If the TC-ER-HL has been installed in accordance with Article 336, it will be predominantly in a cable tray. Any extended run out of the tray is required to be protected by the location. If the cable is being damaged by the location, Section 110.11 may not have been correctly
applied. There is no requirement that this wiring method be used in all installations. It provides another option. The restriction to industrial facilities, limitation on public access, and conditions of maintenance ensure that this will not be used in areas like filling stations that have public access. The shielded construction described is already permitted by UL 1277 and UL 2225, and in fact is often used for the twisted pair constructions.
General.

In Class I, Division 1 locations, the wiring methods in (a) through (f) shall be permitted.

(a) Threaded rigid metal conduit or threaded steel intermediate metal conduit. Exception: Type PVC conduit, Type RTTRC conduit, and Type HDPE conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. The concrete encasement shall be permitted to be omitted where subject to the provisions of 514.8, Exception No. 2, or 515.8(A). Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding of non-current-carrying metal parts.

(b) Type MI cable terminated with fittings listed for the location. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaporlight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application.

Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

(d) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaporlight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application, and installed in accordance with the provisions of Article 727.

(e) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 501.10(A). These optical fiber cables shall be sealed in accordance with 501.15.

(f) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts, nominal, or less, and where protected from damage by location or a suitable guard, listed Type TC-ER-HL cable with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, that is terminated with fittings listed for the location, Type TC-ER-HL cables shall be installed in accordance with the provisions of Article 336.10, including the restrictions of 336.10(7).

Statement of Problem and Substantiation for Public Comment

Including TC-ER-HL as a fixed wiring method in Class I Division 1 locations is a severe reduction in wiring method protection. Certain flammable gases or combustible vapors that are likely to be present in these locations are likely to affect the physical properties of the jacket material and penetrate into the cable. A nonmetallic jacket such as the types used for Type TC cable (including -ER and -HL designated cable) alone will not provide protection equal to metallic wiring methods against the hazards present in Class I Division 1 locations. All Class I Division 1 fixed wiring methods (except optical fiber products) presently require metallic raceways, MI cable or a gas/vaporlight metallic armor wiring method. These are proven wiring methods that maintain the appropriate level of protection and safety. Nonmetallic wiring methods in these locations are required to be encased in concrete, and similar protection should be required for TC-ER-HL if it is permitted.

Related Item

First Revision No. 3940-NFPA 70-2015 [Sections 501.10(A)(1), 501.10(A)(2)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 21:28:36 EDT 2015

Committee Statement

Committee Rejected
| **Action:** |  |
| **Resolution:** | There is no substantiation presented as to why the wiring method is “unsafe”. If the TC-ER-HL has been installed in accordance with Article 336, it will be predominantly in a cable tray. Any extended run out of the tray is required to be protected by the location. If the cable is being damaged by the location, Section 110.11 may not have been correctly applied. There is no requirement that this wiring method be used in all installations. It provides another option. The restriction to industrial facilities, limitation on public access, and conditions of maintenance ensure that this will not be used in areas like filling stations that have public access. The shielded construction described is already permitted by UL 1277 and UL 2225, and in fact is often used for the twisted pair constructions. |
(1) General.

In Class I, Division 1 locations, the wiring methods in (a) through (f) shall be permitted.

(a) Threaded rigid metal conduit or threaded steel intermediate metal conduit.

Exception: Type PVC conduit, Type RTRC conduit, and Type HDPE conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. The concrete encasement shall be permitted to be omitted where subject to the provisions of 514.8, Exception No. 2, or 515.8(A). Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding of non-current-carrying metal parts.

(b) Type MI cable terminated with fittings listed for the location. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application.

Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

(d) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application, and installed in accordance with the provisions of Article 727.

(e) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 501.10(A). These optical fiber cables shall be sealed in accordance with 501.15.

(f) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts, nominal, or less, and where protected from damage by location or a suitable guard, listed Type TC-ER-HL cable with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122 that is terminated with fittings listed for the location. Type TC-ER-HL cables shall be installed in accordance with the provisions of Article 336.10, including the restrictions of 336.10(7).

Statement of Problem and Substantiation for Public Comment

As currently written, there are no restrictions in the use of non-armored cable in Division 1 locations which could compromise the level of safety at the location. The use of this cable in Division 1 locations would be suitable provided there are appropriate restrictions requiring a grounding shield above the voltage or current levels identified in the proposed text to ensure the operation of the circuit's ground fault protection device.

Related Item
First Revision No. 3940-NFPA 70-2015 [Sections 501.10(A)(1), 501.10(A)(2)]

Submitter Information Verification

Submitter Full Name: Mark Goodman
Organization: Mark Goodman Electrical Consulting
Affiliation: American Petroleum Institute
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 02:33:52 EDT 2015

Committee Statement

Committee Action: Rejected
Action:
Resolution: There is no substantiation presented as to why the wiring method is “unsafe”. If the TC-ER-HL has been installed in accordance with Article 336, it will be predominantly in a cable tray. Any extended run out of the tray is required to be protected by the location. If the cable is being damaged by the location, Section 110.11 may not have been correctly applied. There is no requirement that this wiring method be used in all installations. It provides another option. The restriction to industrial facilities, limitation on public access, and conditions of maintenance ensure that this will not be used in areas like filling stations that have public access. The shielded construction described is already permitted by UL 1277 and UL 2225, and in fact is often used for the twisted pair constructions.
Sections 501.10(A)(1), 501.10(A)(2)

(1) General.

In Class I, Division 1 locations, the wiring methods in (a) through (f) shall be permitted.

(a) Threaded rigid metal conduit or threaded steel intermediate metal conduit.

*Exception: Type PVC conduit and Type RTRC conduit and Type HDPE conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. The concrete encasement shall be permitted to be omitted where subject to the provisions of 514.8, Exception No. 2, or 515.8(A). Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding of non-current-carrying metal parts.*

(b) Type MI cable terminated with fittings listed for the location. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application.

Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

(d) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application, and installed in accordance with the provisions of Article 727.

(e) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 501.10(A). These optical fiber cables shall be sealed in accordance with 501.15.

(f).

(2) Flexible Connections.

Where necessary to employ flexible connections, as at motor terminals, the following shall be permitted:

(1) Flexible fittings listed for the location, or

(2) Flexible cord in accordance with the provisions of 501.140, terminated with cord connectors listed for the location, or

(3) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts, nominal, or less, and where protected from damage by location or a suitable guard, listed Type TC-ER-HL cable with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, that is terminated with fittings listed for the location. Type TC-ER-HL cables shall be installed in accordance with the provisions of Article 336.10, including the restrictions of 336.10(7).

(2) Flexible Connections.

Where necessary to employ flexible connections, as at motor terminals, the following shall be permitted:

(1) Flexible fittings listed for the location, or

(2) Flexible cord in accordance with the provisions of 501.140, terminated with cord connectors listed for the location, or

Additional Proposed Changes

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<th>Description</th>
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<td>501_10_A_1_a_and_f_FR3940-5rn.pdf</td>
<td>501.10(A)(1)(a) and 501.10(A)(1)(f) document</td>
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Statement of Problem and Substantiation for Public Comment

We do not support the addition of new (f) Type TC-ER-HL cable to the more robust wiring methods that are permitted in 501.10(A). This change would allow long runs of a cable with only a nonmetallic jacket which would not provide equivalent mechanical and fire protection as that afforded by metal conduit or armored cable.

It is unclear as to what types of connectors and/or couplings are suitable to transition from HDPE to threaded rigid metal conduit or threaded steel IMC prior to emerging from the ground. This needs to be determined before the wiring method is added to 501.10(A).
While PVC and RTRC type conduit are currently allowed when encased in concrete, HDPE is a flammable material and supports combustion.

**Related Item**
- First Revision No. 3940-NFPA 70-2015 [Sections 501.10(A)(1), 501.10(A)(2)]
- Public Input No. 4598-NFPA 70-2014 [Section No. 501.10(A)]
- Public Input No. 1250-NFPA 70-2014 [Section No. 501.10(A)(1)]
- Public Input No. 1906-NFPA 70-2014 [Sections 501.10(A)(1), 501.10(A)(2)]

**Submitter Information Verification**

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Mon Sep 21 12:38:49 EDT 2015

**Committee Statement**

Committee Action: Rejected
Resolution: There is no substantiation presented as to why the wiring method is "unsafe". If the TC-ER-HL has been installed in accordance with Article 336, it will be predominantly in a cable tray. Any extended run out of the tray is required to be protected by the location. If the cable is being damaged by the location, Section 110.11 may not have been correctly applied. There is no requirement that this wiring method be used in all installations. It provides another option. The restriction to industrial facilities, limitation on public access, and conditions of maintenance ensure that this will not be used in areas like filling stations that have public access. The shielded construction described is already permitted by UL 1277 and UL 2225, and in fact is often used for the twisted pair constructions. For transitions to RMC or IMC, a threaded connector would be used in a similar manner to that of PVC or RTRC.
Public Comment No. 902-NFPA 70-2015 [ Sections 501.10(A)(1), 501.10(A)(2) ]

Sections 501.10(A)(1), 501.10(A)(2)

1. General.
   In Class I, Division 1 locations, the wiring methods in (a) through (f) shall be permitted.
   (a) Threaded rigid metal conduit or threaded steel intermediate metal conduit.
      Exception: Type PVC conduit, Type RTRC conduit, and Type HDPE conduit shall be permitted where encased in a concrete
      envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top
      of the conduit to grade. The concrete encasement shall be permitted to be omitted where subject to the provisions of 514.8.
      Exception No. 2, or 515.8(A). Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for
      the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An
      equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding
      of non–current-carrying metal parts.
   (b) Type MI cable terminated with fittings listed for the location. Type MI cable shall be installed and supported in a manner to
      avoid tensile stress at the termination fittings.
   (c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that
      only qualified persons service the installation, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a
      gas/vaportight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment
      grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application.
      Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.
   (d) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that
      only qualified persons service the installation, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a
      gas/vaportight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with
      fittings listed for the application, and installed in accordance with the provisions of Article 727.
   (e) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in
      raceways in accordance with 501.10(A). These optical fiber cables shall be sealed in accordance with 501.15.

2. Flexible Connections.
   Where necessary to employ flexible connections, as at motor terminals, the following shall be permitted:
   (1) Flexible fittings listed for the location, or
   (2) Flexible cord in accordance with the provisions of 501.140, terminated with cord connectors listed for the location, or
   (3) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts, nominal, or less, and where protected from damage by location or a suitable guard, listed Type TC-ER-HL cable with an overall jacket and a
      separate equipment grounding conductor(s) in accordance with 250.122, that is terminated with fittings listed for the location. Type TC-ER-HL cables shall be installed in accordance with the provisions of Article 336.10, including the
      restrictions of 336.10(7).

Statement of Problem and Substantiation for Public Comment

There is no technical substantiation for allowing the use of TC-ER-HL cables for use as a wiring method in Class 1, Division 1 locations.
In the submitter’s substantiation they ask the code-making panel to allow other technologies for these applications so NRTL’s can
develop the appropriate performance requirements. The requirements for these new technologies should be established prior to
allowing them to be approved for Class 1 Division 1 locations. Once the requirements are established and the new technologies prove
they can meet the requirements, then they could submit to update the code.

Related Item
First Revision No. 3940-NFPA 70-2015 [Sections 501.10(A)(1), 501.10(A)(2)]

Submitter Information Verification

Submitter Full Name: JOSEPH ANDERSON
Organization: STEEL TUBE INSTITUTE
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 19:11:03 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There is no substantiation presented as to why the wiring method is “unsafe”. If the TC-ER-HL has been installed in accordance with Article 336, it will be predominantly in a cable tray. Any extended run out of the tray is required to be protected by the location. If the cable is being damaged by the location, Section 110.11 may not have been correctly applied. There is no requirement that this wiring method be used in all installations. It provides another option. The restriction to industrial facilities, limitation on public access, and conditions of maintenance ensure that this will not be used in areas like filling stations that have public access. The shielded construction described is already permitted by UL 1277 and UL 2225, and in fact is often used for the twisted pair constructions.
Public Comment No. 1061-NFPA 70-2015 [Section No. 501.10(B)(1)]

(1) General.
In Class I, Division 2 locations, all wiring methods permitted in 501.10(A) and the following wiring methods shall be permitted:

1. Rigid metal conduit (RMC) and intermediate metal conduit (IMC) with listed threadless fittings.
2. Electrical metallic tubing (EMT) with listed fittings.
3. Enclosed gasketed busways and enclosed gasketed wireways.
4. Type PLTC and Type PLTC-ER cable in accordance with the provisions of Article 725, including installation in cable tray systems. The cable shall be terminated with listed fittings.
5. Type ITC and Type ITC-ER cable as permitted in 727.4 and terminated with listed fittings.
6. Type MC, MV, TC, or TC-ER cable, including installation in cable tray systems. The cable shall be terminated with listed fittings.
7. In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation and where metallic conduit does not provide sufficient corrosion resistance, listed reinforced thermosetting resin conduit (RTRC), factory elbows, and associated fittings, all marked with the suffix -XW, and Schedule 80 PVC conduit, factory elbows, and associated fittings shall be permitted.
8. Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in cable trays or any other raceway in accordance with 501.10(B). Optical fiber cables shall be sealed in accordance with 501.15.

Where seals are required for boundary conditions as defined in 501.15(A)(4), the Division 1 wiring method shall extend into the Division 2 area to the seal, which shall be located on the Division 2 side of the Division 1–Division 2 boundary.

Statement of Problem and Substantiation for Public Comment

The wiring method "EMT" is not equivalent to existing approved wiring methods for use in Class I, Division 2 locations. There were no adequate substantiations provided with this proposal. There is no evidence to justify the lowering of standards for wiring practices in Class I, Division 2 areas. There were no restrictions for fittings; this method would not provide the positive grounding provisions in order to provide a reasonable degree of safety in hazardous locations. An application of a seal fitting with this material would not comply with the requirements of Article 358.12. The physical properties of this method is not sufficient to be installed in hazardous location. The wall thickness of EMT is typically less than half on the other wiring methods identified in this section. This use of this wiring method in Class I, Division 2 locations will lower the standard of safety.

Related Item
First Revision No. 3940-NFPA 70-2015 [Sections 501.10(A)(1), 501.10(A)(2)]

Submitter Information Verification

Submitter Full Name: WILLIAM MCBRIDE
Organization: NORTHERN ELECTRIC COMPANY
Affiliation: IEEE
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 14:36:04 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3901-NFPA 70-2015
Statement: Support requirements in 358.30 are not sufficient to prevent loss of grounding path in threadless couplings when located in Class I, Division 2 areas where uncontrolled arcing becomes an ignition source under fault conditions.
Public Comment No. 564-NFPA 70-2015 [Section No. 501.10(B)(1)]

(1) General.
In Class I, Division 2 locations, all wiring methods permitted in 501.10(A) and the following wiring methods shall be permitted:

(1) Rigid metal conduit (RMC) and intermediate metal conduit (IMC) with listed threadless fittings.
(2) Electrical metallic tubing (EMT) with listed fittings.
(3) Enclosed gasketed busways and enclosed gasketed wireways.
(5) Type PLTC and Type PLTC-ER cable in accordance with the provisions of Article 725, including installation in cable tray systems. The cable shall be terminated with listed fittings.
(6) Type ITC and Type ITC-ER cable as permitted in 727.4 and terminated with listed fittings.
(7) Type MC, MV, TC, or TC-ER cable, including installation in cable tray systems. The cable shall be terminated with listed fittings.
(8) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation and where metallic conduit does not provide sufficient corrosion resistance, listed reinforced thermosetting resin conduit (RTRC), factory elbows, and associated fittings, all marked with the suffix -XW, and Schedule 80 PVC conduit, factory elbows, and associated fittings shall be permitted.
(9) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in cable trays or any other raceway in accordance with 501.10(B). Optical fiber cables shall be sealed in accordance with 501.15.
(10) Cablebus.

Where seals are required for boundary conditions as defined in 501.15(A)(4), the Division 1 wiring method shall extend into the Division 2 area to the seal, which shall be located on the Division 2 side of the Division 1–Division 2 boundary.

Statement of Problem and Substantiation for Public Comment

Requested action is to delete (2) EMT. There has been no data supplied to support EMT’s use in Class I hazardous classified locations and merely suggesting that other methods may or may not offer equivalent protection is highly subjective. We strongly suggest that CMP14 review this application in the comment stage and consider what data, if any, supports adding this use in Class I, hazardous classified locations. Note: Correct spelling of Metallic.

The wiring method “EMT” is not equivalent to any existing approved wiring methods for use in Class I, Division 2 locations. There were no adequate substantiations provided with this proposal. There is no evidence to justify the lowering of standards for wiring practices in Class I, Division 2 areas. There were no restrictions for fittings; this method would not provide the positive grounding provisions in order to provide a reasonable degree of safety in hazardous locations. An application of a seal fitting with this material may not comply with the requirements of Article 358.12. The physical properties of this method is not sufficient to be installed in hazardous location. The wall thickness of EMT is typically less than half on the other wiring methods identified in this section. EMT conduit installed in Division 2 public areas such as garages, gas stations, hangers, etc. could be subject to physical damage and result in an open ignition source in a hazardous location. This use of this wiring method in Class I, Division 2 locations will lower the current standard of safety.

Related Item
First Revision No. 3941-NFPA 70-2015 [Section No. 501.10(B)(1)]

Submitter Information Verification

Submitter Full Name: David Wechsler
Organization: [ Not Specified ]
Affiliation: American Chemistry Council
Street Address: 
City:
State:
Zip:
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**Committee Statement**

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<td>Resolution:</td>
<td>SR-3901-NFPA 70-2015</td>
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<td>Statement:</td>
<td>Support requirements in 358.30 are not sufficient to prevent loss of grounding path in threadless couplings when located in Class I, Division 2 areas where uncontrolled arcing becomes an ignition source under fault conditions.</td>
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Public Comment No. 912-NFPA 70-2015 [Section No. 501.10(B)(1)]

(1) General.
In Class I, Division 2 locations, all wiring methods permitted in 501.10(A) and the following wiring methods shall be permitted:

(1) Rigid metal conduit (RMC) and intermediate metal conduit (IMC) with listed threadless fittings.
(2) Electrical metallic tubing (EMT) with listed fittings.
(3) Enclosed gasketed busways and enclosed gasketed wireways.
(4) Type PLTC and Type PLTC-ER cable in accordance with the provisions of Article 725, including installation in cable tray systems. The cable shall be terminated with listed fittings.
(5) Type ITC and Type ITC-ER cable as permitted in 727.4 and terminated with listed fittings.
(6) Type MC, MV, TC, or TC-ER cable, including installation in cable tray systems. The cable shall be terminated with listed fittings.
(7) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation and where metallic conduit does not provide sufficient corrosion resistance, listed reinforced thermosetting resin conduit (RTRC), factory elbows, and associated fittings, all marked with the suffix -XW, and Schedule 80 PVC conduit, factory elbows, and associated fittings shall be permitted.
(8) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in cable trays or any other raceway in accordance with 501.10(B). Optical fiber cables shall be sealed in accordance with 501.15.
(9) Cablebus.

Where seals are required for boundary conditions as defined in 501.15(A)(4), the Division 1 wiring method shall extend into the Division 2 area to the seal, which shall be located on the Division 2 side of the Division 1–Division 2 boundary.

Statement of Problem and Substantiation for Public Comment

The wiring method “EMT” is not equivalent to any existing approved wiring methods for use in Class I, Division 2 locations as was suggested in the Public Input 2591. There were no technical substantiations provided with this Public Input. There is no evidence to justify the lowering of standards for wiring practices in Class I, Division 2 areas. Additionally, there were no restrictions for the use of this wiring method including no restrictions on the fittings. This method would not provide the positive grounding provisions in order to provide a reasonable degree of safety in hazardous locations with the grounding possibly being limited to a fittings single setscrew. The physical properties of this method is not sufficient to be installed in hazardous location. The wall thickness of EMT is typically less than half on the other conduit wiring methods identified in this section. EMT conduit installed in Division 2 public areas such as garages, gas stations, hangers, etc. could be subject to physical damage and corrosion resulting in an open ignition source in a hazardous location. This use of this wiring method in Class I, Division 2 locations will lower the current standard of safety in Classified Locations. The American Petroleum Institute, Subcommittee on Electrical Equipment is in full support of the removal of EMT as an acceptable wiring method in Class I, Div. 2 locations.

Related Item
Public Input No. 2591-NFPA 70-2014 [Section No. 501.10(B)(1)]
First Revision No. 3941-NFPA 70-2015 [Section No. 501.10(B)(1)]

Submitter Information Verification
Submitter Full Name: Mark Goodman
Organization: Mark Goodman Electrical Consulting
Affiliation: American Petroleum Institute
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 10:50:48 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3901-NFPA 70-2015
| **Statement:** | Support requirements in 358.30 are not sufficient to prevent loss of grounding path in threadless couplings when located in Class I, Division 2 areas where uncontrolled arcing becomes an ignition source under fault conditions. |
Conduits installed in classified areas for future use that do not contain conductors must be effectively closed off to prevent the transmission of hazardous gasses to an unclassified area. A poured seal fitting may be used but is not required. Other approved means are acceptable such as a threaded conduit plug.

Conduits containing conductors must be sealed as required using approved seal fittings. Conductors must be contained within enclosures approved for the location.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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</thead>
<tbody>
<tr>
<td>seal_discussion.xlsx</td>
<td>pics of conduits and seal in classified area</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

Sites for compressed natural gas fueling are originally constructed for (1) gas compressor with future conduits installed for additional gas compressors. The compressor area is a poured concrete yard. There are several spare future use conduit stubs that are in this compressor yard. The compressor yard is a class 1 Div 2 area. The spare conduits extend to an unclassified area. Some inspectors insist that the conduits have poured seals even though there are no wires in the conduits. The transmission of hazardous gas from the classified area to an unclassified area can be eliminated by installing a threaded coupling with a threaded plug. This would function under the same principal as a poured seal. It is the threads of the conduit that mitigate the hazard not the sealing compound. Many general purpose inspectors that do not know the science of sealing in classified areas reject this method because the threaded plug is not a seal. Many future conduits must have the seals broken off and have the raceway system damaged or rendered unusable because of the misunderstandings of the inexperienced inspectors who can only read words and do not understand the intent of the code. This requirement is clarified to require seals where conductors are installed in future use conduit systems. This will eliminate the practice of inexperienced contractors inserting the future conductors back into the conduit and screwing a plug on the end of the future raceway system possibly damaging the conductors.

If a conduit used to transport flammable gas can be considered safely terminated with a threaded plug, an unused conduit system for electrical conductors should be as well.

Related Item
First Revision No. 3941-NFPA 70-2015 [Section No. 501.10(B)(1)]

Submitter Information Verification

Submitter Full Name: GERALD DALEY
Organization: Daley Electric Company
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Jul 22 17:10:18 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Although a threaded plug is not identified for use as a boundary seal, there is no prohibition on its acceptance by the AHJ.
(2) Class I, Division 2 Boundary.

A conduit seal shall be required in each conduit run leaving a Class I, Division 2 location. The sealing fitting shall be permitted to be installed on either side of the boundary within 3.05 m (10 ft) of the boundary and it shall be designed and installed to minimize the amount of gas or vapor within the portion of the conduit installed in the Division 2 location that can be communicated beyond the seal. Rigid metal conduit or threaded steel intermediate metal conduit shall be used between the sealing fitting and the point at which the conduit leaves the Division 2 location, and a threaded connection shall be used at the sealing fitting. The conduit run between the conduit seal and the point at which the conduit leaves the Division 2 location shall contain no union, coupling, box, or other fitting except for a listed explosionproof reducer installed at the conduit seal. Such seals shall not be required to be explosionproof but shall be identified for the purpose of minimizing the passage of gases permitted under normal operating conditions and shall be accessible.

Informational Note: For further information, refer to ANSI/UL 514B-2012, Conduit, Tubing, and Cable Fittings.

Exception No. 1: Metal conduit that contains no unions, couplings, boxes, or fittings, that passes completely through a Division 2 location with no fittings installed within 300 mm (12 in.) of either side of the boundary, shall not be required to be sealed if the termination points of the unbroken conduit are located in unclassified locations.

Exception No. 2: Conduit systems terminating in an unclassified location where the metal conduit transitions to cable tray, cablebus, ventilated busway, or Type MI cable, or to cable not installed in any cable tray or raceway system, shall not be required to be sealed where passing from the Division 2 location into the unclassified location under the following conditions:

(1) The unclassified location is outdoors, or the unclassified location is indoors and the conduit system is entirely in one room.

(2) The conduits shall not terminate at an enclosure containing an ignition source in normal operation.

Exception No. 3: Conduit systems passing from an enclosure or a room that is unclassified, as a result of pressurization, into a Division 2 location shall not require a seal at the boundary.

Informational Note: For further information, refer to NFPA 496-2013, Standard for Purged and Pressurized Enclosures for Electrical Equipment.

Exception No. 4: Segments of aboveground conduit systems shall not be required to be sealed where passing from a Division 2 location into an unclassified location if all of the following conditions are met:

(1) No part of the conduit system segment passes through a Division 1 location where the conduit segment contains unions, couplings, boxes, or fittings that are located within 300 mm (12 in.) of the Division 1 location.

(2) The conduit system segment is located entirely in outdoor locations.

(3) The conduit system segment is not directly connected to canned pumps, process or service connections for flow, pressure, or analysis measurement, and so forth, that depend on a single compression seal, diaphragm, or tube to prevent flammable or combustible fluids from entering the conduit system.

(4) The conduit system segment contains only threaded metal conduit, unions, couplings, conduit bodies, and fittings in the unclassified location.

(5) The conduit system segment is sealed at its entry to each enclosure or fitting located in the Division 2 location that contains terminals, splices, or taps.

### Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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</thead>
<tbody>
<tr>
<td>time_fill_fueling_post.JPG</td>
<td>Pic shows a compressed natural gas time fill fueling post. The Class 1 Div. 2 area is 5 feet in all directions from the post. There are conduits supporting the installation behind the barrier. The rigid conduits run in and out of the Class 1 Div. 2 area to an unclassified area.</td>
<td></td>
</tr>
<tr>
<td>div_2_conduit_segment_1.JPG</td>
<td>This pic shows conduits run behind the CNG fill post. They enter and leave the Class 1 Div. 2 area</td>
<td></td>
</tr>
<tr>
<td>back_time_fill.JPG</td>
<td>This pic shows conduits that support the CNG time fill operation. The conduits feed an Emergency Stop button. The conduits run in and out of the Class 1 Div. 2 area to an unclassified area.</td>
<td></td>
</tr>
<tr>
<td>time_fill_incomming_J_boxes.JPG</td>
<td>The pic shows junction boxes in the class 1 Div 2 area. These Junction boxes feed the conduits that run in and out of the Class 1 Div 2 area. A seal is not required for the conduits entering these junction boxes in the class 1 div 2 area. A seal should not be required for a junction box that left the div 2 area for a few feet just because it has a splice. The seal would not be required if the class 1 div 2 area extended the length of the entire time fill system.</td>
<td></td>
</tr>
</tbody>
</table>
Statement of Problem and Substantiation for Public Comment

Delete the condition in 501.15(B)(2) exception 4 condition (5). Condition (5) requires a seal where a conduit enters a splice box in a Class 1 Div 2 area if a small length of conduit travels through an unclassified area. This would pertain to a compressed natural gas time fill installation. Fill posts are located approximately 25' apart. The fill post is a class 1 div 2 area for 5" in all directions. A conduit is run along the fill post route to provide an emergency stop button near the fill post. There are several fill posts in the time fill area. There may be up to 5 emergency stop buttons serving the fill posts. If the entire area was class 1 div 2 an initial boundary seal would be required for the emergency stop conduit and none required thereafter. Since the boundary of the div 2 area around the fill post is 5' the emergency stop conduit leaves and enters the div 2 area every time it nears a fill post. At each emergency stop button there are terminations at the contact blocks of the stop button. Contact blocks rated for a class 1 div 2 area are used in the button therefore a seal would not be required. With condition (5) a seal would be required because of the termination.

The entire installation is outdoor. The portion of conduit that leaves the class 2 area can be as short as 1'. It does not seem justified to ask for a seal on a splice or termination box that is in a class 1 div 2 area that would not normally be required, but is required now because the conduit left the div 2 area into an unclassified area for a short distance. Why is it required when it was not required for a complete class 1 div 2 area with no short sections of conduit that leave the area?

Related Item
First Revision No. 3974-NFPA 70-2015 [Section No. 501.15(A)(1)]

Submitter Information Verification

Submitter Full Name: GERALD DALEY
Organization: Daley Electric Company
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 11 16:23:09 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There is insufficient substantiation provided for the deletion of (5). One installation does not justify a change to the NEC as it could negatively affect other installations. The Panel noted that a revision to the area classification such that the raceway never left the Division 2 area could have been a benefit in that a boundary seal at the unclassified location was avoided, yet would appear from the pictures provided to not have a detrimental effect on the use of other equipment, as there appeared to be none in that area.
Sealing Compounds must be installed as per manufacturers instructions.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
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<th>Approved</th>
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<tbody>
<tr>
<td>Dryer SEAL_fiber_showing_close_up.JPG</td>
<td>Pic shows a seal with the required trade size diameter thickness of compound. It failed inspection because it did not meet the manufacturer's requirement of having the fiber dam below the hub.</td>
<td></td>
</tr>
<tr>
<td>Appleton SEAL_FILL_instructions_new_version.pdf</td>
<td>Even though the thickness met the code requirement, the seal did not meet the manufacturer's requirement. The code should clarify that compounds must be installed as per manufacturers instruction so the integrity of the seal is not compromised</td>
<td></td>
</tr>
<tr>
<td>Appleton SEAL_FILL_instructions_new_version.pdf</td>
<td>Appleton's seal fill instructions requiring the fiber dam be below the hub</td>
<td></td>
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</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

A seal is one of the most important parts of an explosion proof installation. Many contractors install and pour seals with little concern for the integrity of the compound installation. The manufacturer has very specific details on how to fill a seal. To only require the thickness of compound as an installation requirement does a disservice to the integrity of the installation.

Many contractors review the code prior to completing their work. Having a requirement that a manufacturers instructions must be followed specifically in this article is paramount in helping to insure the seal is properly installed. The manufacturer received the approval of their sealing system based on the instructions and their proper execution. The thickness of compound is important, but the proper sealing technique based on the instructions is important as well.

Committee Statement

Committee Action: Rejected
Resolution: This requirement already exists in Section 110.3(B) which is a general Section to Chapter 5 unless otherwise amended by Chapter 5.
Add new section 501.15(G):
501.15(G) Accessibility
Conduit and cable seals shall be accessible.

Statement of Problem and Substantiation for Public Comment

The committee Resolution reads: "A new accessibility requirement does not need to be added because the topic is already covered in 501.15(B)(2) and (C)(1)."

Please reconsider the comment and the related PI as 501.15(B)(2) and (C)(1) as quoted in the Resolution don't contain any verbiage related to accessibility of the conduit seal.

Related Item
Public Input No. 3784-NFPA 70-2014 [New Section after 501.15(F)(2)]

Submitter Information Verification

Submitter Full Name: PAUL GUIDRY
Organization: FLUOR ENTERPRISES INC
Affiliation: Associated Builders and Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jul 13 15:25:18 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed revision is not necessary as the requirement is already addressed. Section 501.15(B)(2) addresses Class I, Division 2 Boundary Seals and clearly requires that seals "shall be accessible". Section 501.15(C)(1) addresses Class I, Division 1 and 2 Sealing Fittings and clearly requires that seals "shall be accessible".
Public Comment No. 1346-NFPA 70-2015 [Section No. 501.105(A)(2)]

(2) Connections.

To facilitate replacement in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, meters, instruments, and relays shall be permitted to be connected through Type TC-ER-HL cable by means of attachment plugs and receptacles, provided that all of the following conditions apply:

(1) Attachment plug and receptacle is listed for use in Class I, Division 1 locations and for use with TC-ER-HL cable.

(2) The attachment plug and receptacle is interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated.

(3) Type TC-ER-HL cable is listed for use in Class I, Division 1 locations.

(4) Type TC-ER-HL cable is installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7).

(5) Only necessary receptacles are provided.

Statement of Problem and Substantiation for Public Comment

Each revision cycle eases the requirements deemed necessary to ensure safe electrical installations in hazardous (classified) locations for industrial locations. The NEC does not define what is considered to be an industrial location. The proposed text does nothing to ensure that the installation is safe. Accidents can happen no matter who maintains the equipment. What ensures that electrical installations in an undefined "industrial" location is safer than in other facilities? Restricting public access does nothing to create a safer installation. A wiring method is either safe or it is unsafe; the type of facility makes no difference.

Related Item

First Revision No. 3969-NFPA 70-2015 [Section No. 501.105(A)]

Submitter Information Verification

Submitter Full Name: John Simmons
Organization: Florida East Coast JATC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 21:47:01 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The restrictions provide a suitable level of safety for the connection of this wiring method to meters, instruments, and relays.
(2) Connections.

To facilitate replacement in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, meters, instruments, and relays shall be permitted to be connected through Type TC-ER-HL cable by means of attachment plugs and receptacles identified for instrumentation, provided that all of the following conditions apply:

(1) Attachment plug and receptacle is listed for use in Class I, Division 1 locations and for use with TC-ER-HL cable.

(2) The attachment plug and receptacle is interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated.

(3) Type TC-ER-HL cable is listed for use in Class I, Division 1 locations.

(4) Type TC-ER-HL cable is installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7).

(5) Only necessary receptacles are provided.

Statement of Problem and Substantiation for Public Comment

Identification that the plug and receptacle are for instrumentation is consistent with this section and reduces the potential for power and instrumentation receptacles to be confused possibly leading to instruments being exposed to excessive voltage. A possible source of ignition could then result in a Class I, Division 1 hazardous location. Item (5) has been deleted as it is ambiguous, unenforceable and provides nothing of value.

Related Item

First Revision No. 3969-NFPA 70-2015 [Section No. 501.105(A)]

Submitter Information Verification

Submitter Full Name: Mark Goodman
Organization: Mark Goodman Electrical Consulting
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:45:32 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3925-NFPA 70-2015
Statement: List item (5) was not enforceable and was removed. New item (5) was added to clarify that receptacles shall not be interchangeable among different voltage levels. List item (4) was revised to comply with the NEC Style Manual.
(6) Connections.
To facilitate replacements, process control instruments shall be permitted to be connected through flexible cord, listed Type TC-ER cable, or Type TC-ER-HL cable, by means of attachment plug and receptacle, provided that all of the following conditions apply:

(1) Attachment plug and receptacle are listed for use in Class I, Division 2 locations and for use with flexible cords, Type TC-ER cable or Type TC-ER-HL cable as applicable, and shall be of the locking and grounding type.

Exception: A Class I, Division 2 listing is not required if the circuit is nonincendive field wiring.

(2) Unless the attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated, a switch complying with 501.105(B)(2) is provided so that the attachment plug or receptacle is not depended on to interrupt current.

Exception: The switch is not required if the circuit is nonincendive field wiring.

(3) The flexible cord does not exceed 900 mm (3 ft) and is of a type listed for extra-hard usage or for hard usage if protected by location, if applicable.

(4) Type TC-ER cable or Type TC-ER-HL cable is installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7), if applicable.

(5) Only necessary receptacles are provided.

(6) Unless the attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated, the instrumentation receptacle carries a label warning against plugging or unplugging under load. The circuit has a maximum current of 3 amps.

Statement of Problem and Substantiation for Public Comment
This section is for instruments and relays and the current restriction for 3 Amp circuit should be maintained. Delete "if applicable" in (4), delete text in (5) as it adds no value, and delete (6) as the label exception introduces unnecessary hazards in a Division 2 location.

Related Item
First Revision No. 3967-NFPA 70-2015 [Section No. 501.105(B)(6)]

Submitter Information Verification
Submitter Full Name: WILLIAM MCBRIDE
Organization: NORTHERN ELECTRIC COMPANY
Affiliation: IEEE
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 14:39:07 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3926-NFPA 70-2015
Statement: The section was rewritten to clarify the requirements. The request to remove the requirement for a warning label was rejected as there was inadequate substantiation in the comment. The limit for the circuit amperage was restored. List item (5) was not enforceable and was removed. New item (5) was added to clarify that receptacles shall not be interchangeable among different voltage levels.
(6) Connections.

To facilitate replacements, process control instruments shall be permitted to be connected through flexible cord, listed Type TC-ER cable, or Type TC-ER-HL cable, by means of attachment plug and receptacle, provided that all of the following conditions apply:

(1) Attachment plug and receptacle are listed for use in Class I, Division 2 locations and for use with flexible cords, Type TC-ER cable or Type TC-ER-HL cable as applicable, and shall be of the locking and grounding type.

Exception: A Class I, Division 2 listing is not required if the circuit is nonincendive field wiring.

(2) Unless the attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated, a switch complying with 501.105(B)(2) is provided so that the attachment plug or receptacle is not depended on to interrupt current.

Exception: The switch is not required if the circuit is nonincendive field wiring.

(3) The flexible cord does not exceed 900 mm (3 ft) and is of a type listed for extra-hard usage or for hard usage if protected by location, if applicable.

(4) Type TC-ER cable or Type TC-ER-HL cable is installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7), if applicable.

(5) Only necessary receptacles are provided.

(6) The attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated.

The instrumentation receptacle carries a label warning against plugging or unplugging under load.

Statement of Problem and Substantiation for Public Comment

Safety within hazardous (classified) location should not be dependent on a person reading a warning sign to keep a connection from being broken under load.

Submitter Information Verification

Submitter Full Name: John Simmons
Organization: Florida East Coast JATC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 21:24:35 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3926-NFPA 70-2015
Statement: The section was rewritten to clarify the requirements. The request to remove the requirement for a warning label was rejected as there was inadequate substantiation in the comment. The limit for the circuit amperage was restored. List item (5) was not enforceable and was removed. New item (5) was added to clarify that receptacles shall not be interchangeable among different voltage levels.
(6) Connections.
To facilitate replacements, process control instruments shall be permitted to be connected through flexible cord, listed Type TC-ER cable, or Type TC-ER-HL cable, by means of attachment plug and receptacle identified for instrumentation, provided that all of the following conditions apply:

1) Attachment plug and receptacle are listed for use in Class I, Division 2 locations and for use with flexible cords, Type TC-ER cable or Type TC-ER-HL cable as applicable, and shall be of the locking and grounding type.

   Exception: A Class I, Division 2 listing is not required if the circuit is nonincendive field wiring.

2) Unless the attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated, a switch complying with 501.105(B)(2) is provided so that the attachment plug or receptacle is not depended on to interrupt current.

   Exception: The switch is not required if the circuit is nonincendive field wiring.

3) The flexible cord does not exceed 900 mm (3 ft) and is of a type listed for extra-hard usage or for hard usage if protected by location, if applicable.

4) Type TC-ER cable or Type TC-ER-HL cable is installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7), if applicable.

5) Only necessary receptacles are provided.

6) Unless the attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated, the instrumentation receptacle carries a label warning against plugging or unplugging under load.

7) 

8) 

Statement of Problem and Substantiation for Public Comment

Identification that the plug and receptacle are for instrumentation is consistent with this section and reduces the potential for power and instrumentation receptacles to be confused possibly leading to instruments being exposed to excessive voltage. A possible source of ignition could then result in a Class I, Division 2 hazardous location. Item (5) has been deleted as it is ambiguous, unenforceable and provides nothing of value. Item 6 has been deleted as it appears to conflict with item 4 which requires a switch complying with 501.105(B)(2). Item 6 is really an exception by label and introduces unnecessary potential hazards in Class I, Division 2 locations.

Related Item
First Revision No. 3967-NFPA 70-2015 [Section No. 501.105(B)(6)]

Submitter Information Verification

Submitter Full Name: Mark Goodman
Organization: Mark Goodman Electrical Consulting
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:13:51 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3926-NFPA 70-2015
**Statement:** The section was rewritten to clarify the requirements. The request to remove the requirement for a warning label was rejected as there was inadequate substantiation in the comment. The limit for the circuit amperage was restored. List item (5) was not enforceable and was removed. New item (5) was added to clarify that receptacles shall not be interchangeable among different voltage levels.
Public Comment No. 117-NFPA 70-2015 [Section No. 501.125(B)]

(B) Class I, Division 2.

In Class I, Division 2 locations, motors, generators, and other rotating electrical machinery shall comply with the following:

1. Be identified for Class I, Division 2 locations, or
2. Be identified for Class I, Division 1 locations where sliding contacts, centrifugal or other types of switching mechanism (including motor overcurrent, overloading, and overtemperature devices), or integral resistance devices, either while starting or while running, are employed, or
3. Be open or nonexplosionproof enclosed motors, such as squirrel-cage induction motors without brushes, switching mechanisms, or similar arc-producing devices that are not identified for use in a Class I, Division 2 location.
4. The exposed surface of space heaters used to prevent condensation of moisture during shutdown periods shall not exceed 80 percent of the autoignition temperature in degrees Celsius of the gas or vapor involved when operated at rated voltage, and the maximum space heater surface temperature [based on a 40°C or higher marked ambient] shall be permanently marked on a visible nameplate mounted on the motor. Otherwise, space heaters shall be identified for Class I, Division 2 locations.
5. A sliding contact shaft bonding device used for the purpose of maintaining the rotor at ground potential, shall be permitted where the potential discharge energy is determined to be nonincendive for the application. The shaft bonding device shall be permitted to be installed on the inside or the outside of the motor.

Informational Note No. 1: It is important to consider the temperature of internal and external surfaces that may be exposed to the flammable atmosphere.

Informational Note No. 2: It is important to consider the risk of ignition due to currents arcing across discontinuities and overheating of parts in multisection enclosures of large motors and generators. Such motors and generators may need equipotential bonding jumpers across joints in the enclosure and from enclosure to ground. Where the presence of ignitable gases or vapors is suspected, clean-air purging may be needed immediately prior to and during start-up periods.

Informational Note No. 3: For further information on the application of electric motors in Class I, Division 2 hazardous (classified) locations, see IEEE 1349-2011, IEEE Guide for the Application of Electric Motors in Class I, Division 2 and Class I, Zone 2 Hazardous (classified) Locations.

Informational Note No. 4: Reciprocating engine-driven generators, compressors, and other equipment installed in Class I, Division 2 locations may present a risk of ignition of flammable materials associated with fuel, starting, compression, and so forth, due to inadvertent release or equipment malfunction by the engine ignition system and controls. For further information on the requirements for ignition systems for reciprocating engines installed in Class I, Division 2 hazardous (classified) locations, see ANSI/UL 122001-2004, General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (classified) Locations.

Informational Note No. 5: For details of the evaluation process to determine incendivity, refer to Annex A and Figure A1 of UL SL11836 1836 Outline-2014, Outline of Investigation for Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (classified) Locations.

Statement of Problem and Substantiation for Public Comment

Referenced correct edition of UL 122001 & UL 1836 Outline.

Related Item
Public Input No. 1067-NFPA 70-2014 [Section No. 501.125(B)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Jul 05 01:27:50 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
<table>
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<tr>
<th>Resolution:</th>
<th>SR-3927-NFPA 70-2015</th>
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<tbody>
<tr>
<td>Statement:</td>
<td>This section has been rewritten to clarify the requirements at the direction of the Correlating Committee. Updated standards references to the applicable editions</td>
</tr>
</tbody>
</table>
Public Comment No. 1804-NFPA 70-2015 [ Section No. 501.125(B) ]

(B) Class I, Division 2.

In Class I, Division 2 locations, motors, generators, and other rotating electrical machinery shall comply with the following:

1. Be identified for Class I, Division 2 locations, or
2. Be identified for Class I, Division 1 locations where sliding contacts, centrifugal or other types of switching mechanism (including motor overcurrent, overloading, and overtemperature devices), or integral resistance devices, either while starting or while running, are employed, or
3. Be open or nonexplosion-proof enclosed motors, such as squirrel-cage induction motors without brushes, switching mechanisms, or similar arc-producing devices that are not identified for use in a Class I, Division 2 location.
4. The exposed surface of space heaters used to prevent condensation of moisture during shutdown periods shall not exceed 80 percent of the autoignition temperature in degrees Celsius of the gas or vapor involved when operated at rated voltage, and the maximum space heater surface temperature [based on a 40°C or higher marked ambient] shall be permanently marked on a visible nameplate mounted on the motor. Otherwise, space heaters shall be identified for Class I, Division 2 locations.
5. A sliding contact shaft bonding device used for the purpose of maintaining the rotor at ground potential, shall be permitted where the potential discharge energy is determined to be nonincendive for the application. The shaft bonding device shall be permitted to be installed on the inside or the outside of the motor.

Informational Note No. 1: It is important to consider the temperature of internal and external surfaces that may be exposed to the flammable atmosphere.

Informational Note No. 2: It is important to consider the risk of ignition due to currents arcing across discontinuities and overheating of parts in multisection enclosures of large motors and generators. Such motors and generators may need equipotential bonding jumpers across joints in the enclosure and from enclosure to ground. Where the presence of ignitable gases or vapors is suspected, clean-air purging may be needed immediately prior to and during start-up periods.

Informational Note No. 3: For further information on the application of electric motors in Class I, Division 2 hazardous (classified) locations, see IEEE 1349-2011, IEEE Guide for the Application of Electric Motors in Class I, Division 2 and Class I, Zone 2 Hazardous (Classified) Locations.

Informational Note No. 4: Reciprocating engine-driven generators, compressors, and other equipment installed in Class I, Division 2 locations may present a risk of ignition of flammable materials associated with fuel, starting, compression, and so forth, due to inadvertent release or equipment malfunction by the engine ignition system and controls. For further information on the requirements for ignition systems for reciprocating engines installed in Class I, Division 2 hazardous (classified) locations, see ANSI/UL 122001-2004, General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (Classified) Locations.

Informational Note No. 5: For details of the evaluation process to determine incendivity, refer to Annex A and Figure A1 of UL SU1836, Outline of Investigation for Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the Panel review the proposed text to determine if the conjunction “or” is appropriate in items (1) and (2) and being inclusive of all proposed items (1), (2), and (3) with regard to a similar parallel format in 501.125(A).

Related Item
First Revision No. 3970-NFPA 70-2015 [Section No. 501.125(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 09:06:08 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected but see related SR</th>
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</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>SR-3927-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement:</td>
<td>This section has been rewritten to clarify the requirements at the direction of the Correlating Committee. Updated standards references to the applicable editions</td>
</tr>
</tbody>
</table>
Public Comment No. 565-NFPA 70-2015 [Section No. 501.125(B)]

(B) Class I, Division 2.

In Class I, Division 2 locations, motors, generators, and other rotating electrical machinery shall comply with the following:

(1) Be identified for Class I, Division 2 locations, or

(2) Be identified for Class I, Division 1 locations where sliding contacts, centrifugal or other types of switching mechanism (including motor overcurrent, overloading, and overtemperature devices), or integral resistance devices, either while starting or while running, are employed, or

(3) Be open or nonexplosionproof enclosed motors, such as squirrel-cage induction motors without brushes, switching mechanisms, or similar arc-producing devices that are not identified for use in a Class I, Division 2 location.

(4) The exposed surface of space heaters used to prevent condensation of moisture during shutdown periods shall not exceed 80 percent of the autoignition temperature in degrees Celsius of the gas or vapor involved when operated at rated voltage, and the maximum space heater surface temperature [based on a 40°C or higher marked ambient] shall be permanently marked on a visible nameplate mounted on the motor. Otherwise, space heaters shall be identified for Class I, Division 2 locations.

(5) A sliding contact shaft bonding device used for the purpose of maintaining the rotor at ground potential, shall be permitted where the potential discharge energy is determined to be nonincendive for the application. The shaft bonding device shall be permitted to be installed on the inside or the outside of the motor.

(6) Informational Note No. 1: It is important to consider the temperature of internal and external surfaces that may be exposed to the flammable atmosphere.

Informational Note No. 2: It is important to consider the risk of ignition due to currents arcing across discontinuities and overheating of parts in multisection enclosures of large motors and generators. Such motors and generators may need equipotential bonding jumpers across joints in the enclosure and from enclosure to ground. Where the presence of ignitable gases or vapors is suspected, clean-air purging may be needed immediately prior to and during start-up periods.

Informational Note No. 3: For further information on the application of electric motors in Class I, Division 2 hazardous (classified) locations, see IEEE 1349-2011, IEEE Guide for the Application of Electric Motors in Class I, Division 2 and Class I, Zone 2 Hazardous (Classified) Locations.

Informational Note No. 4: Reciprocating engine-driven generators, compressors, and other equipment installed in Class I, Division 2 locations may present a risk of ignition of flammable materials associated with fuel, starting, compression, and so forth, due to inadvertent release or equipment malfunction by the engine ignition system and controls. For further information on the requirements for ignition systems for reciprocating engines installed in Class I, Division 2 hazardous (classified) locations, see ANSI/UL 122001-2004, General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (Classified) Locations.

Informational Note No. 5: For details of the evaluation process to determine incendivity, refer to Annex A and Figure A1 of UL SU1836, Outline of Investigation for Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations.

Statement of Problem and Substantiation for Public Comment

Requested action is to delete (5).

Nothing in the NEC prohibits a shaft bonding device that is approved for the location. See 501.125 (B) (3) which addresses an installation with no brushes. There is no documentation to suggest that all motors require this bond. No standard has been supplied to define how the potential discharge energy would be ‘nonincendive’. The term ‘application’ for which the requirement of nonincendive is not identified.

There seems to be a required evaluation for the shaft bonding device installed on a motor in a hazardous classified location of unknown mJ exposure and no method has been suggested as to how a user might evaluate this condition for a nonincendive condition.

Related Item

First Revision No. 3970-NFPA 70-2015 [Section No. 501.125(B)]

Submitter Information Verification

Submitter Full Name: David Wechsler
Organization: [Not Specified]
Affiliation: ACC
Street Address: 
City:
### Committee Statement

<table>
<thead>
<tr>
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<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected</td>
<td>The panel disagrees with the removal of item 5. This item is not a requirement as it is permissive language. It indicates when used and does not require assignment as to who determines the nonincendive criteria. See Informational Note No. 5 for more information regarding determination of suitability.</td>
</tr>
</tbody>
</table>
Public Comment No. 1348-NFPA 70-2015 [Section No. 501.145(B)]

(B) Attachment Plugs.
Attachment plugs shall be of the type providing for connection to the equipment grounding conductor of a permitted flexible cord or cable and shall be identified for the location.

Statement of Problem and Substantiation for Public Comment

In the panel statement for the FR, the justification for the addition of "cable" was: "Type TC-ER-HL cable is a permissible wiring method in Class I, Division 1 locations, therefore Section 501.145(B) should be expanded to include the term "cable" along with "cord"."

However, TC-ER-HL is not a flexible cable. Flexible cables are covered in Article 400; TC cable (including TC cable rated with "-ER" and/or "-HL") is covered in Article 336. Flexible cords and flexible cables undergo entirely different evaluation processes than Chapter 3 wiring methods like TC cable, and the terminations and fittings are completely different.

Related Item
First Revision No. 3975-NFPA 70-2015 [Section No. 501.145(B)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 21:49:15 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: TC-ER-HL is a flexible wiring method. It is already recognized in Section 501.10(A)(2) for use where flexibility is required.
Public Comment No. 566-NFPA 70-2015 [Section No. 501.145(B)]

(B) Attachment Plugs.
Attachment plugs shall be of the type providing for connection to the equipment grounding conductor of a permitted flexible cord or cable and shall be identified for the location.

Exception: Receptacles and attachment plugs as provided in 501.105 (B)(6).

Statement of Problem and Substantiation for Public Comment

Action to add exception as shown.
The revision to 501.145(B) removed the exception which said “Receptacles and attachment plugs as provided in 501.105(B)(6).” Now, all attachment plugs are going to have to be “identified for the location”. The problem is that 501.105(B)(6) allowed (and still allows) receptacles that aren’t identified for the location if the circuit is non-incendive or if there is a switch installed and a label is applied such that the plug isn’t pulled under load. It looks like 501.145(B) is going to negate what was previously and currently allow to be done.

Related Item
First Revision No. 3975-NFPA 70-2015 [Section No. 501.145(B)]

Submitter Information Verification
Submitter Full Name: David Wechsler
Organization: [Not Specified]
Affiliation: ACC
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 05 13:28:34 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The requirements in Section 501.145(B) are specific to both Receptacles and Attachment Plugs in a Class I, Division 1 and Division 2 area. The requirements in Section 501.105(B) are specific to only the wire methods for meters, instruments, and relays in a Class I, Division 2 area. Plugs and Receptacles are not identified in terms of suitability for use with meters, instruments, and relays. The exception caused confusion as to what requirement in Section 501.145(B) was being amended by the exception. The exception was deleted, as the reference was incorrect and the original intent was unclear.
Public Comment No. 1343-NFPA 70-2015 [Section No. 502.10(A)(1)]

(1) General.
In Class II, Division 1 locations, the wiring methods in (1) through (5) shall be permitted:

(1) Threaded rigid metal conduit, or threaded steel intermediate metal conduit.
(2) Type MI cable with termination fittings listed for the location. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.
(3) In industrial establishments with limited public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type MC-HL cable, listed for use in Class II, Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, a separate equipment grounding conductor(s) in accordance with 250.122, and provided with termination fittings listed for the location, shall be permitted.
(4) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 502.10(A). Optical fiber cables shall be sealed in accordance with 502.15.
(5) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, listed Type ITC-HL cable with a gas/vaportight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application, and installed in accordance with the provisions of Article 727.

Statement of Problem and Substantiation for Public Comment
Each revision cycle eases the requirements deemed necessary to ensure safe electrical installations in hazardous (classified) locations for industrial locations. The NEC does not define what is considered to be an industrial location. The proposed text does nothing to ensure that the installation is safe. Accidents can happen no matter who maintains the equipment. What ensures that electrical installations in an undefined "industrial" location is safer than in other facilities? Restricting public access does nothing to create a safer installation. A wiring method is either safe or it is unsafe; the type of facility makes no difference.

Related Item
First Revision No. 3942-NFPA 70-2015 [Section No. 502.10(A)(1)]

Submitter Information Verification
Submitter Full Name: John Simmons
Organization: Florida East Coast JATC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 21:37:44 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: No substantiation was provided as to why ITC-HL was "unsafe".
Public Comment No. 1406-NFPA 70-2015 [Section No. 502.125(B)]

(B) Class II, Division 2.

In Class II, Division 2 locations, motors, generators, and other rotating electrical equipment shall be totally enclosed nonventilated, totally enclosed pipe-ventilated, totally enclosed water-air-cooled, totally enclosed fan-cooled, or dust-ignitionproof, for which maximum full-load external temperature shall be in accordance with 500.8(D)(2) for normal operation when operating in free air (not dust blanketed) and shall have no external openings, such as unused conduit openings, drain holes, or through lifting lug holes.

Exception: If the authority having jurisdiction believes accumulations of nonconductive, nonabrasive dust will be moderate and if machines can be easily reached for routine cleaning and maintenance, the following shall be permitted to be installed:

1. Standard open-type machines without sliding contacts, centrifugal or other types of switching mechanism (including motor overcurrent, overloading, and overtemperature devices), or integral resistance devices
2. Standard open-type machines with such contacts, switching mechanisms, or resistance devices enclosed within dusttight housings without ventilating or other openings
3. Self-cleaning textile motors of the squirrel-cage type

Statement of Problem and Substantiation for Public Comment

As stated in Public Input 1591, motor manufacturers are changing bearing designs because they believe the standard bearings being used on IEEE 841 motors present an "external opening". As a result, the standard available motors aren't being sold for use in areas classified for dust, even though they meet the temperature code and are TEFC design. These IEEE 841 motors have bearings with Inpro® Seals, or bearing isolators, and are not an "external opening" that would credibly allow dust inside the motor in any significant way such that the motor internal would be an ignition source. This is not what was intended by the language inserted, here, and the committee should take this opportunity to clarify what is meant by "unused openings".

Related Item
Public Input No. 1591-NFPA 70-2014 [Section No. 502.125(B)]

Submitter Information Verification
Submitter Full Name: Richard Holub
Organization: The DuPont Company, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 10:15:55 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3928-NFPA 70-2015
Statement: Suitable means for sealing external openings have been addressed by the addition of list item (4) to the exception. The panel does not agree with the PC-1406 language that provides examples as to what are external openings, as these examples are not all inclusive.
Public Comment No. 1064-NFPA 70-2015 [Section No. 503.10(A)(1)]

(1) General.
In Class III, Division 1 locations, the wiring method shall be in accordance with (1) through (5):

(1) Rigid metal conduit, Type PVC conduit, Type RTRC conduit, intermediate metal conduit, electrical metallic tubing, dusttight wireways, or Type MC or MI cable with listed termination fittings.

(2) Type PLTC and Type PLTC-ER cable in accordance with the provisions of Article 725, including installation in cable tray systems. The cable shall be terminated with listed fittings.

(3) Type ITC and Type ITC-ER cable as permitted in 727.4 and terminated with listed fittings.

(4) Type MC, MI, MV, TC, or TC-ER cable installed in ladder, ventilated trough, or ventilated channel cable trays in a single layer, with a space not less than the larger cable diameter between the two adjacent cables, shall be the wiring method employed. The cable shall be terminated with listed fittings.

Exception to (4): Type MC cable listed for use in Class II, Division 1 locations shall be permitted to be installed without the spacings required by 503.10(A)(1)(4).

(5) Cablebus.

Statement of Problem and Substantiation for Public Comment

The use of non-metallic jacked MV cable should not be allowed in Class III, Division 1 locations. The substantiation for this proposal provided by a cable manufacturer "MV cable is allowed for Class I, Division 2 locations and should be allowed in Class III, Division 1 and 2 locations, as well" in not sufficient to lower the current standard of safety. Type MV Cable should have a more robust jacket if it is to be allowed in a Division 1 location; possibly a MV-ER-HL that has increased crush and impact requirements.

Related Item
First Revision No. 3944-NFPA 70-2015 [Section No. 503.10(A)(1)]

Submitter Information Verification

Submitter Full Name: WILLIAM MCBRIDE
Organization: NORTHERN ELECTRIC COMPANY
Affiliation: IEEE
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 14:43:11 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Insufficient substantiation provided for the removal of MV. It was also noted that the difference between Division 1 and Division 2 locations in Class III is quite different from Class I or Class II, as the only difference is related to "manufactured" and not a specific risk of release.
Public Comment No. 1379-NFPA 70-2015 [ Section No. 503.10(A)(1) ]

(1) General.
In Class III, Division 1 locations, the wiring method shall be in accordance with (1) through (5):

(1) Rigid metal conduit, Type PVC conduit, Type RTRC conduit, intermediate metal conduit, electrical metallic tubing, dusttight wireways, or Type MC or MI cable with listed termination fittings.

(2) Type PLTC and Type PLTC-ER cable in accordance with the provisions of Article 725, including installation in cable tray systems. The cable shall be terminated with listed fittings.

(3) Type ITC and Type ITC-ER cable as permitted in 727.4 and terminated with listed fittings.

(4) Type MC, MI, MV TC, TC, or TC-ER cable installed in ladder, ventilated trough, or ventilated channel cable trays in a single layer, with a space not less than the larger cable diameter between the two adjacent cables, shall be the wiring method employed. The cable shall be terminated with listed fittings.

   Exception to (4): Type MC cable listed for use in Class II, Division 1 locations shall be permitted to be installed without the spacings required by. 503.10(A)(1)(4).

(5) Cablebus.

Statement of Problem and Substantiation for Public Comment

The use of non-shielded and non-metallic jacked MV cable should not be allowed in any Division 1 location including Class III, Division 1. The substantiation for this proposal provided by a cable manufacturer "MV cable is allowed for Class I, Division 2 locations and should be allowed in Class III, Division 1 and 2 locations, as well" is not sufficient technical substantiation to lower the current standard of safety. Type MV Cable should have a more robust jacket if it is to be allowed in a Division 1 location.

Related Item
First Revision No. 3944-NFPA 70-2015 [Section No. 503.10(A)(1)]

Submitter Information Verification

Submitter Full Name: Mark Goodman
Organization: Mark Goodman Electrical Consulting
Affiliation: American Petroleum Institute

Committee Statement
Committee Action: Rejected
Resolution: Insufficient substantiation provided for the removal of MV. It was also noted that the difference between Division 1 and Division 2 locations in Class III is quite different from Class I or Class II, as the only difference is related to "manufactured" and not a specific risk of release.
504.4 Equipment.

All intrinsically safe apparatus and associated apparatus shall be listed and labeled.

*Exception: Simple apparatus, as described on the control drawing, shall not be required to be listed and labeled.*

### Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition, please see document pages 5, 8 and 10 to see that in addition to UL requirements, ETL also requires products that they have certified are required to be labeled in order to be considered as listed.</td>
<td></td>
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</tbody>
</table>

### Statement of Problem and Substantiation for Public Comment

Listings do not specify labeling as defined by the NEC, labeling requirements are determined by the certification organization.

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

**Related Item**

Public Input No. 913-NFPA 70-2014 [Section No. 504.4]
Committee Statement

Committee Action: Rejected

Resolution: “Listed” and “labeled” are defined separately in Art. 100. Listed is the correct term. Requirements for product listing, to include the affixing of a certification label or mark are specified by certification organizations. Whereas the two certification organizations cited do require listed products to bear a certification mark, these requirements may vary between other organizations.
505.2 Definitions.

Encapsulation "m".
Type of protection where electrical parts that could ignite an explosive atmosphere by either sparking or heating are enclosed in a compound in such a way that this explosive atmosphere cannot be ignited.


Informational Note No. 2: Encapsulation is designated type of protection "ma" for use in Zone 0 locations. Encapsulation is designated type of protection "m" or "mb" for use in Zone 1 locations. Encapsulation is designated type of protection "mc" for use in Zone 2 locations.

Flameproof "d".
Type of protection where the enclosure will withstand an internal explosion of a flammable mixture that has penetrated into the interior, without suffering damage and without causing ignition, through any joints or structural openings in the enclosure, of an external explosive gas atmosphere consisting of one or more of the gases or vapors for which it is designed.


Increased Safety "e".
Type of protection applied to electrical equipment that does not produce arcs or sparks in normal service and under specified abnormal conditions, in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks.

Informational Note: See ANSI/ISA-60079-7-2009, Explosive Atmospheres — Part 7: Equipment protection by increased safety "e"; and ANSI/UL 60079-7-2009, Electrical Apparatus for Explosive Gas Atmospheres — Part 7: Increased Safety "e".

Intrinsic Safety "i".
Type of protection where any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions.


Informational Note No. 2: Intrinsic safety is designated type of protection "ia" for use in Zone 0 locations. Intrinsic safety is designated type of protection "ib" for use in Zone 1 locations. Intrinsic safety is designated type of protection "ic" for use in Zone 2 locations.

Informational Note No. 3: Intrinsically safe associated apparatus, designated by [ia], [ib], or [ic], is connected to intrinsically safe apparatus ("ia", "ib", or "ic", respectively) but is located outside the hazardous (classified) location unless also protected by another type of protection (such as flameproof).

Oil Immersion "o".
Type of protection where electrical equipment is immersed in a protective liquid in such a way that an explosive atmosphere that may be above the liquid or outside the enclosure cannot be ignited.


Powder Filling "q".
Type of protection where electrical parts capable of igniting an explosive atmosphere are fixed in position and completely surrounded by filling material (glass or quartz powder) to prevent the ignition of an external explosive atmosphere.

Pressurization “p”:
Type of protection for electrical equipment that uses the technique of guarding against the ingress of the external atmosphere, which may be explosive, into an enclosure by maintaining a protective gas therein at a pressure above that of the external atmosphere.


Type of Protection “n”:
Type of protection where electrical equipment, in normal operation, is not capable of igniting a surrounding explosive gas atmosphere and a fault capable of causing ignition is not likely to occur.


Statement of Problem and Substantiation for Public Comment

Referenced current standards.

Related Public Comments for This Document

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<tr>
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<tbody>
<tr>
<td>Public Comment No. 39-NFPA 70-2015 [Section No. 110.31]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
</tr>
<tr>
<td>Public Comment No. 41-NFPA 70-2015 [Section No. 399.10]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<tr>
<td>Public Comment No. 42-NFPA 70-2015 [Section No. Table]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 43-NFPA 70-2015 [Section No. B.310.15(B)(2)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]</td>
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<tr>
<td>Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<tr>
<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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<tr>
<td>Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]
Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]
Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]
Public Comment No. 95-NFPA 70-2015 [Section No. 620.1]
Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack.]
Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]
Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]
Public Comment No. 161-NFPA 70-2015 [Section No. 506.2]

Related Item
First Revision No. 3927-NFPA 70-2015 [Definitions (505.2): Encapsulati... to Type of Pro...]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
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Zip:
Submittal Date: Sat Jul 04 03:05:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3917-NFPA 70-2015
Statement: Standards referenced in the informational notes have been updated and the current revisions of these documents have been shown. In cases where the ANSI/UL standard has moved to a new edition and no corresponding ANSI/ISA document is available, the ANSI/ISA reference has been eliminated to ensure that we don’t introduce two different editions of the same standard in these references. IEC 60079-13-2010 was not adopted in the US and it is confusing to be referring to it in this informational note because this standard is not formally adopted.
505.4  General.

(A)  Documentation for Industrial Occupancies.

All areas in industrial occupancies designated as hazardous (classified) locations shall be properly documented. This documentation shall be available to those authorized to design, install, inspect, maintain, or operate electrical equipment at the location.


Informational Note No. 2: Where gas detection equipment is used as a means of protection in accordance with 505.8(i)(1), (i)(2), or (i)(3), the documentation typically includes the type of detection equipment, its listing, installation location(s), alarm and shutdown criteria, and calibration frequency.

(B)  Reference Standards.

Important information relating to topics covered in Chapter 5 may be found in other publications.

Informational Note No. 1: It is important that the authority having jurisdiction be familiar with recorded industrial experience as well as with standards of the National Fire Protection Association (NFPA), the American Petroleum Institute (API), the International Society of Automation (ISA), and the International Electrotechnical Commission (IEC) that may be of use in the classification of various locations, the determination of adequate ventilation, and the protection against static electricity and lightning hazards.


Informational Note No. 3: For further information on protection against static electricity and lightning hazards in hazardous (classified) locations, see NFPA 77-2014, Recommended Practice on Static Electricity; NFPA 780-2014, Standard for the Installation of Lightning Protection Systems; and API RP 2003-2008, Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

Informational Note No. 4: For further information on ventilation, see NFPA 30-2015, Flammable and Combustible Liquids Code, and ANSI/API RP 505-1997, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, or Zone 2.

Informational Note No. 5: For further information on electrical systems for hazardous (classified) locations on offshore oil and gas producing platforms, see ANSI/API RP 14FZ-2013, Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations.

Informational Note No. 6: For further information on the installation of electrical equipment in hazardous (classified) locations in general, see IEC 60079-14-2013, Electrical apparatus for explosive gas atmospheres — Part 14: Electrical installations in explosive gas atmospheres (other than mines), and IEC 60079-16-1990, Electrical apparatus for explosive gas atmospheres — Part 16: Artificial ventilation for the protection of analyzer(s) houses.

Informational Note No. 7: For further information on application of electrical equipment in hazardous (classified) locations in general, see ANSI/ISA-60079-0 (12.00.01)-2013, Explosive Atmospheres — Part 0: Equipment — General Requirements; ANSI/ISA-12.01.01-1999 2013, Definitions and Information Pertaining to Electrical Apparatus Electrical Equipment in Hazardous (Classified) Locations; and ANSI/UL 60079-0:2013, Electrical Apparatus for Explosive Gas Atmospheres — Part 0: General Requirements.

Informational Note No. 8: Portable or transportable equipment having self-contained power supplies, such as battery-operated, could potentially become an ignition source in hazardous (classified) locations. See ANSI/ISA-12.12.03-2011, Standard for Portable Electronic Products Suitable for Use in Class I and II, Division 2, Class I Zone 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations.

Informational Note No. 9: For additional information concerning the installation of equipment utilizing optical emissions technology (such as laser equipment) that could potentially become an ignition source in hazardous (classified) locations, see ANSI/ISA-60079-28 (12.21.02)-2013, Explosive Atmospheres — Part 28: Protection of equipment and transmission systems using optical radiation.
Referenced current editions, and names of standards.

### Related Public Comments for This Document

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<tr>
<td>Public Comment No. 161-NFPA 70-2015 [Section No. 506.2]</td>
<td>Related Item</td>
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<tr>
<td>First Revision No. 3939-NFPA 70-2015 [Section No. 505.4]</td>
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### Submitter Information Verification

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State:  
Zip:  
Submittal Date: Mon Jul 06 16:54:56 EDT 2015

### Committee Statement

Committee Action: Rejected but see related SR  
Resolution: SR-3919-NFPA 70-2015  
Statement: The recommended change for IP Model Code P15 is not a correct reference as the "IP 15" has been changed to EI 15 per the Energy Institute website. The recommendation to update the ANSI/ISA 12.01.01 to 2013 has been so adopted, though it is worth noting that the Energy Institute has published a 4th edition effective July 2015.
(A) Documentation for Industrial Occupancies.

All areas in industrial occupancies designated as hazardous (classified) locations shall be properly documented. This documentation shall be available to those authorized to design, install, inspect, maintain, or operate electrical equipment at the location.


Informational Note No. 2: Where gas detection equipment is used as a means of protection in accordance with 505.8(I)(1), (I)(2), or (I)(3), the documentation typically includes the type of detection equipment, its listing, installation location(s), alarm and shutdown criteria, and calibration frequency.

Statement of Problem and Substantiation for Public Comment

RP 505 reference date update. The next edition of ANSI/API RP 505 has completed, balloted, and is anticipated to be published before the end of 2015.

Related Public Comments for This Document

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<td>Public Comment No. 1572-NFPA 70-2015 [Section No. 505.8(I) [Excluding any Sub-Sections]]</td>
<td>Related Item</td>
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<td>Public Input No. 4766-NFPA 70-2014 [Section No. 505.4(A)]</td>
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Submitter Information Verification

Submitter Full Name: Mark Goodman  
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State:  
Zip:  
Submittal Date: Fri Sep 25 14:02:50 EDT 2015

Committee Statement

Committee Action: Rejected  
Resolution: The next revision of document, ANSI/API RP 505 has not yet been published and thus the document is not available for review or update of the publication date.
Public Comment No. 1599-NFPA 70-2015 [Section No. 505.4(B)]

(B) Reference Standards.

Important information relating to topics covered in Chapter 5 may be found in other publications.

Informational Note No. 1: It is important that the authority having jurisdiction be familiar with recorded industrial experience as well as with standards of the National Fire Protection Association (NFPA), the American Petroleum Institute (API), the International Society of Automation (ISA), and the International Electrotechnical Commission (IEC) that may be of use in the classification of various locations, the determination of adequate ventilation, and the protection against static electricity and lightning hazards.


Informational Note No. 3: For further information on protection against static electricity and lightning hazards in hazardous (classified) locations, see NFPA 77-2014, Recommended Practice on Static Electricity; NFPA 780-2014, Standard for the Installation of Lightning Protection Systems; and API RP 2003-2008, Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

Informational Note No. 4: For further information on ventilation, see NFPA 30-2015, Flammable and Combustible Liquids Code, and ANSI/API RP 505-1997, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, or Zone 2.

Informational Note No. 5: For further information on electrical systems for hazardous (classified) locations on offshore oil and gas producing platforms, see ANSI/API RP 14FZ-2013, Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations.

Informational Note No. 6: For further information on the installation of electrical equipment in hazardous (classified) locations in general, see IEC 60079-14-2013, Electrical apparatus for explosive gas atmospheres — Part 14: Electrical installations in explosive gas atmospheres (other than mines), and IEC 60079-16-1990, Electrical apparatus for explosive gas atmospheres — Part 16: Artificial ventilation for the protection of analyzer(s) houses.

Informational Note No. 7: For further information on application of electrical equipment in hazardous (classified) locations in general, see ANSI/ISA-60079-0 (12.00.01)-2013, Explosive Atmospheres — Part 0: Equipment — General Requirements; ANSI/ISA-12.01.01-1999, Definitions and Information Pertaining to Electrical Apparatus in Hazardous (Classified) Locations; and ANSI/UL 60079-0:2013, Electrical Apparatus for Explosive Gas Atmospheres — Part 0: General Requirements.

Informational Note No. 8: Portable or transportable equipment having self-contained power supplies, such as battery-operated equipment, could potentially become an ignition source in hazardous (classified) locations. See ANSI/ISA-12.12.03-2011, Standard for Portable Electronic Products Suitable for Use in Class I and II, Division 2, Class I Zone 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations.

Informational Note No. 9: For additional information concerning the installation of equipment utilizing optical emissions technology (such as laser equipment) that could potentially become an ignition source in hazardous (classified) locations, see ANSI/ISA-60079-28 (12.21.02)-2013, Explosive Atmospheres — Part 28: Protection of equipment and transmission systems using optical radiation.

Statement of Problem and Substantiation for Public Comment

RP 505 reference date update. The next edition of ANSI/API RP 505 has been completed, balloted, and is anticipated to be published before the end of 2015.

Related Public Comments for This Document

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<td>Public Input No. 4767-NFPA 70-2014 [Section No. 505.4(B)]</td>
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Submitter Information Verification

Submitter Full Name: Mark Goodman
Committee Statement

Committee Action: Rejected

Resolution: The next revision of document, ANSI/API RP 505 has not yet been published and thus the document is not available for review or update of the publication date.
Public Comment No. 251-NFPA 70-2015 [Section No. 505.4(B)]

(B) Reference Standards.

Important information relating to topics covered in Chapter 5 may be found in other publications.

Informational Note No. 1: It is important that the authority having jurisdiction be familiar with recorded industrial experience as well as with standards of the National Fire Protection Association (NFPA), the American Petroleum Institute (API), the International Society of Automation (ISA), and the International Electrotechnical Commission (IEC) that may be of use in the classification of various locations, the determination of adequate ventilation, and the protection against static electricity and lightning hazards.


Informational Note No. 3: For further information on protection against static electricity and lightning hazards in hazardous (classified) locations, see NFPA 77-2014, Recommended Practice on Static Electricity; NFPA 780-2014, Standard for the Installation of Lightning Protection Systems; and API RP 2003-2008, Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

Informational Note No. 4: For further information on ventilation, see NFPA 30-2015, Flammable and Combustible Liquids Code, and ANSI/API RP 505-1997, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, or Zone 2.

Informational Note No. 5: For further information on electrical systems for hazardous (classified) locations on offshore oil and gas producing platforms, oil and gas well drilling land rigs, and skid mounted oilfield equipment, see ANSI/API RP 14FZ-2013, Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations.

Informational Note No. 6: For further information on the installation of electrical equipment in hazardous (classified) locations in general, see IEC 60079-14-2013, Electrical apparatus for explosive gas atmospheres — Part 14: Electrical installations in explosive gas atmospheres (other than mines), and IEC 60079-16-1990, Electrical apparatus for explosive gas atmospheres — Part 16: Artificial ventilation for the protection of analyzer(s) houses.

Informational Note No. 7: For further information on application of electrical equipment in hazardous (classified) locations in general, see ANSI/ISA-60079-9-0 (12.00.01)-2013, Explosive Atmospheres — Part 0: Equipment — General Requirements; ANSI/ISA-12.12.01-1999, Definitions and Information Pertaining to Electrical Apparatus in Hazardous (Classified) Locations; and ANSI/UL 60079-0:2013, Electrical Apparatus for Explosive Gas Atmospheres — Part 0: General Requirements.

Informational Note No. 8: Portable or transportable equipment having self-contained power supplies, such as battery-operated equipment, could potentially become an ignition source in hazardous (classified) locations. See ANSI/ISA-12.12.03-2011, Standard for Portable Electronic Products Suitable for Use in Class I and II, Division 2, Class I Zone 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations.

Informational Note No. 9: For additional information concerning the installation of equipment utilizing optical emissions technology (such as laser equipment) that could potentially become an ignition source in hazardous (classified) locations, see ANSI/ISA-60079-28 (12.21.02)-2013, Explosive Atmospheres — Part 28: Protection of equipment and transmission systems using optical radiation.

Statement of Problem and Substantiation for Public Comment

The Oil and Gas Well Drilling Land Rig Industry faces unique challenges as a result of their need for quick and easy mobility when rigging up and rigging down as the drilling land rig is transported overland between drill sites. In addition, the drilling rigs and the machines on them are subjected to significant movement, shaking, and vibration while drilling. Therefore these conditions require special consideration with regards to the selection and installation of electrical cables in hazardous (classified) locations.

Rigid conduit and Type MC-HL cable are not suitable for the application and in the absence of a consensus standard or recommended practice addressing the unique requirements for installing electric cables in hazardous (classified) locations on land rigs, the Oil and Gas Well Drilling Land Rig Industry has historically looked to consensus standards and practices in the Oil and Gas Well Drilling Offshore Industry for guidance; specifically API RP 14F entitled “Recommended Practice for Design, Installation, and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Division 1 and Division 2 Locations” and API RP 14FZ entitled “Recommended Practice for Design, Installation, and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Zone 0, Zone 1, and Zone 2 Locations.”

Adopting wiring methods from API RP 14F and API RP 14FZ, the Oil and Gas Well Drilling Land Rig Industry has historically and for
over 30 years used IEEE-1580, Type P, marine shipboard cable to cable-up and interconnect the various machines and equipment that make up the drilling land rig. These cables may also be listed as UL-1309 Marine Shipboard Cable. The flexible and rugged IEEE-1580, Type P, marine shipboard cable is highly suitable for the oil and gas well drilling land rig application because of its ability to resist drilling muds that contain various chemicals, abrasives, and petroleum based additives as well as its ability to resist damage from vibration, shaking, and movement that occurs during the drilling process, and the rigors of rig-up and rig-down. They are also highly suited because of their ability to perform in extreme cold weather conditions in that they can pass a -40\(^\circ\)C cold bend test and a -35\(^\circ\)C cold impact test. In addition to their flexibility and mechanical ruggedness as just described, the IEEE-1580, Type P, marine shipboard cable is rated 600/1000 volts or 2000 volts which makes it suitable for use on both AC and DC powered drilling rigs, has a maximum conductor temperature rating of 110\(^\circ\)C, has a flexible tinned-copper stranded conductor that resists oxidation, and passes an IEEE 1202 vertical cable tray flame test. In addition, these flexible tinned-copper conductors are available in sizes like 444 Kcmil, 535 Kcmil, 646 Kcmil, and 777 Kcmil that are currently not recognized in NFPA 70. These cables are also available with a metallic basket-weave braided armor that effectively enhances their durability, provides crush, impact, and cut-through resistance, and is not prone to failure due to fatigue and cracking; properties that are very important in the drilling environment. Collectively, all of these properties and features which are required of both single-conductor and multi-conductor cable used on an oil and gas well drilling land rig are not available on any one cable type included in NFPA 70.

More specifically and per API RP 14F and API RP 14FZ; in Class 1, Division 1 and Class 1, Zone 1 hazardous (classified) locations, the Oil and Gas Well Drilling Land Rig Industry uses IEEE-1580, Type P, marine shipboard cable with a metallic basket-weave braided armor and outer polymeric sheath. The metallic basket-weave braided armor with outer polymeric sheath mechanically protects the cable from damage and yet provides the flexibility required for the application.

In addition, recommendations in API RP 14F and API RP 14FZ allow the use of unarmored IEEE-1580, Type P, marine shipboard cable in Class 1, Division 2 and Class 1, Zone 2 hazardous areas. Regardless, the specific location on the land rig is given engineering consideration relative to the cable’s vulnerability to mechanical damage. If the location in itself does not provide suitable mechanical protection or the addition of steel guards is not practical for the location, then armored and sheathed IEEE-1580, Type P, marine shipboard cable may be used.

**Related Item**

Public Input No. 2401-NFPA 70-2014 [Section No. 505.15(B)(1)]

Public Input No. 2400-NFPA 70-2014 [Section No. 505.15(C)(1)]

**Submitter Information Verification**

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Submittal Date: Wed Jul 15 14:58:13 EDT 2015

**Committee Statement**

Committee Action: Rejected but held  
Resolution: ANSI/API RP 14FZ-2013 is specific to fixed and floating off shore platforms and not relevant to “Oil and Gas Well Drilling Land Rigs”. Wiring methods on land based drilling rigs and related skid mounted equipment in the current NEC does not reflect the current practices utilizing flexible methods such as Type P cable. Panel recommends consideration of a task group consisting of CMP 14, CMP 6 and CMP 7 to allow wiring methods utilizing Type P cable (UL 1309) for this application.
Reference Standards.

Important information relating to topics covered in Chapter 5 may be found in other publications.

Informational Note No. 1: It is important that the authority having jurisdiction be familiar with recorded industrial experience as well as with standards of the National Fire Protection Association (NFPA), the American Petroleum Institute (API), the International Society of Automation (ISA), and the International Electrotechnical Commission (IEC) that may be of use in the classification of various locations, the determination of adequate ventilation, and the protection against static electricity and lightning hazards.


Informational Note No. 3: For further information on protection against static electricity and lightning hazards in hazardous (classified) locations, see NFPA 77-2014, Recommended Practice on Static Electricity; NFPA 780-2014, Standard for the Installation of Lightning Protection Systems; and API RP 2003-2008, Protection Against Ignitions Arising Out of Static Lightning and Stray Currents.

Informational Note No. 4: For further information on ventilation, see NFPA 30-2015, Flammable and Combustible Liquids Code, and ANSI/API RP 505-1997, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, or Zone 2.

Informational Note No. 5: For further information on electrical systems for hazardous (classified) locations on offshore oil and gas producing platforms, see ANSI/API RP 14FZ-2013, Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations.

Informational Note No. 6: For further information on the installation of electrical equipment in hazardous (classified) locations in general, see IEC 60079-14-2013, Electrical apparatus for explosive gas atmospheres — Part 14: Electrical installations in explosive gas atmospheres (other than mines), and IEC 60079-16-1990, Electrical apparatus for explosive gas atmospheres — Part 16: Artificial ventilation for the protection of analyzer(s) houses.

Informational Note No. 7: For further information on application of electrical equipment in hazardous (classified) locations in general, see ANSI/ISA-60079-0 (12.00.01)-2013, Explosive Atmospheres — Part 0: Equipment — General Requirements; ANSI/ISA-12.01.01-1999, Definitions and Information Pertaining to Electrical Apparatus in Hazardous (Classified) Locations; and ANSI/UL 60079-0:2013, Electrical Apparatus for Explosive Gas Atmospheres — Part 0: General Requirements.

Informational Note No. 8: Portable or transportable equipment having self-contained power supplies, such as battery-operated equipment, could potentially become an ignition source in hazardous (classified) locations. See ANSI/ISA-12.12.03-2011, Standard for Portable Electronic Products Suitable for Use in Class I and II, Division 2, Class I Zone 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations.

Informational Note No. 9: For additional information concerning the installation of equipment utilizing optical emissions technology (such as laser equipment) that could potentially become an ignition source in hazardous (classified) locations, see ANSI/ISA-60079-28 (12.21.02)-2013, Explosive Atmospheres — Part 28: Protection of equipment and transmission systems using optical radiation.
Committee Statement

<table>
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<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>The informational note is intended to provide the user with useful information related to the installation and use of electrical equipment installed in Zone 20, 21 or 22 locations when such equipment emits optical radiation in free air.</td>
</tr>
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</table>
505.5 - Classification of Locations.

(A) - Classification of Locations.

Locations shall be classified depending on the properties of the flammable gases, flammable liquid–produced vapors, combustible liquid–produced vapors, combustible dusts, or fibers/flyings that may be present and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section, or area shall be considered individually in determining its classification. Where pyrophoric materials are the only materials used or handled, these locations are outside the scope of this article.

Informational Note No. 1: See 505.7 for restrictions on area classification.

Informational Note No. 2: Through the exercise of ingenuity in the layout of electrical installations for hazardous (classified) locations, it is frequently possible to locate much of the equipment in reduced level of classification or in an unclassified location and, thus, to reduce the amount of special equipment required.

Refrigerant machinery rooms containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm may be classified as “unclassified” locations.

Rooms and refrigerated areas containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm may be classified as “unclassified” locations.

Informational Note: For further information regarding classification and ventilation of areas involving ammonia, see ANSI/ASHRAE 15, 15, & 34 -2013, Safety Standard for Refrigeration Systems.

(B) - Class I, Zone 0, 1, and 2 Locations.

Class I, Zone 0, 1, and 2 locations are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitible mixtures. Class I, Zone 0, 1, and 2 locations shall include those specified in 505.5(B)(1), (B)(2), and (B)(3).

(1) - Class I, Zone 0.

A Class I, Zone 0 location is a location in which

1. Ignitible concentrations of flammable gases or vapors are present continuously, or

2. Ignitible concentrations of flammable gases or vapors are present for long periods of time.

Informational Note No. 1: As a guide in determining when flammable gases or vapors are present continuously or for long periods of time, refer to ANSI/API RP 505-1997, Recommended Practice for Classification of Locations for Electrical Installations of Petroleum Facilities Classified as Class I, Zone 0, Zone 1 or Zone 2; ANSI/ISA-TR12.24.01-1998 (IEC 60079-10 Mod), Recommended Practice for Classification of Locations for Electrical Installations Classified as Class I, Zone 0, Zone 1, or Zone 2; IEC 60079-10-1995, Electrical apparatus for explosive gas atmospheres - classifications of hazardous areas; and 1-2008, Explosive Atmospheres - Part 10-1: Classification of Areas - Explosive Gas Atmospheres; and Model Code of Safe Practice Part 15: Area Classification Code for Petroleum Installations, Model Code, Part 15, Institute of Petroleum Handling Flammable Fluids, 3rd Edition, 2005, Energy Institute.

Informational Note No. 2: This classification includes locations inside vented tanks or vessels that contain volatile flammable liquids; inside inadequately vented spraying or coating enclosures, where volatile flammable solvents are used; between the inner and outer roof sections of a floating roof tank containing volatile flammable liquids; inside open vessels, tanks and pits containing volatile flammable liquids; the interior of an exhaust duct that is used to vent ignitible concentrations of gases or vapors; and inside inadequately ventilated enclosures that contain normally venting instruments utilizing or analyzing flammable fluids and venting to the inside of the enclosures.
Class I, Zone 1.

A Class I, Zone 1 location is a location

1. In which ignitable concentrations of flammable gases or vapors are likely to exist under normal operating conditions; or
2. In which ignitable concentrations of flammable gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or
3. In which equipment is operated or processes are carried on, of such a nature that equipment breakdown or faulty operations could result in the release of ignitable concentrations of flammable gases or vapors and also cause simultaneous failure of electrical equipment in a mode to cause the electrical equipment to become a source of ignition; or
4. That is adjacent to a Class I, Zone 0 location from which ignitible concentrations of vapors could be communicated, unless communication is prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

Informational Note No. 1: Normal operation is considered the situation when plant equipment is operating within its design parameters. Minor releases of flammable material may be part of normal operations. Minor releases include the releases from mechanical packings on pumps. Failures that involve repair or shutdown (such as the breakdown of pump seals and flange gaskets, and spillage caused by accidents) are not considered normal operation.

Informational Note No. 2: This classification usually includes locations where volatile flammable liquids or liquefied flammable gases are transferred from one container to another. In areas in the vicinity of spraying and painting operations where flammable solvents are used; adequately ventilated drying rooms or compartments for evaporation of flammable solvents; adequately ventilated locations containing fat and oil extraction equipment using volatile flammable solvents; portions of cleaning and dyeing plants where volatile flammable liquids are used; adequately ventilated gas generator rooms and other portions of gas manufacturing plants where flammable gas may escape; inadequately ventilated pump rooms for flammable gas or for volatile flammable liquids; the interiors of refrigerators and freezers in which volatile flammable materials are stored in the open, lightly stoppered, or in easily ruptured containers; and other locations where ignitable concentrations of flammable vapors or gases are likely to occur in the course of normal operation but not classified Zone 0.

Class I, Zone 2.

A Class I, Zone 2 location is a location

1. In which ignitable concentrations of flammable gases or vapors are not likely to occur in normal operation and, if they do occur, will exist only for a short period; or
2. In which volatile flammable liquids, flammable gases, or flammable vapors are handled, processed, or used but in which the liquids, gases, or vapors normally are confined within closed containers of closed systems from which they can escape, only as a result of accidental rupture or breakdown of the containers or system, or as a result of the abnormal operation of the equipment with which the liquids or gases are handled, processed, or used; or
3. In which ignitable concentrations of flammable gases or vapors normally are prevented by positive mechanical ventilation but which may become hazardous as a result of failure or abnormal operation of the ventilation equipment; or
4. That is adjacent to a Class I, Zone 1 location, from which ignitible concentrations of flammable gases or vapors could be communicated, unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

Informational Note: The Zone 2 classification usually includes locations where volatile flammable liquids or flammable gases or vapors are used but which would become hazardous only in case of an accident or of some unusual operating condition.

Statement of Problem and Substantiation for Public Comment

Referenced ASHRAE STD 15 & AS4 which is a combined standard in the informational note to 505.5(A).

In 505.5(B)(1)(2) informational note 1 referenced current editions of two of the standards.

Related Public Comments for This Document

<table>
<thead>
<tr>
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<th>Relationship</th>
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<tbody>
<tr>
<td>Public Comment No. 39-NFPA 70-2015 [Section No. 110.31]</td>
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<td>Public Comment No. 40-NFPA 70-2015 [Section No. 225.61]</td>
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<td>Public Comment No. 43-NFPA 70-2015 [Section No. B.310.15(B)(2)]</td>
<td>Referenced current SDO name, standard name, number, and edition.</td>
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Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]

Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]

Public Comment No. 50-NFPA 70-2015 [Section No. 800.80(A)]

Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]

Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]

Public Comment No. 53-NFPA 70-2015 [Section No. 840.44(B)]

Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]

Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]

Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]

Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]

Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]

Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]

Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]

Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]

Public Comment No. 92-NFPA 70-2015 [Section No. 210.12(A)]

Public Comment No. 93-NFPA 70-2015 [Section No. 505.2]

Public Comment No. 95-NFPA 70-2015 [Section No. 620.1]

Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack.]

Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]

**Related Item**

First Revision No. 3936-NFPA 70-2015 [Section No. 505.5(A)]

First Revision No. 3935-NFPA 70-2015 [Section No. 500.6(A)(4)]

First Revision No. 3934-NFPA 70-2015 [Section No. 500.5(A)]

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**Submitter Information Verification**

**Submitter Full Name:** Aaron Adamczyk  
**Organization:** [ Not Specified ]  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Sat Jul 04 10:57:21 EDT 2015

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**Committee Statement**
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<tr>
<td>Resolution:</td>
<td>SR-3918-NFPA 70-2015</td>
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<tr>
<td>Statement:</td>
<td>The standard reviewed for the first revision was ASHRAE 15. While the standards organization in question offers a packaged set of ASHRAE 15 and 34, combined, that is not justification to include a reference to ASHRAE 34. Updated reference to the US adoption of IEC 60079-10-1. Also removed the reference to IP 15, see action on PC 160.</td>
</tr>
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</table>
Public Comment No. 1624-NFPA 70-2015 [Section No. 505.5(A)]

(A) Classification of Locations

Locations shall be classified depending on the properties of the flammable gases, flammable liquid–produced vapors, combustible liquid–produced vapors, combustible dusts, or fibers/flyings that may be present and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section, or area shall be considered individually in determining its classification. Where pyrophoric materials are the only materials used or handled, these locations are outside the scope of this article.

Informational Note No. 1: See 505.7 for restrictions on area classification.

Informational Note No. 2: Through the exercise of ingenuity in the layout of electrical installations for hazardous (classified) locations, it is frequently possible to locate much of the equipment in reduced level of classification or in an unclassified location and, thus, to reduce the amount of special equipment required.

Refrigerant machinery rooms containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm may be classified as “unclassified” locations.

Rooms and refrigerated areas containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm may be classified as “unclassified” locations.


Statement of Problem and Substantiation for Public Comment

There is no logical reason for NFPA 70 to uniquely include specific provisions to regulate ammonia refrigeration in Section 505.5, given that there is no other material or application similarly regulated by this section. Any other material or application is governed by the general requirement. With the proposed change, classification of an area containing ammonia refrigeration equipment will be done in the same manner as any other material or application. The risk and mitigation measures must be evaluated using the NEC, NFPA 497 and other applicable codes/standards; and the area classification must established based on that evaluation, as stated in the first paragraph of 505.5. In the case of ammonia refrigeration, ANSI/ASHRAE 15 and ANSI/IIAR 2 provide detailed requirements covering the use of leak detection and ventilation systems that are too complex to duplicate into the NEC.

By approving this change, the NEC will eliminate overlap and conflict with these other ANSI standards, and by retaining the Informational Note pointing to these standards, users will be made aware of the special requirements and not be left with the impression that requirements for ammonia were simply dropped.

Related Item
First Revision No. 3936-NFPA 70-2015 [Section No. 505.5(A)]

Submitter Information Verification

Submitter Full Name: Jeffrey Shapiro
Organization: International Code Consultants
Affiliations: International Institute of Ammonia Refrigeration
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:31:16 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3915-NFPA 70-2015
Statement: This change will correlate the NEC® with applicable ANSI standards that govern ammonia refrigeration systems, ANSI/IIAR 2 and ANSI/ASHRAE 15. Ammonia refrigeration machinery rooms are always required by these standards to have leak detection and ventilation systems and are designated as unclassified locations based on these mitigations. The
NEC® is therefore being updated to reflect IIAR 2’s more restrictive 150 ppm ventilation trigger. Other areas where ammonia refrigeration equipment may be present, such as freezers, may have detection, alarms, ventilation or other mitigation measures approved by the AHJ, in accordance with ANSI/ASHRAE 15 and ANSI/IIAR 2 as a basis of assigning an unclassified area designation. The provisions in these standards are too lengthy to warrant duplication in the NEC® for such a special situation. Informational Note 2 provides an appropriate pointer directing NEC® users to ANSI/ASHRAE 15 and ANSI/IIAR 2 for guidance, and these are legally mandated reference standards in adopted fire and mechanical codes.
**Class I, Zone 0.**

A Class I, Zone 0 location is a location in which

1. Ignitible concentrations of flammable gases or vapors are present continuously, or
2. Ignitible concentrations of flammable gases or vapors are present for long periods of time.

**Informational Note No. 1:** As a guide in determining when flammable gases or vapors are present continuously or for long periods of time, refer to ANSI/API RP 505-1997, Recommended Practice for Classification of Locations for Electrical Installations of Petroleum Facilities Classified as Class I, Zone 0, Zone 1 or Zone 2; ANSI/ISA-TR12.24.01-1998 (IEC 60079-10 Mod), Recommended Practice for Classification of Locations for Electrical Installations Classified as Class I, Zone 0, Zone 1, or Zone 2; IEC 60079-10-1995, Electrical apparatus for explosive gas atmospheres, classifications of hazardous areas; and Area Classification Code for Petroleum Installations, Model Code, Part 15, Institute of Petroleum.

**Informational Note No. 2:** This classification includes locations inside vented tanks or vessels that contain volatile flammable liquids; inside inadequately vented spraying or coating enclosures, where volatile flammable solvents are used; between the inner and outer roof sections of a floating roof tank containing volatile flammable liquids; inside open vessels, tanks and pits containing volatile flammable liquids; the interior of an exhaust duct that is used to vent ignitible concentrations of gases or vapors; and inside inadequately ventilated enclosures that contain normally venting instruments utilizing or analyzing flammable fluids and venting to the inside of the enclosures.

**Statement of Problem and Substantiation for Public Comment**

RP 505 reference date update. The next edition of ANSI/API RP 505 has been completed, balloted, and is anticipated to be published before the end of 2015.

**Related Public Comments for This Document**

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<tr>
<td>Public Comment No. 1572-NFPA 70-2015 [Section No. 505.8(I) [Excluding any Sub-Sections]]</td>
<td>Related Item</td>
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<tr>
<td>Public Input No. 4769-NFPA 70-2014 [Section No. 505.5(B)(1)]</td>
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**Submitter Information Verification**

**Submitter Full Name:** Mark Goodman  
**Organization:** Mark Goodman Electrical Consulting  
**Affiliation:** AMERICAN PETROLEUM INSTITUTE  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Fri Sep 25 15:10:55 EDT 2015

**Committee Statement**

**Committee Action:** Rejected  
**Resolution:** The next revision of document, ANSI/API RP 505 has not yet been published and thus the document is not available for review or update of the publication date.
For purposes of testing, approval, and area classification, various air mixtures (not oxygen enriched) shall be grouped as required in 505.6(A), (B), and (C).

Informational Note No. 1: Group I is intended for use in describing atmospheres that contain firedamp (a mixture of gases, composed mostly of methane, found underground, usually in mines). This Code does not apply to installations underground in mines. See 90.2(B).

Informational Note No. 2: The gas and vapor subdivision as described above is based on the maximum experimental safe gap (MESG), minimum igniting current (MIC), or both. Test equipment for determining the MESG is described in IEC 60079-1A-1975, Amendment No. 1 (1993), Construction and verification tests of flameproof enclosures of electrical apparatus and, UL Technical Report No. 58 (1993). The test equipment for determining MIC is described in IEC 60079-11-1999, Electrical apparatus for explosive gas atmospheres. Equipment Safety by Intrinsic safety. The classification of gases or vapors according to their maximum experimental safe gaps and minimum igniting currents is described in IEC 60079-12-1978, Explosive Atmospheres—Part 11: Classification of mixtures of gases or vapours with air according to their maximum experimental safe gaps and minimum igniting currents 2012, Explosive Atmospheres—Part 20-1: Characteristics for Gas and Vapour Classification—Tests, Methods, and Data.

Informational Note No. 3: Group II is currently subdivided into Group IIA, Group IIB, and Group IIC. Prior marking requirements permitted some types of protection to be marked without a subdivision, showing only Group II.

Informational Note No. 4: It is necessary that the meanings of the different equipment markings and Group II classifications be carefully observed to avoid confusion with Class I, Divisions 1 and 2, Groups A, B, C, and D.

Class I, Zone 0, 1, and 2, groups shall be as follows:

Statement of Problem and Substantiation for Public Comment

In informational note 2 removed an withdrawn IEC standard and UL technical report.
In informational note 2 referenced updated edition of IEC 60079-11.
In informational note 2 referenced IEC 60079-20-1 which supersedes IEC 60079-12.

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Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]
Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]
Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]
Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]
Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]
Public Comment No. 93-NFPA 70-2015 [Section No. 210.12(A)]
Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]
Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]
Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]
Public Comment No. 111-NFPA 70-2015 [Section No. 505.2]
Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]
Public Comment No. 95-NFPA 70-2015 [Section No. 620.1]
Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack.]

Related Item
First Revision No. 3977-NFPA 70-2015 [Section No. 505.9(C)(2)]

Submitter Information Verification
Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
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City:
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Submittal Date: Sat Jul 04 17:09:00 EDT 2015

Committee Statement
Committee Action: Rejected but held
Resolution: No public inputs were made and no first revisions were introduced to Section 505.6 so the proposed comments at this second revision stage have not been subject to public review. As such, the proposed changes are new material at this stage of the revision process and are recommended to be held for the next revision.
505.8 Protection Techniques.

Acceptable protection techniques for electrical and electronic equipment in hazardous (classified) locations shall be as described in 505.8(A) through (I).

Informational Note: For additional information, see ANSI/ISA-60079-0, (12.00.01)-2009, Explosive Atmospheres — Part 0: Equipment — General Requirements; ANSI/ISA 12.01.01-2013, Definitions and Information Pertaining to Electrical Apparatus. Electrical Equipment, in Hazardous (Classified) Locations; and ANSI/UL 60079–0, Electrical Apparatus for Explosive Gas Atmospheres — Part 0: General Requirements.

(A) Flameproof “d”.
This protection technique shall be permitted for equipment in Class I, Zone 1 or Zone 2 locations.

(B) Pressurization “p”.
This protection technique shall be permitted for equipment in those Class I, Zone 1 or Zone 2 locations for which it is identified.

(C) Intrinsic Safety “i”.
This protection technique shall be permitted for apparatus and associated apparatus in Class I, Zone 0, Zone 1, or Zone 2 locations for which it is listed.

(D) Type of Protection “n”.
This protection technique shall be permitted for equipment in Class I, Zone 2 locations. Type of protection “n” is further subdivided into nA, nC, and nR.

Informational Note: See Table 505.9(C)(2)(4) for the descriptions of subdivisions for type of protection “n”.

(E) Oil Immersion “o”.
This protection technique shall be permitted for equipment in Class I, Zone 1 or Zone 2 locations.

(F) Increased Safety “e”.
This protection technique shall be permitted for equipment in Class I, Zone 1 or Zone 2 locations.

(G) Encapsulation “m”.
This protection technique shall be permitted for equipment in Class I, Zone 0, Zone 1, or Zone 2 locations for which it is identified.

Informational Note: See Table 505.9(C)(2)(4) for the descriptions of subdivisions for encapsulation.

(H) Powder Filling “q”.
This protection technique shall be permitted for equipment in Class I, Zone 1 or Zone 2 locations.

(I) Combustible Gas Detection System.
A combustible gas detection system shall be permitted as a means of protection in industrial establishments with restricted public access and where the conditions of maintenance and supervision ensure that only qualified persons service the installation. Where such a system is installed, equipment specified in 505.8(I)(1), (I)(2), or (I)(3) shall be permitted. The type of detection equipment, its listing, installation location(s), alarm and shutdown criteria, and calibration frequency shall be documented when combustible gas detectors are used as a protection technique.

Informational Note No. 1: For further information, see ANSI/API RP 505-1997, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2.

Informational Note No. 2: For further information, see ANSI/ISA-60079-29-2013, Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen.

Informational Note No. 3: For further information, see ANSI/ISA-TR12.13.03-2009, Guide for Combustible Gas Detection as a Method of Protection.

(1) Inadequate Ventilation.
In a Class I, Zone 1 location that is so classified due to inadequate ventilation, electrical equipment suitable for Class I, Zone 2 locations shall be permitted. Combustible gas detection equipment shall be listed for Class I, Zone 1, for the appropriate material group, and for the detection of the specific gas or vapor to be encountered.

(2) Interior of a Building.
In a building located in, or with an opening into, a Class I, Zone 2 location where the interior does not contain a source of flammable gas or vapor, electrical equipment for unclassified locations shall be permitted. Combustible gas detection equipment shall be listed for Class I, Zone 1 or Class I, Zone 2, for the appropriate material group, and for the detection of the specific gas or vapor to be encountered.
Interior of a Control Panel.

In the interior of a control panel containing instrumentation utilizing or measuring flammable liquids, gases, or vapors, electrical equipment suitable for Class I, Zone 2 locations shall be permitted. Combustible gas detection equipment shall be listed for Class I, Zone 1, for the appropriate material group, and for the detection of the specific gas or vapor to be encountered.

Statement of Problem and Substantiation for Public Comment

Referenced current titles and editions.

Related Item
First Revision No. 3980-NFPA 70-2015 [Section No. 505.8(B)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address: [ Not Specified ]
City: [ Not Specified ]
State: [ Not Specified ]
Zip: [ Not Specified ]
Submittal Date: Sat Jul 04 19:20:04 EDT 2015

Committee Statement

Committee Action: Rejected but held
Resolution: No public inputs were made and no first revisions were introduced to Section 505.8 related to changing the references in the informational notes so the proposed comments at this second revision stage have not been subject to public review. As such, the proposed changes are new material at this stage of the revision process and are recommended to be held for the next revision.
A combustible gas detection system shall be permitted as a means of protection in industrial establishments with restricted public access and where the conditions of maintenance and supervision ensure that only qualified persons service the installation. Where such a system is installed, equipment specified in 505.8(I)(1), (I)(2), or (I)(3) shall be permitted. The type of detection equipment, its listing, installation location(s), alarm and shutdown criteria, and calibration frequency shall be documented when combustible gas detectors are used as a protection technique.

Informational Note No. 1: For further information, see ANSI/API RP 505-1997 2015, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2.

Informational Note No. 2: For further information, see ANSI/ISA-60079-29-2, Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen.

Informational Note No. 3: For further information, see ANSI/ISA-TR12.13.03-2009, Guide for Combustible Gas Detection as a Method of Protection.

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<td>Consistency of reference date</td>
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<td>Public Comment No. 1599-NFPA 70-2015 [Section No. 505.4(B)]</td>
<td>Consistency of reference date</td>
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<td>Public Comment No. 1604-NFPA 70-2015 [Section No. 505.5(B)(1)]</td>
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<td>Consistency of reference date</td>
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<td>Public Input No. 4767-NFPA 70-2014 [Section No. 505.4(B)]</td>
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<td>Public Input No. 4769-NFPA 70-2014 [Section No. 505.5(B)(1)]</td>
<td>Consistency of reference date</td>
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Submitter Information Verification:

Submitter Full Name: Mark Goodman
Organization: Mark Goodman Electrical Consulting
Affiliation: AMERICAN PETROLEUM INSTITUTE
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:34:43 EDT 2015

Committee Statement:

Committee Action: Rejected
Resolution: The next revision of document, ANSI/API RP 505 has not yet been published and thus the document is not available for review or update of the publication date.
505.9 Equipment.

(A) Suitability.

Suitability of identified equipment shall be determined by one of the following:

(1) Equipment listing or labeling

(2) Evidence of equipment evaluation from a qualified testing laboratory or inspection agency concerned with product evaluation

(3) Evidence acceptable to the authority having jurisdiction such as a manufacturer's self-evaluation or an owner's engineering judgment

Informational Note: Additional documentation for equipment may include certificates demonstrating compliance with applicable equipment standards, indicating special conditions of use, and other pertinent information.

(B) Listing.

(1) Equipment that is listed for a Zone 0 location shall be permitted in a Zone 1 or Zone 2 location of the same gas or vapor, provided that it is installed in accordance with the requirements for the marked type of protection. Equipment that is listed for a Zone 1 location shall be permitted in a Zone 2 location of the same gas or vapor, provided that it is installed in accordance with the requirements for the marked type of protection.

(2) Equipment shall be permitted to be listed for a specific gas or vapor, specific mixtures of gases or vapors, or any specific combination of gases or vapors.

Informational Note: One common example is equipment marked for "IIB + H2."

(C) Marking.

Equipment shall be marked in accordance with 505.9(C)(1) or (C)(2).

(1) Division Equipment.

Equipment identified for Class I, Division 1 or Class I, Division 2 shall, in addition to being marked in accordance with 500.8(C), be permitted to be marked with all of the following:

(1) Class I, Zone 1 or Class I, Zone 2 (as applicable)

(2) Applicable gas classification group(s) in accordance with Table 505.9(C)(1)(2)

(3) Temperature classification in accordance with 505.9(D)(1)

Table 505.9(C)(1)(2) Material Groups

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<tr>
<td>IIC</td>
<td>See 505.6(A)</td>
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<tr>
<td>IIB</td>
<td>See 505.6(B)</td>
</tr>
<tr>
<td>IIA</td>
<td>See 505.6(C)</td>
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</table>
(2) Zone Equipment.
Equipment meeting one or more of the protection techniques described in 505.8 shall be marked with all of the following in the order shown:

1. Class
2. Zone
3. Symbol “AEx”
4. Protection technique(s) in accordance with Table 505.9(C)(2)(4)
5. Applicable material group in accordance with Table 505.9(C)(1)(2) or a specific gas or vapor
6. Temperature classification in accordance with 505.9(D)(1)

Exception No. 1: Associated apparatus NOT suitable for installation in a hazardous (classified) location shall be required to be marked only with (3), (4), and (5), but BOTH the symbol AEx (3) and the symbol for the type of protection (4) shall be enclosed within the same square brackets, for example, [AEx ia] IIC.

Exception No. 2: Simple apparatus as defined in 504.2 shall not be required to have a marked operating temperature or temperature class.

Exception No. 3: Fittings for the termination of cables shall not be required to have a marked operating temperature or temperature class.

Informational Note No. 1: An example of the required marking for intrinsically safe apparatus for installation in Class I, Zone 0 is “Class I, Zone 0, AEx ia IIC T6.” An explanation of the marking that is required is shown in Informational Note Figure 505.9(C)(2), No.1.

Informational Note No. 2: An example of the required marking for intrinsically safe associated apparatus mounted in a flameproof enclosure for installation in Class I, Zone 1 is “Class I, Zone 1 AEx d[ia] IIC T4.”

Informational Note No. 3: An example of the required marking for intrinsically safe associated apparatus NOT for installation in a hazardous (classified) location is “[AEx ia] IIC.”

Informational Note No. 4: The EPL (or equipment protection level) may appear in the product marking. EPLs are designated as G for gas, D for dust, or M for mining and are then followed by a letter (a, b, or c) to give the user a better understanding as to whether the equipment provides either (a) a “very high,” (b) a “high,” or (c) an “enhanced” level of protection against ignition of an explosive atmosphere. For example, a Class I, Zone 1, AEx d IIC T4 motor (which is suitable by protection concept for application in Zone 1) may additionally be marked with an EPL of “Gb” to indicate that it was provided with a high level of protection, such as Class I, Zone 1 AEx d IIC T4 Gb.

Informational Note No. 5: Equipment installed outside a Zone 0 location, electrically connected to equipment located inside a Zone 0 location, may be marked Class I, Zone 0(1). The “/” indicates that equipment contains a separation element and can be installed at the boundary between a Zone 0 and a Zone 1 location. See ANSI/ISA-60079-26, Electrical Apparatus -2011, Explosive Atmospheres - Part 26: Equipment for Use in Class I, Zone 0 Hazardous (Classified) Locations.

Informational Note Figure 505.9(C)(2), No.1, Zone Equipment Marking.

Table 505.9(C)(2)(4) Types of Protection Designation

<table>
<thead>
<tr>
<th>Designation</th>
<th>Technique</th>
<th>Zone*</th>
</tr>
</thead>
<tbody>
<tr>
<td>d</td>
<td>Flameproof enclosure</td>
<td>1</td>
</tr>
<tr>
<td>db</td>
<td>Flameproof enclosure</td>
<td>1</td>
</tr>
<tr>
<td>e</td>
<td>Increased safety</td>
<td>1</td>
</tr>
<tr>
<td>eb</td>
<td>Increased safety</td>
<td>1</td>
</tr>
<tr>
<td>ia</td>
<td>Intrinsic safety</td>
<td>0</td>
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<tr>
<td>ib</td>
<td>Intrinsic safety</td>
<td>1</td>
</tr>
<tr>
<td>ic</td>
<td>Intrinsic safety</td>
<td>2</td>
</tr>
<tr>
<td>[ia]</td>
<td>Associated apparatus</td>
<td>Unclassified**</td>
</tr>
<tr>
<td>[ib]</td>
<td>Associated apparatus</td>
<td>Unclassified**</td>
</tr>
<tr>
<td>[ic]</td>
<td>Associated apparatus</td>
<td>Unclassified**</td>
</tr>
<tr>
<td>ma</td>
<td>Encapsulation</td>
<td>0</td>
</tr>
<tr>
<td>Designation</td>
<td>Technique</td>
<td>Zone*</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------</td>
<td>-------</td>
</tr>
<tr>
<td>m</td>
<td>Encapsulation</td>
<td>1</td>
</tr>
<tr>
<td>mb</td>
<td>Encapsulation</td>
<td>1</td>
</tr>
<tr>
<td>mc</td>
<td>Encapsulation</td>
<td>1</td>
</tr>
<tr>
<td>nA</td>
<td>Nonsparking equipment</td>
<td>2</td>
</tr>
<tr>
<td>nAc</td>
<td>Nonsparking equipment</td>
<td>2</td>
</tr>
<tr>
<td>nC</td>
<td>Sparking equipment in which the contacts are suitably protected other than by restricted breathing enclosure</td>
<td>2</td>
</tr>
<tr>
<td>nCc</td>
<td>Sparking equipment in which the contacts are suitably protected other than by restricted breathing enclosure</td>
<td>2</td>
</tr>
<tr>
<td>nR</td>
<td>Restricted breathing enclosure</td>
<td>2</td>
</tr>
<tr>
<td>nRc</td>
<td>Restricted breathing enclosure</td>
<td>2</td>
</tr>
<tr>
<td>o</td>
<td>Oil immersion</td>
<td>1</td>
</tr>
<tr>
<td>ob</td>
<td>Oil immersion</td>
<td>1</td>
</tr>
<tr>
<td>px</td>
<td>Pressurization</td>
<td>1</td>
</tr>
<tr>
<td>pxb</td>
<td>Pressurization</td>
<td>1</td>
</tr>
<tr>
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</tr>
<tr>
<td>qb</td>
<td>Powder filled</td>
<td>1</td>
</tr>
</tbody>
</table>

*Does not address use where a combination of techniques is used.

**Associated apparatus is permitted to be installed in a hazardous (classified) location if suitably protected using another type of protection.

(D) Class I Temperature.

The temperature marking specified in 505.9(D)(1) shall not exceed the autoignition temperature of the specific gas or vapor to be encountered.

Informational Note: For information regarding autoignition temperatures of gases and vapors, see NFPA 497-2012, Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas; and IEC 60079-20-1996, Electrical Apparatus for Explosive Gas Atmospheres, Data for Flammable Gases and Vapours, Relating to the Use of Electrical Apparatus 1-2012, Explosive Atmospheres - Part 20-1: Material Characteristics for Gas and Vapour Classification - Test Methods and Data (Supersedes IEC 60079-20).
(1) Temperature Classifications.

Equipment shall be marked to show the operating temperature or temperature class referenced to a 40°C ambient, or at the higher ambient temperature if the equipment is rated and marked for an ambient temperature of greater than 40°C. The temperature class, if provided, shall be indicated using the temperature class (T code) shown in Table 505.9(D)(1).

Table 505.9(D)(1) Classification of Maximum Surface Temperature for Group II Electrical Equipment

<table>
<thead>
<tr>
<th>Temperature Class (T Code)</th>
<th>Maximum Surface Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>≤450</td>
</tr>
<tr>
<td>T2</td>
<td>≤300</td>
</tr>
<tr>
<td>T3</td>
<td>≤200</td>
</tr>
<tr>
<td>T4</td>
<td>≤135</td>
</tr>
<tr>
<td>T5</td>
<td>≤100</td>
</tr>
<tr>
<td>T6</td>
<td>≤85</td>
</tr>
</tbody>
</table>

Electrical equipment designed for use in the ambient temperature range between -20°C and ± 40°C shall require no ambient temperature marking.

Electrical equipment that is designed for use in a range of ambient temperatures other than -20°C to ± 40°C is considered to be special; and the ambient temperature range shall then be marked on the equipment, including either the symbol “Ta” or “Tamb” together with the special range of ambient temperatures, in degrees Celsius.

Informational Note: As an example, such a marking might be “-30°C to ± 40°C.”

Exception No. 1: Equipment of the non–heat-producing type, such as conduit fittings, and equipment of the heat-producing type having a maximum temperature of not more than 100°C (212°F) shall not be required to have a marked operating temperature or temperature class.

Exception No. 2: Equipment identified for Class I, Division 1 or Division 2 locations as permitted by 505.20(A), (B), and (C) shall be permitted to be marked in accordance with 505.8(C) and Table 500.8(C).

(E) Threading.

The supply connection entry thread form shall be NPT or metric. Conduit and fittings shall be made wrenchtight to prevent sparking when fault current flows through the conduit system, and to ensure the explosionproof or flameproof integrity of the conduit system where applicable. Equipment provided with threaded entries for field wiring connections shall be installed in accordance with 505.9(E)(1) or (E)(2) and with (E)(3).

(1) Equipment Provided with Threaded Entries for NPT Threaded Conduit or Fittings.

For equipment provided with threaded entries for NPT threaded conduit or fittings, listed conduit, listed conduit fittings, or listed cable fittings shall be used.

All NPT threaded conduit and fittings shall be threaded with a National (American) Standard Pipe Taper (NPT) thread.

NPT threaded entries into explosionproof or flameproof equipment shall be made up with at least five threads fully engaged.

Exception: For listed explosionproof or flameproof equipment, factory-threaded NPT entries shall be made up with at least 4 1/2 threads fully engaged.

Informational Note No. 1: Thread specifications for male NPT threads are located in ANSI/ASME B1.20.1-2013, Pipe Threads, General Purpose (Inch).


(2) Equipment Provided with Threaded Entries for Metric Threaded Conduit or Fittings.

For equipment provided with metric threaded entries, listed conduit fittings or listed cable fittings shall be used. Such entries shall be identified as being metric, or listed adapters to permit connection to conduit or NPT threaded fittings shall be provided with the equipment and shall be used for connection to conduit or NPT threaded fittings.

Metric threaded fittings installed into explosionproof or flameproof equipment entries shall have a class of fit of at least 6g/6H and be made up with at least five threads fully engaged for Groups C, D, IIB, or IIA and not less than eight threads fully engaged and wrenchtight.


(3) Unused Openings.

All unused openings shall be closed with close-up plugs listed for the location and shall maintain the type of protection. The plug engagement shall comply with 505.9(E)(1) or 505.9(E)(2).
Optical Fiber Cables.
An optical fiber cable, with or without current-carrying current (composite optical fiber cable), shall be installed to address the associated fire hazard and sealed to address the associated explosion hazard in accordance with the requirements of 505.15 and 505.16.

Statement of Problem and Substantiation for Public Comment

Referenced current standard numbers, titles, and editions.

Related Item
First Revision No. 3977-NFPA 70-2015 [Section No. 505.9(C)(2)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 08 18:33:51 EDT 2015

Committee Statement

Committee Action: Rejected but held
Resolution: No public inputs were made and no first revisions were introduced to Section 505.9 related to changing the references in the informational notes so the proposed comments at this second revision stage have not been subject to public review. As such, the proposed changes are new material at this stage of the revision process and are recommended to be held for the next revision.
505.15 Wiring Methods.

Wiring methods shall maintain the integrity of protection techniques and shall comply with 505.15(A) through (C).

(A) Class I, Zone 0.

In Class I, Zone 0 locations, equipment protected by intrinsic safety “ia” and equipment protected by encapsulation “ma” shall be connected using intrinsically safe “ia” circuits with wiring methods in accordance with Article 504.

(B) Class I, Zone 1.
(1) General.

In Class I, Zone 1 locations, the wiring methods in 505.15(B)(1) (a) through (B)(1)(i) shall be permitted.

(a) All wiring methods permitted by 505.15(A).

(b) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application. Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application. Type ITC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

Informational Note: See 727.4 and 727.5 for restrictions on use of Type ITC cable.

(d) Type MI cable terminated with fittings listed for Class I, Zone 1 or Division 1 locations. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(e) Threaded rigid metal conduit, or threaded steel intermediate metal conduit.

(f) Type PVC conduit and Type RTRC conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emerge or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding of non–current-carrying metal parts.

(g) Intrinsic safety type of protection “ib” shall be permitted using the wiring methods specified in Article 504.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2013, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(2) Flexible Connections.

Where necessary to employ flexible connections, flexible fittings listed for Class I, Zone 1 or Division 1 locations, or flexible cord in accordance with the provisions of 505.17(A) terminated with a listed cord connector that maintains the type of protection of the terminal compartment, shall be permitted.

(C) Class I, Zone 2.
In Class I, Zone 2 locations, the following wiring methods shall be permitted:

1. All wiring methods permitted by 505.15(B).
2. Types MC, MV, TC, or TC-ER cable, including installation in cable tray systems. The cable shall be terminated with listed fittings. Single conductor Type MV cables shall be shielded or metallic-armored.
3. Type ITC and Type ITC-ER cable as permitted in 727.4 and terminated with listed fittings.
4. Type PLTC and Type PLTC-ER cable in accordance with the provisions of Article 725, including installation in cable tray systems. The cable shall be terminated with listed fittings.
5. Enclosed gasketed busways, enclosed gasketed wireways.
6. In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where metallic conduit does not provide sufficient corrosion resistance, listed reinforced thermosetting resin conduit (RTRC), factory elbows, and associated fittings, all marked with the suffix -XW, and Schedule 80 PVC conduit, factory elbows, and associated fittings shall be permitted. Where seals are required for boundary conditions as defined in 505.16(C)(1)(b), the Zone 1 wiring method shall extend into the Zone 2 area to the seal, which shall be located on the Zone 2 side of the Zone 1/Zone 2 boundary.
7. Intrinsic safety type of protection “ic” shall be permitted using any of the wiring methods permitted for unclassified locations. Intrinsic safety type of protection “ic” systems shall be installed in accordance with the control drawing(s). Simple apparatus, not shown on the control drawing, shall be permitted in an intrinsic safety type of protection “ic” circuit, provided that the simple apparatus does not interconnect the intrinsic safety type of protection “ic” systems to any other circuit.

Informational Note: Simple apparatus is defined in 504.2.
8. Optical fiber cable of Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in cable trays or any other raceway in accordance with 505.15(C). Optical fiber cable shall be sealed in accordance with 505.16.
9. Cablebus. Separate intrinsic safety type of protection “ic” systems shall be installed in accordance with one of the following:
   1. In separate cables
   2. In multiconductor cables where the conductors of each circuit are within a grounded metal shield
   3. In multiconductor cables where the conductors of each circuit have insulation with a minimum thickness of 0.25 mm (0.01 in.)

2. Flexible Connections.
Where provision must be made for flexibility, flexible metal fittings, flexible metal conduit with listed fittings, liquidtight flexible metal conduit with listed fittings, liquidtight flexible nonmetallic conduit with listed fittings, or flexible cord in accordance with the provisions of 505.17 terminated with a listed cord connector that maintains the type of protection of the terminal compartment shall be permitted.

Informational Note: See 505.25(B) for grounding requirements where flexible conduit is used.

Exception: For elevator use, an identified elevator cable of Type EO, ETP, or ETT, shown under the “use” column in Table 400.4 for “hazardous (classified) locations,” that is terminated with listed connectors that maintain the type of protection of the terminal compartment, shall be permitted.
<table>
<thead>
<tr>
<th>Committee Action</th>
<th>Rejected but see related SR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>SR-3906-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement</td>
<td>The Panel noted that this change represents the current issue of ANSI/UL 2225.</td>
</tr>
</tbody>
</table>
Public Comment No. 1065-NFPA 70-2015 [Section No. 505.15(B)(1)]

(1) General.
In Class I, Zone 1 locations, the wiring methods in 505.15(B)(1) (a) through (B)(1)(i) shall be permitted.

(a) All wiring methods permitted by 505.15(A).

(b) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application. Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application. Type ITC-HL cable shall be installed in accordance with the provisions of Article 727.

Informational Note: See 727.4 and 727.5 for restrictions on use of Type ITC cable.

(d) Type MI cable terminated with fittings listed for Class I, Zone 1 or Division 1 locations. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(e) Threaded rigid metal conduit, or threaded steel intermediate metal conduit.

(f) Type PVC conduit and Type RTRC conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide electrical continuity of the raceway system and for grounding of non-current-carrying metal parts.

(g) Intrinsic safety type of protection "ib" shall be permitted using the wiring methods specified in Article 504.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2011, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(h) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 505.15(B). Optical fiber cable shall be sealed in accordance with 505.16.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2011, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(i) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts nominal or less, and where the cable is not subject to physical damage, Type TC-ER-HL cable listed for use in Class I, Zone 1 locations, with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the location, Type TC-ER-HL cable shall be installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7). For circuits over 150 volts to ground nominal or 30 amps, the TC-ER-HL cables shall have a metallic shield covering the current carrying conductor to provide a reliable ground fault path that will ensure the operation of a ground fault protection device.

Statement of Problem and Substantiation for Public Comment

TC-ER-HL Cable was added as a new product in 2014 NEC. There has been little experience with the use of TC-ER-HL Cables in Class I, Division 1 and Zone 1 locations even for under 1 inch diameter. If the cable size is going to become unrestricted then we should include metal shield to provide ground fault protection for the over 150 volts and over 30 amp circuits.

Related Item
Committee Statement

Committee Action: Rejected

Resolution: There is no substantiation presented as to why the wiring method is "unsafe". If the TC-ER-HL has been installed in accordance with Article 336, it will be predominantly in a cable tray. Any extended run out of the tray is required to be protected by the location. If the cable is being damaged by the location, Section 110.11 may not have been correctly applied. There is no requirement that this wiring method be used in all installations. It provides another option. The restriction to industrial facilities, limitation on public access, and conditions of maintenance ensure that this will not be used in areas like filling stations that have public access. The shielded construction described is already permitted by UL 1277 and UL 2225, and in fact is often used for the twisted pair constructions. Shielding is for EMC and not for equipment grounding.
(1) General.

In Class I, Zone 1 locations, the wiring methods in 505.15(B)(1) (a) through (B)(1)(i) shall be permitted.

(a) All wiring methods permitted by 505.15(A).

(b) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application. Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vapor tight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application. Type ITC-HL cable shall be installed in accordance with the provisions of Article 727.

Informational Note: See 727.4 and 727.5 for restrictions on use of Type ITC cable.

(d) Type MI cable terminated with fittings listed for Class I, Zone 1 or Division 1 locations. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(e) Threaded rigid metal conduit, or threaded steel intermediate metal conduit.

(f) Type PVC conduit and Type RTRC conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding of non-current-carrying metal parts.

(g) Intrinsic safety type of protection “ib” shall be permitted using the wiring methods specified in Article 504.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2011, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(h) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 505.15(B). Optical fiber cable shall be sealed in accordance with 505.16.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2011, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(i) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts nominal or less, and where the cable is not subject to physical damage, Type TC-ER-HL cable listed for use in Class I, Zone 1 locations, with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the location. Type TC-ER-HL cable shall be installed in accordance with the provisions of Article 336, including the restrictions of 336.10(2).

Statement of Problem and Substantiation for Public Comment

Expanding the use of TC-ER-HL as a fixed wiring method in Class I Zone 1 locations is a severe reduction in wiring method protection. Certain flammable gases or combustible vapors that are likely to be present in these locations are likely to affect the physical properties of the jacket material and penetrate into the cable. A nonmetallic jacket such as those used on Type TC cables (including those designated as -ER and/or -HL) alone will not provide protection equal to metallic wiring methods against the hazards present in Class I...
Zone 1 locations. All other Class I Zone 1 fixed wiring methods (except optical fiber products) presently require metallic raceways, MI cable or a gas/vaportight metallic armor wiring method. These are proven wiring methods that maintain the appropriate level of protection and safety. Nonmetallic wiring methods in these locations are required to be encased in concrete, and similar protection should be required for TC-ER-HL if it is permitted. The 2014 NEC allowed the use of 1” TC-ER-HL, but it should be limited to flexible connections, not unlimited lengths of fixed wiring.

Related Item
First Revision No. 3945-NFPA 70-2015 [Section No. 505.15(B)(1)]

Submitter Information Verification
Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 21:54:46 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: There is no substantiation presented as to why the wiring method is "unsafe". If the TC-ER-HL has been installed in accordance with Article 336, it will be predominantly in a cable tray. Any extended run out of the tray is required to be protected by the location. If the cable is being damaged by the location, Section 110.11 may not have been correctly applied. There is no requirement that this wiring method be used in all installations. It provides another option. The restriction to industrial facilities, limitation on public access, and conditions of maintenance ensure that this will not be used in areas like filling stations that have public access. The shielded construction described is already permitted by UL 1277 and UL 2225, and in fact is often used for the twisted pair constructions. Shielding is for EMC and not for equipment grounding.
Public Comment No. 1380-NFPA 70-2015 [Section No. 505.15(B)(1)]

(1) General.

In Class I, Zone 1 locations, the wiring methods in 505.15(B)(1) (a) through (B)(1)(i) shall be permitted.

(a) All wiring methods permitted by 505.15(A).

(b) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application. Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vaportight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application. Type ITC-HL cable shall be installed in accordance with the provisions of Article 727.

Informational Note: See 727.4 and 727.5 for restrictions on use of Type ITC cable.

(d) Type MI cable terminated with fittings listed for Class I, Zone 1 or Division 1 locations. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(e) Threaded rigid metal conduit, or threaded steel intermediate metal conduit.

(f) Type PVC conduit and Type RTRC conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding of non-current-carrying metal parts.

(g) Intrinsic safety type of protection "ib" shall be permitted using the wiring methods specified in Article 504.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2011, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(h) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 505.15(B). Optical fiber cable shall be sealed in accordance with 505.16.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2011, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(i) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts nominal or less, and where the cable is not subject to physical damage, Type TC-ER-HL cable listed for use in Class I, Zone 1 locations, with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the location, Type TC-ER-HL cable shall be installed in accordance with the provisions of Article 336.10, including the restrictions of 336.10(7).

Statement of Problem and Substantiation for Public Comment

As currently written, there are no restrictions in the use of non-armored cable in Zone 1 locations which could compromise the level of safety at the location. The use of this cable in Zone 1 locations is suitable provided there are appropriate restrictions requiring a grounding shield above the voltage or current levels identified in the proposed text to ensure the operation of the circuit's ground fault protection device.
Related Item
First Revision No. 3945-NFPA 70-2015 [Section No. 505.15(B)(1)]

Submitter Information Verification

Submitter Full Name: Mark Goodman
Organization: Mark Goodman Electrical Consulting
Affiliation: American Petroleum Institute
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 04:16:51 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There is no substantiation presented as to why the wiring method is "unsafe". If the TC-ER-HL has been installed in accordance with Article 336, it will be predominantly in a cable tray. Any extended run out of the tray is required to be protected by the location. If the cable is being damaged by the location, Section 110.11 may not have been correctly applied. There is no requirement that this wiring method be used in all installations. It provides another option. The restriction to industrial facilities, limitation on public access, and conditions of maintenance ensure that this will not be used in areas like filling stations that have public access. The shielded construction described is already permitted by UL 1277 and UL 2225, and in fact is often used for the twisted pair constructions. Shielding is for EMC and not for equipment grounding.
Public Comment No. 846-NFPA 70-2015 [ Section No. 505.15(B)(1) ]

(1) General.
In Class I, Zone 1 locations, the wiring methods in 505.15(B)(1) (a) through (B)(1)(i) shall be permitted.

(a) All wiring methods permitted by 505.15(A).

(b) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application. Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vapor tight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application. Type ITC-HL cable shall be installed in accordance with the provisions of Article 727.

Informational Note: See 727.4 and 727.5 for restrictions on use of Type ITC cable.

(d) Type MI cable terminated with fittings listed for Class I, Zone 1 or Division 1 locations. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(e) Threaded rigid metal conduit, or threaded steel intermediate metal conduit.

(f) Type PVC conduit and Type RTRC conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding of non–current-carrying metal parts.

(g) Intrinsic safety type of protection “ib” shall be permitted using the wiring methods specified in Article 504.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2011, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(h) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 505.15(B). Optical fiber cable shall be sealed in accordance with 505.16.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2011, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(i) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts nominal or less, for cable diameters 25mm (1 in) or less, and where the cable is not subject to physical damage, Type TC-ER-HL cable listed for use in Class I, Zone 1 locations, with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the location, Type TC-ER-HL cable shall be installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7).

Statement of Problem and Substantiation for Public Comment

No changes to the informational notes.

Type TC-ER-HL is limited to 1” by the product standard and should continue to be limited in size and use to maintain the safety of wiring methods allowed in Class I, Zone 1 locations.
Related Item
First Revision No. 3945-NFPA 70-2015 [Section No. 505.15(B)(1)]
Public Input No. 614-NFPA 70-2014 [Section No. 505.15(B)(1)]
Public Input No. 1908-NFPA 70-2014 [Section No. 505.15(B)(1)]
Public Input No. 4585-NFPA 70-2014 [Section No. 505.15(B)]

Submitter Information Verification
Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 12:47:18 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: There is no substantiation presented as to why the wiring method is “unsafe”. If the TC-ER-HL has been installed in accordance with Article 336, it will be predominantly in a cable tray. Any extended run out of the tray is required to be protected by the location. If the cable is being damaged by the location, Section 110.11 may not have been correctly applied. There is no requirement that this wiring method be used in all installations. It provides another option. The restriction to industrial facilities, limitation on public access, and conditions of maintenance ensure that this will not be used in areas like filling stations that have public access. The shielded construction described is already permitted by UL 1277 and UL 2225, and in fact is often used for the twisted pair constructions. Shielding is for EMC and not for equipment grounding.
Public Comment No. 904-NFPA 70-2015 [Section No. 505.15(B)(1)]

(1) General.
In Class I, Zone 1 locations, the wiring methods in 505.15(B)(1) (a) through (B)(1)(i) shall be permitted.

(a) All wiring methods permitted by 505.15(A).

(b) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type MC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the application. Type MC-HL cable shall be installed in accordance with the provisions of Article 330, Part II.

(c) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage, Type ITC-HL cable listed for use in Class I, Zone 1 or Division 1 locations, with a gas/vapor tight continuous corrugated metallic sheath and an overall jacket of suitable polymeric material, and terminated with fittings listed for the application. Type ITC-HL cable shall be installed in accordance with the provisions of Article 727.

Informational Note: See 727.4 and 727.5 for restrictions on use of Type ITC cable.

(d) Type MI cable terminated with fittings listed for Class I, Zone 1 or Division 1 locations. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(e) Threaded rigid metal conduit, or threaded steel intermediate metal conduit.

(f) Type PVC conduit and Type RTRC conduit shall be permitted where encased in a concrete envelope a minimum of 50 mm (2 in.) thick and provided with not less than 600 mm (24 in.) of cover measured from the top of the conduit to grade. Threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last 600 mm (24 in.) of the underground run to emergence or to the point of connection to the aboveground raceway. An equipment grounding conductor shall be included to provide for electrical continuity of the raceway system and for grounding of non–current-carrying metal parts.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2011, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(g) Intrinsic safety type of protection "ib" shall be permitted using the wiring methods specified in Article 504.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2011, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(h) Optical fiber cable Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC shall be permitted to be installed in raceways in accordance with 505.15(B). Optical fiber cable shall be sealed in accordance with 505.16.

Informational Note: For entry into enclosures required to be flameproof, explosionproof, or of increased safety, see the information on construction, testing, and marking of cables; flameproof and increased safety cable fittings; and flameproof and increased safety cord connectors in ANSI/UL 2225-2011, Cables and Cable-Fittings for Use in Hazardous (Classified) Locations.

(i) In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, for applications limited to 600 volts nominal or less, for cable diameters 25 mm (1 in.) or less, and where the cable is not subject to physical damage, Type TC-ER-HL cable listed for use in Class I, Zone 1 locations, with an overall jacket and a separate equipment grounding conductor(s) in accordance with 250.122, and terminated with fittings listed for the location, Type TC-ER-HL cable shall be installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7).

Statement of Problem and Substantiation for Public Comment

All metallic conduit systems are protected against rust and corrosion. The submitter mentions in their substantiation that deficiencies exist with cables with diameters above and below 25mm. The fact that there are deficiencies in cables with diameters less than 25mm should not be acceptable substantiation to allow cables with diameters greater than 25mm.

Related Item
First Revision No. 3945-NFPA 70-2015 [Section No. 505.15(B)(1)]
Submitter Information Verification

Submitter Full Name: JOSEPH ANDERSON
Organization: STEEL TUBE INSTITUTE
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 19:19:49 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There is no substantiation presented as to why the wiring method is “unsafe”. If the TC-ER-HL has been installed in accordance with Article 336, it will be predominantly in a cable tray. Any extended run out of the tray is required to be protected by the location. If the cable is being damaged by the location, Section 110.11 may not have been correctly applied. There is no requirement that this wiring method be used in all installations. It provides another option. The restriction to industrial facilities, limitation on public access, and conditions of maintenance ensure that this will not be used in areas like filling stations that have public access. The shielded construction described is already permitted by UL 1277 and UL 2225, and in fact is often used for the twisted pair constructions. Shielding is for EMC and not for equipment grounding.
505.17 Flexible Cables, Cords and Connections.
A flexible cord shall be permitted for connection between portable lighting equipment or other portable utilization equipment and
the fixed portion of their supply circuit. Flexible cord shall also be permitted for that portion of the circuit where the fixed wiring
methods of 505.15(B) and (C) cannot provide the necessary degree of movement for fixed and mobile electrical utilization
equipment in an industrial establishment where conditions of maintenance and engineering supervision ensure that only
qualified persons install and service the installation, and where the flexible cord is protected by location or by a suitable guard
from damage. The length of the flexible cord shall be continuous. Where flexible cords are used, the cords shall comply with the
following:

1. Be of a type listed for extra-hard usage.
2. Contain, in addition to the conductors of the circuit, an equipment grounding conductor complying with 400.23.
3. Be connected to terminals or to supply conductors in an approved manner.
4. Be supported by clamps or by other suitable means in such a manner that there will be no tension on the terminal
   connections.
5. Be terminated with a listed cord connector that maintains the type of protection where the flexible cord enters boxes,
   fittings, or enclosures that are required to be explosionproof or flameproof.
6. Cord entering an increased safety “e” enclosure shall be terminated with a listed increased safety “e” cord connector.

Informational Note: See 400.10 for permitted uses of flexible cords.

Electric submersible pumps with means for removal without entering the wet-pit shall be considered portable utilization
equipment. The extension of the flexible cord within a suitable raceway between the wet-pit and the power source shall be
permitted.

Electric mixers intended for travel into and out of open-type mixing tanks or vats shall be considered portable utilization
equipment.

Informational Note: See 505.18 for flexible cords exposed to liquids having a deleterious effect on the conductor
insulation.

(B) Power, Control, and Instrumentation Connections for Zone 1 and 2.

To facilitate replacements in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, and where the cable is not subject to physical damage; power, control, and instrumentation replacements, process control instruments shall be permitted to be connected through Type TC-ER-HL cable, by means of attachment plugs, flexible cords, attachment plugs, and receptacles, provided that all of the following conditions apply:

- Attachment plug and receptacle are listed for use in Class I, Zone 1 locations and for use with TC-ER-HL cable.
  
  Exception: A Class I, Zone 1 listing is not required if the circuit type of protection is “ia” or “ib”.

- Type TC-ER-HL cable is listed for use in Class I, Zone 1 locations.
- Type TC-ER-HL cable is installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7).
- Only necessary receptacles are provided.
- Unless the attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they
  cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet
  are separated, a switch listed for the location is provided so that the attachment plug or receptacle is not depended on to interrupt current. Exception: A switch is not required if, unless the circuit type of protection is “ia” or “ib”.
- Type TC-ER-HL cable is listed for use in Class I, Zone 1 locations.
- Type TC-ER-HL cable is installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7).
- Only necessary receptacles are provided.
- Unless the attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they
  cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet
  are separated, the instrumentation receptacle carries a label warning against plugging or unplugging under load.

(C) - Power, Control, and Instrumentation Connections for Zone 2.

To facilitate replacements, power, control and instrumentation shall be permitted to be connected through flexible cords,
listed Type TC-ER cable or Type TC-ER-HL cable, by means of attachment plugs, and receptacles, provided that all of the
following conditions apply:

- Attachment plug and receptacle are listed for use in Class I, Zone 2 locations and for use with flexible cords, Type TC-ER
cable or Type TC-ER-HL cable, as applicable, and shall be of the locking and grounding type.

National Fire Protection Association Report
Exception: A Class I, Zone 2 listing is not required if the circuit type of protection is "ia", "ib", or "ic".

- Unless the attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated, a switch listed for the location is provided so that the attachment plug or receptacle is not depended on to interrupt current.

Exception: A switch is not required if the circuit type of protection is "ia", "ib", or "ic".

The flexible is type "ia," "ib," or "ic" protection, in which case the switch is not required.

(2) The current does not exceed 3 amperes at 120 volts, nominal.

(3) The power-supply, cord does not exceed 900 mm (3 ft), is of a type listed for extra-hard usage or for hard usage if protected by location, if applicable.

- Type TC-ER cable or Type TC-ER-HL cable is installed in accordance with the provisions of Article 336, including the restrictions of 336.10(7), if applicable and is supplied through an attachment plug and receptacle of the locking and grounding type.

(4) Only necessary receptacles are provided.

Unless the attachment plug and receptacle are interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when the plug and socket outlet are separated, the instrumentation receptacle carries a label warning against unplugging under load.

Statement of Problem and Substantiation for Public Comment

Type TC-ER-HL is not a flexible cord or flexible cable. It is a Chapter 3 wiring method, and it is inappropriate to use this cable type in place of flexible cord products and associated equipment that is intended for the use. The suggested revisions in this comment will return the text to the language found in the 2014 NEC.

Related Item
First Revision No. 3968-NFPA 70-2015 [Section No. 505.17]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 22:11:06 EDT 2015

Committee Statement

Committee Action: Rejected
| Resolution: | First Revision 3968 was made with due regard for the need for flexible wiring and termination methods to facilitate maintenance and repair. The comment does not technically substantiate any safety concern with the specific language other than to disagree with the approach taken. As such, the panel does not support returning to the 2014 language as proposed. |
506.2 Definitions.

For purposes of this article, the following definitions apply.

**Informational Note:** Informational Note: For further information, see ANSI NFPA 496-2013, Standard for Purged and Pressurized Enclosures for Electrical Equipment.

**Protection by Encapsulation "m".**

Type of protection where electrical parts that could cause ignition of a mixture of combustible dust or fibers/flyings in air are protected by enclosing them in a compound in such a way that the explosive atmosphere cannot be ignited.

**Informational Note No. 1:** For additional information, see ANSI ISA-60079-18 - (12.03.01) - 2009 - 2012, Explosive atmospheres — Part 18: Equipment protection by encapsulation “m”; ANSI/UL 60079-19: 2009 2012: Explosive atmospheres — Part 18: Equipment protection by encapsulation “m”; and ANSI/ISA-61241-18 - (12.10.07) - 2011 - 2012, Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Encapsulation “m D.”

Informational Note No. 2: Encapsulation is designated level of protection “maD” or “ma” for use in Zone 20 locations. Encapsulation is designated level of protection “mbD” or “mb” for use in Zone 21 locations. Encapsulation is designated type of protection “mc” for use in Zone 22 locations.

**Protection by Enclosure “t”**.

Type of protection for explosive dust atmospheres where electrical apparatus is provided with an enclosure providing dust ingress protection and a means to limit surface temperatures.

**Informational Note No. 1:** For additional information, see ANSI ISA-60079-31 - (12.10.03) - 2009 - 2014, Explosive Atmospheres — Part 31: Equipment Dust Ignition Protection by Enclosure “t”; and ANSI ISA-61241-1 - (12.10.03) - 2011, Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Enclosure “t”.

Informational Note No. 2: Protection by enclosure is designated level of protection “ta” for use in Zone 20 locations. Protection by enclosure is designated level of protection “tb” or “tD” for use in Zone 21 locations. Protection by enclosure is designated level of protection “tc” or “tD” for use in Zone 22 locations.

**Protection by Intrinsic Safety “iD.”**

Type of protection where any spark or thermal effect is incapable of causing ignition of a mixture of combustible dust, fibers, or flyings in air under prescribed test conditions.

**Informational Note No. 1:** For additional information, see ANSI ISA - 60079-11 - (12.01.01) - 2011, Electrical Apparatus for Explosive Gas - 2013, Explosive Atmospheres — Part 11: Intrinsic safety “i”; ANSI UL 60079-11-2011 2015, Electrical Apparatus for Explosive Gas Atmospheres — Part 11: Equipment Protection by Intrinsic safety “i”; and ANSI ISA - 61241-11 - (12.10.04) - 2011, Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 (Classified) Locations — Protection by Intrinsic Safety “iD.”

Informational Note No. 2: Intrinsic safety is designated level of protection “iaD” or “ia” for use in Zone 20 locations. Intrinsic safety is designated level of protection “ibD” or “ib” for use in Zone 21 locations. Intrinsic safety is designated type of protection “ic” for use in Zone 22 locations.

**Protection by Pressurization “p”**.

Type of protection that guards against the ingress of a mixture of combustible dust or fibers/flyings in air into an enclosure containing electrical equipment by providing and maintaining a protective gas atmosphere inside the enclosure at a pressure above that of the external atmosphere.

**Informational Note:** For additional information, see ANSI ISA-61241-2 - (12.10.06) - 2006 - 2011, Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations — Protection by Pressurization “pD.”

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**Statement of Problem and Substantiation for Public Comment**

Referenced current editions.

**Related Public Comments for This Document**

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**Related Item**

First Revision No. 3927-NFPA 70-2015 [Definitions (505.2): Encapsulation... to Type of Pro...]
Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jul 06 18:07:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3903-NFPA 70-2015
Statement: The informational note referencing ANSI/NFPA 496 was deleted as the informational note should have been relocated to Art. 100 with the term 'Pressurized' under FR 3924.

The documents referenced in 506.2 have been revised to reflect the correct title, numeric designation, ANSI approval and publication dates.

Reference to ANSI/UL 60079-31-2015 was added and replaced the ANSI/ISA 60079-31-2009 standard
Public Comment No. 569-NFPA 70-2015 [Section No. 506.4(B)]

(B) Reference Standards.

Important information relating to topics covered in Chapter 5 can be found in other publications.

Informational Note No. 1: It is important that the authority having jurisdiction be familiar with the recorded industrial experience as well as with standards of the National Fire Protection Association (NFPA), the International Society of Automation (ISA), and the International Electrotechnical Commission (IEC) that may be of use in the classification of various locations, the determination of adequate ventilation, and the protection against static electricity and lightning hazards.

Informational Note No. 2: For additional information concerning the installation of equipment utilizing optical emissions technology (such as laser equipment) that could potentially become an ignition source in hazardous (classified) locations, see ANSI/ISA-60079-28 (12.21.02)-2013, Explosive Atmospheres — Part 28: Protection of equipment and transmission systems using optical radiation.

Statement of Problem and Substantiation for Public Comment

Regarding Informational Note 2: While potential risks of ignition from electrical equipment utilizing optical emissions technology may exist, the design and use of suitable electrical equipment used in hazardous classified locations is already addressed in the NEC. Optical emissions are not within the scope of the NEC. Therefore there is no need to include this reference in the NEC.

Related Item

First Revision No. 4000-NFPA 70-2015 [Section No. 506.4(B)]

Submitter Information Verification

Submitter Full Name: David Wechsler
Organization: [Not Specified]
Affiliation: ACC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 05 13:48:17 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The informational note is intended to provide the user with useful information related to the installation and use of electrical equipment installed in Zone 20, 21 or 22 locations when such equipment emits optical radiation in free air.
(2) Zone 21.

A Zone 21 location is a location where one of the following apply:

1. Ignitible concentrations of combustible dust or ignitible fibers/flyings are likely to exist occasionally under normal operating conditions; or
2. Ignitible concentrations of combustible dust or ignitible fibers/flyings may exist frequently because of repair or maintenance operations or because of leakage; or
3. Equipment is operated or processes are carried on, of such a nature that equipment breakdown or faulty operations could result in the release of ignitable concentrations of combustible dust or ignitible fibers/flyings and also cause simultaneous failure of electrical equipment in a mode to cause the electrical equipment to become a source of ignition; or
4. Adjacent to a Zone 20 location from which ignitible concentrations of dust or ignitible fibers/flyings could be communicated, unless communication is prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

Informational Note No. 1: As a guide to classification of Zone 21 locations, refer to ANSI/ISA-60079-10-2 (12.10.05)-2013, Explosive Atmospheres — Part 10-2: Classification of areas — Combustible dust atmospheres.

Informational Note No. 2: This classification usually includes locations outside dust containment and in the immediate vicinity of access doors subject to frequent removal or opening for operation purposes when internal combustible mixtures are present; locations outside dust containment in the proximity of filling and emptying points, feed belts, sampling points, truck dump stations, belt dump over points, etc., where no measures are employed to prevent the formation of combustible mixtures; locations outside dust containment where dust accumulates and where due to process operations the dust layer is likely to be disturbed and form combustible mixtures; locations inside dust containment where explosive dust clouds are likely to occur (but neither continuously, nor for long periods, nor frequently) as, for example, silos (if filled and/or emptied only occasionally) and the dirty side of filters if large self-cleaning intervals are occurring.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that list item (4) in this First Revision be rewritten to comply with the NEC Style Manual.

Related Item
First Revision No. 3959-NFPA 70-2015 [Section No. 506.5(B)(2)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 09:34:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3904-NFPA 70-2015
Statement: At the direction of the Correlating Committee, the text of 506.5(B)(2)(4) was revised in accordance with the NEC Style Manual.
Zone 22.

A Zone 22 location is a location where one of the following apply:

1. Ignitible concentrations of combustible dust or ignitable fibers/flyings are not likely to occur in normal operation and, if they do occur, will only persist for a short period; or
2. Combustible dust or fibers/flyings are handled, processed, or used but in which the dust or fibers/flyings are normally confined within closed containers of closed systems from which they can escape only as a result of the abnormal operation of the equipment with which the dust or fibers/flyings are handled, processed, or used; or
3. Adjacent to a Zone 21 location, from which ignitible concentrations of dust or fibers/flyings could be communicated, unless such communication is prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

Informational Note No. 1: As a guide to classification of Zone 22 locations, refer to ANSI/ISA-60079-10-2 12.10.05-2013, Explosive Atmospheres — Part 10-2: Classification of areas — Combustible dust atmospheres.

Informational Note No. 2: Zone 22 locations usually include outlets from bag filter vents, because in the event of a malfunction there can be emission of combustible mixtures; locations near equipment that has to be opened at infrequent intervals or equipment that from experience can easily form leaks where, due to pressure above atmospheric, dust will blow out; pneumatic equipment, flexible connections that can become damaged, etc.; storage locations for bags containing dusty product, since failure of bags can occur during handling, causing dust leakage; and locations where controllable dust layers are formed that are likely to be raised into explosive dust–air mixtures. Only if the layer is removed by cleaning before hazardous dust–air mixtures can be formed is the area designated unclassified.

Informational Note No. 3: Locations that normally are classified as Zone 21 can fall into Zone 22 when measures are employed to prevent the formation of explosive dust–air mixtures. Such measures include exhaust ventilation. The measures should be used in the vicinity of (bag) filling and emptying points, feed belts, sampling points, truck dump stations, belt dump over points, etc.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that list item (3) in this First Revision be rewritten to comply with the NEC Style Manual

Related Item
First Revision No. 3960-NFPA 70-2015 [Section No. 506.5(B)(3)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 09:35:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3905-NFPA 70-2015
Statement: At the direction of the Correlating Committee, the text of 506.5(B)(3)(3) was revised in accordance with the NEC Style Manual.
A Group IIIC.

Remove this term "Combustible metal dust." and replace it with the following:

Atmospheres containing metallic combustible dust including aluminum, magnesium, and their commercial alloys, or other combustible dusts whose particle size, abrasiveness, and conductivity present similar hazards in the use of electrical equipment.

Retain current informational note

Informational note: Group IIIC is equivalent to Class II, Group E as described in 500.6(B)(1).

Statement of Problem and Substantiation for Public Comment

The Committee statement stated: "CMP-14 reaffirms the existing text of the material group definitions based on the current alignment of the published area classification documents, product standards and installation documents."

If IEC, ISA and NFPA represent the significant publishers of area classification documents, as indicated below except for one case, which does not support this application, the term 'combustible metal dust' is not defined.

The informational note contains extremely important information, but due to the style manual, is not part of the definition and it really needs to be part of this description.

The recommended comment change first uses the specific term 'metallic combustible dust' found in the ANSI/ISA document. This change also includes the important aspects of Group E materials in the phrase "including aluminum ...". Since the IEC uses the term 'conductive dust', the aspect of the IEC is also addressed by including the term 'conductivity'. This then truly represents not only an alignment of the published classification documents but a truly understandable and applicable term which is directly traceable to published classification documents.

Exhibit 1 - IEC classification document

The current published IEC classification document addresses dusts specifically under 4.2 Area classification procedure for explosive atmospheres stating:

Area classification is based on a number of factors and may require informed input from a number of sources. These factors include:

• Whether the dust is combustible or not. Dust combustibility can be confirmed by laboratory tests to the future IEC 60079-20-2.

Additionally it states-

a) The first step is to identify whether the material is combustible and, for the purpose of assessment of ignition sources, determine the material characteristics, such as particle size, moisture content, cloud and layer minimum ignition temperature and electrical resistivity, and the appropriate dust group, Group IIIA for combustible flyings, Group IIIB for non-conductive dust, or Group IIIC for conductive dust.

The IEC defined term 'conductive dust' is –

Combustible dust with electrical resistivity equal to or less than 103 Ωm

The IEC defined term for non-conductive dust is –

Combustible dust with electrical resistivity greater than 103 Ωm

The IEC defined term for combustible dust is –

Finely divided solid particles, 500 μm or less in nominal size, which may be suspended in air, may settle out of the atmosphere under their own weight, can burn or glow in air, and may form explosive mixtures with air at atmospheric pressure and normal temperatures

NOTE 1 This definition may also include dust and grit as defined in ISO 4225.

NOTE 2 The term 'solid particle' is intended to address particles in the solid phase and not the gaseous or liquid phase, but does not preclude a hollow particle.

Exhibit 2 - ISA classification

The current published USA ISA classification document addresses dust specifically under 4.2 Area classification procedure for explosive atmospheres stating, with US deviations shown with strikeout and underlines:

Area classification is based on a number of factors and may require informed input from a number of sources. These factors include:

• Whether or not the material is a combustible dust or not. Dust combustibility explosibility can be confirmed by laboratory tests to the ANSI/ASTM E1226 future IEC 60079-20-2.

Additionally it states-

a) The first step is to identify whether the material is combustible and, for the purpose of assessment of ignition sources, determine
the material characteristics, such as particle size, moisture content, cloud and layer minimum ignition temperature and electrical resistivity, and the appropriate dust group, Group IIIA for combustible flyings, Group IIIB for non-conductive dust, or Group IIIC for conductive dust.

NOTE The 2011 ANSI/NFPA 70 (NEC®) does not differentiate selection and installation requirements based on dust groups for Zone 20, Zone 21 and Zone 22 installations.

The ISA Defined term ‘conductive dust’ is —
metallic combustible dust with electrical resistivity equal to or less than 103 Ωm

NOTE The term “conductive dust” is not considered to be the proper technical designation of “metallic dust” but is maintained to support consistency across the ANSI/ISA -60079 documents at this time.

NFPA 70, Article 500.6 B (1)- states:
Group E. Atmospheres containing combustible metal
dusts, including aluminum, magnesium, and their commercial alloys, or other combustible dusts whose particle size, abrasiveness, and conductivity present similar hazards in the use
of electrical equipment. [499:3.3.4.1]

NFPA 484, defines Combustible Metal Dusts as:
A combustible particulate metal that presents a fire or explosion hazard when suspended in air or the process specific oxidizing medium over a range of concentrations, regardless of particle size or shape.
Since Article 506 only pertains to air atmospheres, this definition which includes oxidizing medium over a range of concentrations, is not considered to be valid.

Related Item
Public Input No. 708-NFPA 70-2014 [Section No. 506.6(A)]

Submitter Information Verification

Submitter Full Name: DAVID WECHSLER
Organization: [ Not Specified ]
Affiliation: American Chemistry Council
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Aug 11 14:21:24 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3907-NFPA 70-2015
Statement: The text of 506.6(A) was revised to align with the Group IIIC material classification in ANSI/UL 60079-0 and Article 500.
Group IIIB.

Remove this statement: Combustible dust other than combustible metal dust.

Add the following replacement:

Atmospheres containing non-metallic combustible dusts, including flour, grain, wood, plastic, and chemicals, and combustible carbonaceous dusts that have more than 8 percent total entrapped volatiles (see ASTM D 3175-02, Standard Test Method for Volatile Matter in the Analysis Sample for Coal and Coke, for coal and coke dusts) or that have been sensitized by other materials so that they present an explosion hazard. Coal, carbon black, charcoal, and coke dusts are examples of carbonaceous dusts.

Retain the Informational Note:

Informational Note: Group IIIB is equivalent to Class II, Groups F and G as described in 500.6(B)(2) and 500.6(B)(3), respectively.

Related Item

Public Input No. 709-NFPA 70-2014 [Section No. 506.6(B)]

Submitter Information Verification

Submitter Full Name: DAVID WECHSLER
Organization: [ Not Specified ]
Affiliation: American Chemistry Council
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 11 14:48:21 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3908-NFPA 70-2015
Statement: The text of 506.6(B) was revised to align with the Group IIIB material classification in ANSI/UL 60079-0 and Article 500.
Public Comment No. 535-NFPA 70-2015 [Section No. 506.8(I)]

Protection by Intrinsic Safety “iD”.
This protection technique shall be permitted for equipment in Zone 20, Zone 21, and Zone 22 locations for which it is listed and labeled.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
</table>

Statement of Problem and Substantiation for Public Comment

Listings do not specify labeling as defined by the NEC, labeling requirements are determined by the certification organization.

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
Public Input No. 914-NFPA 70-2014 [Section No. 506.8(I)]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
Committee Statement

Committee Action: Rejected

Resolution: “Listed” and “labeled” are defined separately in Art. 100. Listed is the correct term. Requirements for product listing, to include the affixing of a certification label or mark are specified by certification organizations. Whereas the two certification organizations cited do require listed products to bear a certification mark, these requirements may vary between other organizations.
(2) Zone Equipment.

Equipment meeting one or more of the protection techniques described in 506.8 shall be marked with the following in the order shown:

(1) Zone
(2) Symbol “AEx”
(3) Protection technique(s) in accordance with Table 506.9(C)(2)(3)
(4) Material group in accordance with 506.6 or a specific dust or ignitible fiber/flying or a specific combination thereof
(5) Maximum surface temperature in accordance with 506.9(D), marked as a temperature value in degrees C, preceded by “T” and followed by the symbol “°C”
(6) Ambient temperature marking in accordance with 506.9(D)

Informational Note: The EPL (or equipment protection level) can appear in the product marking. EPLs are designated as G for gas, D for dust, or M for mining, and are then followed by a letter (a, b, or c) to give the user a better understanding as to whether the equipment provides either (a) a “very high,” (b) a “high,” or (c) an “enhanced” level of protection against ignition of an explosive atmosphere. For example, a Zone 21 AEx pb IIIB T165°C motor can additionally be marked with an EPL of “Db”, Zone 21 AEx p IIIB T165°C Db.

Exception: Associated apparatus NOT suitable for installation in a hazardous (classified) location shall be required to be marked only with 506.9(C)(2)(2) and (3), and where applicable (4), but BOTH the symbol AEx in 506.9(C)(2)(2) and the symbol for the type of protection in 506.9(C)(2)(3) shall be enclosed within the same square brackets; for example, [AEx iaD] or [AEx ia] IIIIC.

Table 506.9(C)(2)(3) Types of Protection Designation

<table>
<thead>
<tr>
<th>Designation</th>
<th>Technique</th>
<th>Zone*</th>
</tr>
</thead>
<tbody>
<tr>
<td>iaD</td>
<td>Protection by intrinsic safety</td>
<td>20</td>
</tr>
<tr>
<td>ia</td>
<td>Protection by intrinsic safety</td>
<td>20</td>
</tr>
<tr>
<td>ibD</td>
<td>Protection by intrinsic safety</td>
<td>21</td>
</tr>
<tr>
<td>ib</td>
<td>Protection by intrinsic safety</td>
<td>21</td>
</tr>
<tr>
<td>ic</td>
<td>Protection by intrinsic safety</td>
<td>22</td>
</tr>
<tr>
<td>[iaD]</td>
<td>Associated apparatus</td>
<td></td>
</tr>
<tr>
<td>[ia]</td>
<td>Associated apparatus</td>
<td></td>
</tr>
<tr>
<td>[ibD]</td>
<td>Associated apparatus</td>
<td></td>
</tr>
<tr>
<td>[ib]</td>
<td>Associated apparatus</td>
<td>Unclassified**</td>
</tr>
<tr>
<td>[ic]</td>
<td>Associated apparatus</td>
<td></td>
</tr>
<tr>
<td>maD</td>
<td>Protection by encapsulation</td>
<td>20</td>
</tr>
<tr>
<td>ma</td>
<td>Protection by encapsulation</td>
<td>20</td>
</tr>
<tr>
<td>mbD</td>
<td>Protection by encapsulation</td>
<td>21</td>
</tr>
<tr>
<td>mb</td>
<td>Protection by encapsulation</td>
<td>21</td>
</tr>
<tr>
<td>mc</td>
<td>Protection by encapsulation</td>
<td>22</td>
</tr>
<tr>
<td>pD</td>
<td>Protection by pressurization</td>
<td>21</td>
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<tr>
<td>p</td>
<td>Protection by pressurization</td>
<td>21</td>
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<tr>
<td>pb</td>
<td>Protection by pressurization</td>
<td>21</td>
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<tr>
<td>ID</td>
<td>Protection by enclosures</td>
<td>21</td>
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<tr>
<td>ta</td>
<td>Protection by enclosures</td>
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<tr>
<td>tb</td>
<td>Protection by enclosures</td>
<td>21</td>
</tr>
<tr>
<td>tc</td>
<td>Protection by enclosures</td>
<td>22</td>
</tr>
</tbody>
</table>

*Does not address use where a combination of techniques is used.

**Associated apparatus is permitted to be installed in a hazardous (classified) location if suitably protected using another type of protection.

Informational Note: The “D” suffix on the type of protection designation was employed prior to the introduction of Group IIIA, IIIB, and IIIC; which is now used to distinguish between the type of protection employed for Group II (Gases) or Group III (Dusts).
### Statement of Problem and Substantiation for Public Comment

Remove the addition of the words "or a specific dust or ignitable fiber/flying or a specific combination thereof". The additional provision only creates confusion for the installers and inspectors. The "specific dust" that the device maybe approved for will not likely appear on the label and will be only in some documentation. Current product standards do not permit the listing, testing or approval of specific dusts.

**Related Item**

First Revision No. 3930-NFPA 70-2015 [Section No. 506.9(C)(2)]

### Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name</th>
<th>Mark Goodman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Mark Goodman Electrical Consulting</td>
</tr>
<tr>
<td>Affiliation</td>
<td>American Petroleum Institute</td>
</tr>
<tr>
<td>Street Address</td>
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</tr>
<tr>
<td>City</td>
<td></td>
</tr>
<tr>
<td>State</td>
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<tr>
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<tr>
<td>Submittal Date</td>
<td>Fri Sep 25 04:29:55 EDT 2015</td>
</tr>
</tbody>
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### Committee Statement

<table>
<thead>
<tr>
<th>Committee Action</th>
<th>Accepted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>SR-3910-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement</td>
<td>The product standards for Zone 20, 21 and 22 equipment do not permit marking for specific dusts or ignitable fiber/flyings.</td>
</tr>
</tbody>
</table>
(1) Equipment Provided with Threaded Entries for NPT-Threaded Conduit or Fittings.

For equipment provided with threaded entries for NPT-threaded conduit or fittings, listed conduit fittings or listed cable fittings shall be used. All NPT-threaded conduit and fittings shall be threaded with a National (American) Standard Pipe Taper (NPT) thread.

Informational Note: Thread specifications for NPT threads are located in ANSI/ASME B1.20.1-2013, Pipe Threads, General Purpose (Inch).

Statement of Problem and Substantiation for Public Comment

Referenced correct SDO name.

Related Item
First Revision No. 3965-NFPA 70-2015 [Section No. 506.9(E)(1)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jul 08 19:43:35 EDT 2015

Committee Statement

Committee Action: Rejected
513.1 Scope.

This article shall apply to buildings or structures in any part of which aircraft containing Class I (flammable) liquids or Class II (combustible) liquids whose temperatures are above their flash points are housed or stored and in which aircraft might undergo service, repairs, or alterations. It shall not apply to locations used exclusively for aircraft that have never contained fuel or unfueled aircraft.

Informational Note No. 1: For definitions of aircraft hangar and unfueled aircraft, see NFPA 409-2011, Standard on Aircraft Hangars.

Informational Note No. 2: For further information on fuel classification see NFPA 30-2015, Flammable and Combustible Liquids Code.

Statement of Problem and Substantiation for Public Comment

As written, the paragraph is confusing and contradicts Article 500.5. The scope appears to allow standard electrical equipment to be installed and used in an aircraft hangar with fueled aircraft as long as the ambient temperature never reaches the flash point of the fuel. Article 500.5 defines Classified Locations regardless of temperatures. The proposed change aligns it with Article 500.5 and meets the intent of NFPA 409.

Related Item

Public Input No. 571-NFPA 70-2014 [Section No. 210.64]

Submitter Information Verification

Submitter Full Name: JOSEPH SIMONE
Organization: US DEPARTMENT OF THE NAVY
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 08 06:52:42 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The scope of the article is under the purview of the Correlating Committee. The Panel does not agree with the change to the scope.
Public Comment No. 183-NFPA 70-2015 [Section No. 514.3(B)]

(B) Classified Locations.

[See Figure 514.3(B).]

Figure 514.3(B) Classified Areas Adjacent to Dispenser Mounted on Aboveground Storage Tank. [30A: Figure 8.3.2(b)]
(1) Class I Locations.
Table 514.3(B)(1) shall be applied where Class I liquids are stored, handled, or dispensed and shall be used to delineate and classify motor fuel dispensing facilities and commercial garages as defined in Article 511. Table 515.3 shall be used for the purpose of delineating and classifying aboveground tanks. A Class I location shall not extend beyond an unpierced wall, roof, or other solid partition. [30A:8.1, 8.2, 8.3]

### Table 514.3(B)(1) Class I Locations — Motor Fuel Dispensing Facilities

<table>
<thead>
<tr>
<th>Location</th>
<th>Division (Group D)</th>
<th>Zone (Group II A)</th>
<th>Extent of Classified Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dispensing Device (except Overhead Type)</strong> 2, 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under dispenser containment</td>
<td>1</td>
<td>1</td>
<td>Entire space within and under dispenser pit or containment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Within 450 mm (18 in.) of dispenser enclosure or that portion of dispenser enclosure containing liquid-handling components, extending horizontally in all directions and down to grade level</td>
</tr>
<tr>
<td><strong>Dispenser</strong></td>
<td>2</td>
<td>2</td>
<td>Up to 450 mm (18 in.) above grade level, extending 6 m (20 ft) horizontally in all directions from dispenser enclosure</td>
</tr>
<tr>
<td><strong>Outdoor</strong></td>
<td>2</td>
<td>2</td>
<td>Up to 450 mm (18 in.) above grade level, extending 6 m (20 ft) horizontally in all directions from dispenser enclosure</td>
</tr>
<tr>
<td><strong>Indoor</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- with mechanical ventilation</td>
<td>2</td>
<td>2</td>
<td>Up to 450 mm (18 in.) above floor level, extending 6 m (20 ft) horizontally in all directions from dispenser enclosure</td>
</tr>
<tr>
<td>- with gravity ventilation</td>
<td>2</td>
<td>2</td>
<td>Up to 450 mm (18 in.) above floor level, extending 7.5 m (25 ft) horizontally in all directions from dispenser enclosure</td>
</tr>
<tr>
<td><strong>Dispensing Device — Overhead Type</strong> 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Space within dispenser enclosure and all electrical equipment integral with dispensing hose or nozzle</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Within 450 mm (18 in.) of dispenser enclosure, extending horizontally in all directions and down to grade level</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Up to 450 mm (18 in.) above grade level, extending 6 m (20 ft) horizontally in all directions from a point vertically below edge of dispenser enclosure</td>
</tr>
<tr>
<td><strong>Remote Pump</strong> —</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Outdoor</strong></td>
<td>1</td>
<td>1</td>
<td>Entire space within any pit or box below grade level, any part of which is within 3 m (10 ft) horizontally from any edge of pump</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Within 900 mm (3 ft) of any edge of pump, extending horizontally in all directions</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Up to 450 mm (18 in.) above grade level, extending 3 m (10 ft) horizontally in all directions from any edge of pump</td>
</tr>
<tr>
<td><strong>Indoor</strong></td>
<td>1</td>
<td>1</td>
<td>Entire space within any pit</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Within 1.5 m (5 ft) of any edge of pump, extending in all directions</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Up to 900 mm (3 ft) above floor level, extending 7.5 m (25 ft) horizontally in all directions from any edge of pump</td>
</tr>
<tr>
<td><strong>Sales, Storage, Rest Rooms</strong> including structures (such as the attendant's kiosk) on or adjacent to dispensers</td>
<td>unclassified</td>
<td>unclassified</td>
<td>Except as noted below</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Entire volume, if there is any opening to room within the extent of a Division 1 or Zone 1 location</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Entire volume, if there is any opening to room within the extent of a Division 2 or Zone 2 location</td>
</tr>
<tr>
<td><strong>Tank, Aboveground</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inside tank</strong></td>
<td>1</td>
<td>0</td>
<td>Entire inside volume</td>
</tr>
<tr>
<td><strong>Shell, ends, roof, dike area</strong></td>
<td>1</td>
<td>1</td>
<td>Entire space within dike, where dike height exceeds distance from tank shell to inside of dike wall for more than 50 percent of tank circumference</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Entire space within dike, where dike height does not exceed distance from tank shell to inside of dike wall for more than 50 percent of tank circumference</td>
</tr>
<tr>
<td><strong>Vent</strong></td>
<td>2</td>
<td>2</td>
<td>Within 3 m (10 ft) of shell, ends, or roof of tank</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Within 1.5 m (5 ft) of open end of vent, extending in all directions</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Between 1.5 m and 3 m (5 ft and 10 ft) from open end of vent, extending in all directions</td>
</tr>
<tr>
<td>Location</td>
<td>Division (Group D)</td>
<td>Zone (Group IIA)</td>
<td>Extent of Classified Location 1</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------</td>
<td>------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td><strong>Tank, Underground</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inside tank</td>
<td>1</td>
<td>0</td>
<td>Entire inside volume</td>
</tr>
<tr>
<td>Fill Opening</td>
<td>1</td>
<td>1</td>
<td>Entire space within any pit or box below grade level, any part of which is within a Division 1 or Division 2 classified location or within a Zone 1 or Zone 2 classified location</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Up to 450 mm (18 in.) above grade level, extending 1.5 m (5 ft) horizontally in all directions from any tight-fill connection and extending 3 m (10 ft) horizontally in all directions from any loose-fill connection</td>
</tr>
<tr>
<td><strong>Vent</strong></td>
<td>1</td>
<td>1</td>
<td>Within 1.5 m (5 ft) of open end of vent, extending in all directions</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Between 1.5 m and 3 m (5 ft and 10 ft) from open end of vent extending in all directions</td>
</tr>
<tr>
<td><strong>Vapor Processing System</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pits</td>
<td>1</td>
<td>1</td>
<td>Entire space within any pit or box below grade level, any part of which: (1) is within a Division 1 or Division 2 classified location; (2) is within a Zone 1 or Zone 2 classified location; (3) houses any equipment used to transfer or process vapors</td>
</tr>
<tr>
<td>Equipment in protective enclosures</td>
<td>2</td>
<td>2</td>
<td>Entire space within enclosure</td>
</tr>
<tr>
<td>Equipment not within protective enclosure</td>
<td>2</td>
<td>2</td>
<td>Within 450 mm (18 in.) of equipment containing flammable vapors or liquid, extending horizontally in all directions and down to grade level</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Up to 450 mm (18 in.) above grade level within 3 m (10 ft) horizontally of the vapor processing equipment</td>
</tr>
<tr>
<td>Equipment enclosure</td>
<td>1</td>
<td>1</td>
<td>Entire space within enclosure, if flammable vapor or liquid is present under normal operating conditions</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Entire space within enclosure, if flammable vapor or liquid is not present under normal operating conditions</td>
</tr>
<tr>
<td>Vacuum assist blower</td>
<td>2</td>
<td>2</td>
<td>Within 450 mm (18 in.) of blower, extending horizontally in all directions and down to grade level</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Up to 450 mm (18 in.) above grade level, extending 3 m (10 ft) horizontally in all directions</td>
</tr>
<tr>
<td><strong>Vault</strong></td>
<td>1</td>
<td>1</td>
<td>Entire interior space, if Class 1 liquids are stored within</td>
</tr>
</tbody>
</table>

1For marine application, grade level means the surface of a pier, extending down to water level.

2Refer to Figure 514.3(a) and Figure 514.3(b) for an illustration of classified location around dispensing devices.

3Area classification inside the dispenser enclosure is covered in UL 87, Standard for Power-Operated Dispensing Devices for Petroleum Products.

4Ceiling-mounted hose reel. [30A:Table 8.3.1]
Compressed Natural Gas, Liquefied Natural Gas, and Liquefied Petroleum Gas Areas.

Table 514.3(B)(2) shall be used to delineate and classify areas where CNG, LNG, compressed or liquefied hydrogen, LP-Gas, or combinations of these, are dispensed as motor vehicle fuels along with Class I or Class II liquids that are also dispensed as motor vehicle fuels. [30A:12.1]

Where CNG or LNG dispensers are installed beneath a canopy or enclosure, either the canopy or enclosure shall be designed to prevent accumulation or entrapment of ignitable vapors or all electrical equipment installed beneath the canopy or enclosure shall be suitable for Class I, Division 2 hazardous (classified) locations. [30A:12.4]

Dispensing devices for LP-Gas shall be located as follows:

1. At least 3 m (10 ft) from any dispensing device for Class I liquids.
2. At least 1.5 m (5 ft) from any dispensing device for Class I liquids where the following conditions exist:
   3. The LP-Gas deliver nozzle and filler valve release no more than 4 cm³ (0.1 oz) of liquid upon disconnection.
   4. The fixed maximum liquid level gauge remains closed during the entire refueling process.

[30A:12.5.2]


Informational Note No. 3: See 514.3(C) for motor fuel dispensing stations in marinas and boatyards.

Table 514.3(B)(2) Electrical Equipment Classified Areas for Dispensing Devices

<table>
<thead>
<tr>
<th>Dispensing Device</th>
<th>Extent of Classified Area</th>
</tr>
</thead>
</table>
| **Compressed natural gas (CNG)** | **Class I, Division 1**
|                                  | Entire space within the dispenser enclosure                                                  |
|                                  | **Class I, Division 2**
|                                  | 1.5 m (5 ft) in all directions from dispenser enclosure                                    |
| **Liquefied natural gas (LNG)**  | **Class I, Division 1**
|                                  | Entire space within the dispenser enclosure                                                  |
|                                  | **Class I, Division 2**
|                                  | 3 m (10 ft) in all directions from the dispenser enclosure                                 |
| **Liquefied petroleum gas (LP-Gas)** | **Class I, Division 1**
|                                  | Entire space within the dispenser enclosure; 450 mm (18 in.) from the exterior surface of the dispenser enclosure to an elevation of 1.22 m (4 ft) above the base of the dispenser; the entire pit or open space beneath the dispenser and within 6 m (20 ft) horizontally from any edge of the dispenser when the pit or trench is not mechanically ventilated |
|                                  | **Class I, Division 2**
|                                  | Up to 450 mm (18 in.) above ground and within 6 m (20 ft) horizontally from any edge of the dispenser enclosure, including pits or trenches within this area when provided with adequate mechanical ventilation |

[30A:Table 12.6.2]
(3) Fuel Storage.

(a) Aboveground tanks storing CNG or LNG shall be separated from any adjacent property line that is or can be built upon, any public way, and the nearest important building on the same property. [30A:12.3.1]

Informational Note: The relevant distances are given in Section 8.4 of NFPA 52-2013, Vehicular Gaseous Fuel Systems Code.

(b) Aboveground tanks storing hydrogen shall be separated from any adjacent property line that is or can be built upon, any public way, and the nearest important building on the same property. [30A:12.3.2]

Informational Note: The relevant distances given in NFPA 2-2011, Hydrogen Technologies Code.

(c) Aboveground tanks storing LP-Gas shall be separated from any adjacent property line that is or can be built upon, any public way, and the nearest important building on the same property. [30A:12.3.3]

Informational Note: The relevant distances are given in Section 6.3 of NFPA 58-2014, Liquefied Petroleum Gas Code.

(d) Aboveground tanks storing CNG, LNG, or LP-Gas shall be separated from each other by at least 6 m (20 ft) and from dispensing devices that dispense liquid or gaseous motor vehicle fuels by at least 6 m (20 ft). [30A:12.3.3]

Exception No. 1: The required separation shall not apply to tanks or dispensers storing or handling fuels of the same chemical composition.

Exception No. 2: The required separation shall not apply when both the gaseous fuel storage and dispensing equipment are at least 15 m (50 ft) from any other aboveground motor fuel storage or dispensing equipment.

Informational Note: For further information, see NFPA 52-2013, Vehicular Gaseous Fuel Systems Code, or NFPA 58-2014, Liquefied Petroleum Gas Code, as applicable.

(e) Dispenser Installations Beneath Canopies. Where CNG or LNG dispensers are installed beneath a canopy or enclosure, either the canopy or enclosure shall be designed to prevent accumulation or entrapment of ignitible vapors or all electrical equipment installed beneath the canopy or enclosure shall be suitable for Class I, Division 2 hazardous (classified) locations. [30A:12.4]

(f) Specific Requirements for LP-Gas Dispensing Devices. [30A:12.5] Dispensing devices for LP-Gas shall be located as follows:

(7) At least 3 m (10 ft) from any dispensing device for Class I liquids

(8) At least 1.5 m (5 ft) from any dispensing device for Class I liquids where the following conditions exist:

(9) The LP-Gas deliver nozzle and filler valve release no more than 4 cm³ (0.1 oz) of liquid upon disconnection.

(10) The fixed maximum liquid level gauge remains closed during the entire refueling process. [30A:12.5.2]

Table 514.3(B)(2) shall be used to delineate and classify areas for the purpose of installation of electrical wiring and electrical utilization equipment.

Statement of Problem and Substantiation for Public Comment

Referenced current editions.

Related Item
First Revision No. 4001-NFPA 70-2015 [Section No. 514.3(B)(2)]
First Revision No. 4002-NFPA 70-2015 [New Section after 514.3(B)(2)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address: [Not Specified]
City: [Not Specified]
State: [Not Specified]
Zip: [Not Specified]
Submittal Date: Wed Jul 08 19:48:08 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>References within the Informational Notes are a result of revisions to extracted material in order to comply with the NEC Style Manual. Updating the document edition will result in a change to the extracted text and therefore should not be changed.</td>
</tr>
</tbody>
</table>
514.8 Revision of sealing underground conduits in a classified location

Conduits that are installed to serve a classified area must be sealed within 10' of the point of emergence if the point of emergence is in an unclassified area. Conduits that run within the same classified area are not required to be sealed as they emerge from the ground. Conduits that serve a div 1 area and emerge in a div 2 area must be sealed within 10' of the point of emergence. The seal may be at either end as per 501.15(A)(4) and (B)(2) Conduits that run under a classified area that do not emerge in the classified area do not require sealing if the installation is for compressed natural gas.

Revision of exception #2

Exception #2 add the following:
The grounding conductor is not required to be installed within the conduit if both ends are effectively grounded and bonded and the conductors or cables within the conduit are for communications and are not current carrying. The installation must comply with 250.6

Statement of Problem and Substantiation for Public Comment

The way 514.8 is written, it requires a seal on both ends of a conduit that runs under and serves a classified area. Conduits that run above grade in a classified area from point a to point b do not require a seal if within the same area, but if buried underground (to eliminate a trip hazard) a seal would be required at both ends to comply with the way 514.8 is written. The change would clarify the requirement and agree with 501.15

When the installation is compressed natural gas, there are no fitting’s underground on the high pressure gas line. If ruptured, the gas is expelled into the atmosphere. It does not seep into the soil as with liquid fuel. The entrance of compressed natural gas into an underground electrical conduit that does not serve the classified area is unlikely.

Revision of exception #2
Ethernet or CAT 5 cables interconnect PLC’s and modems plus connect dispensers to monitoring equipment and point of sales equipment.

If a grounding conductor was run with a CAT 5 cable and it was connected to other grounding conductors for power or control wiring at the load there could be objectionable current imposed on the ground wire when a ground fault is being cleared. This will induce a voltage on a CAT 5 cable and would damage PLC’s, modems, or other equipment. If the requirements of 250.6 are met a grounding conductor can be eliminated. Some inspectors require the grounding conductor even though it will damage equipment just because the 514.8 requires it. They do not recognize 250.6 and say 514.8 takes president over 250.6.

Related Item
First Revision No. 3993-NFPA 70-2015 [Section No. 514.8]

Submitter Verification

Submitter Full Name: GERALD DALEY
Organization: Daley Electric Company
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 22 16:42:41 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There is no substantiation to make a change in the text of 514.8. Seals are installed to prevent gases from using the conduit as a pathway. Buried conduits above High Pressure Gas lines could have gases enter and travel upward through the conduit system. Grounding conductors are required.
Use of seal in dispenser
The first seal fitting emerging from the ground inside the dispenser may serve as the boundary seal in Compressed Natural gas installations.

Statement of Problem and Substantiation for Public Comment

514.9 requires a seal at the dispenser. The purpose of this seal is unclear. Where a dispenser has a conduit entering from an unclassified area or a div 2 area the seal in the dispenser should be acceptable as the boundary seal identified in 501.15 (A) (4) and (B) (2)

Related Item
First Revision No. 3995-NFPA 70-2015 [Section No. 514.9(A)]

Submitter Information Verification

Submitter Full Name: GERALD DALEY
Organization: Daley Electric Company
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 22 17:04:49 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: It is unclear why the submitter wants to use the seal as the required dispenser seal and the boundary seal. There is no technical substantiation for this change. The code allows a common seal for multiple purposes.
Title of New Content NFPA 70: 514 (D)

Type your content here ... Where facilities have fire alarm systems installed, motor fueling facilities with fire alarm systems shall have the emergency circuits for the emergency disconnects interconnected with the fire alarm system.

Statement of Problem and Substantiation for Public Comment

There is not a current mandate for such interconnection between the emergency stops for the fueling pumps and the fire alarm system of the fueling station. When this connection is incorporated, the fueling pumps shut off when the fire alarm is activated. Customers could be actively fueling vehicles when the fire alarm is activated, without the interconnection, the vehicles could continue to actively be fueled (fuel dispensing could continue).

By emergency stop activation combined with the fire alarms system, the potential for creating a greater incident could be lessened.

Related Item

Public Input No. 282-NFPA 70-2014 [Section No. 800.113(B)]

Submitter Information Verification

Submitter Full Name: ROBERT TRIBBIE
Organization: WEST VIRGINIA STATE FIRE MAR
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Jul 22 14:35:35 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This requirement is not within the scope of Article 514 of the NEC. This is more appropriately addressed by NFPA 30A and NFPA 72.
515.3 Class I Locations.
Table 515.3 shall be applied where Class I liquids are stored, handled, or dispensed and shall be used to delineate and classify bulk storage plants. The class location shall not extend beyond a floor, wall, roof, or other solid partition that has no communicating openings. [30:7.3, 7.4]

Informational Note No. 1: The area classifications listed in Table 515.3 are based on the premise that the installation meets the applicable requirements of NFPA 30-2015, Flammable and Combustible Liquids Code, Chapter 5, in all respects. Should this not be the case, the authority having jurisdiction has the authority to classify the extent of the classified space.

Informational Note No. 2: See 514.3(C) through (E) for gasoline dispensing stations in marinas and boatyards.

### Table 515.3 Electrical Area Classifications

<table>
<thead>
<tr>
<th>Location</th>
<th>Division</th>
<th>Zone</th>
<th>Extent of Classified Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor equipment installed in accordance with Section 7.3 of NFPA 30 where flammable vapor–air mixtures can exist under normal operation</td>
<td>1</td>
<td>0</td>
<td>The entire area associated with such equipment where flammable gases or vapors are present continuously or for long periods of time</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Area within 1.5 m (5 ft) of any edge of such equipment, extending in all directions</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Area between 1.5 m and 2.5 m (5 ft and 8 ft) of any edge of such equipment, extending in all directions; also, space up to 900 mm (3 ft) above floor or grade level within 1.5 m to 7.5 m (5 ft to 25 ft) horizontally from any edge of such equipment</td>
</tr>
<tr>
<td>Outdoor equipment of the type covered in Section 7.3 of NFPA 30 where flammable vapor–air mixtures can exist under normal operation</td>
<td>1</td>
<td>0</td>
<td>The entire area associated with such equipment where flammable gases or vapors are present continuously or for long periods of time</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Area within 900 mm (3 ft) of any edge of such equipment, extending in all directions</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Area between 900 mm (3 ft) and 2.5 m (8 ft) of any edge of such equipment, extending in all directions; also, space up to 900 mm (3 ft) above floor or grade level within 900 mm to 3.0 m (3 ft to 10 ft) horizontally from any edge of such equipment</td>
</tr>
<tr>
<td>Tank storage installations inside buildings</td>
<td>1</td>
<td>1</td>
<td>All equipment located below grade level</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Any equipment located at or above grade level</td>
</tr>
<tr>
<td>Tank — aboveground, fixed roof</td>
<td>1</td>
<td>0</td>
<td>Inside fixed roof tank</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Area inside dike where dike height is greater than the distance from the tank to the dike for more than 50 percent of the tank circumference</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Within 3.0 m (10 ft) from shell, ends, or roof of tank; also, area inside dike to level of top of dike wall</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0</td>
<td>Area inside of vent piping or opening</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Within 1.5 m (5 ft) of open end of vent, extending in all directions</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Area between 1.5 m and 3.0 m (5 ft and 10 ft) from open end of vent, extending in all directions</td>
</tr>
<tr>
<td>Tank — aboveground, floating roof</td>
<td>1</td>
<td>0</td>
<td>Area between the floating and fixed roof sections and within the shell</td>
</tr>
<tr>
<td>With fixed outer roof</td>
<td>1</td>
<td>1</td>
<td>Area above the floating roof and within the shell</td>
</tr>
<tr>
<td>With no fixed outer roof</td>
<td>1</td>
<td>1</td>
<td>Entire interior volume, if Class I liquids are stored within</td>
</tr>
<tr>
<td>Tank vault — interior</td>
<td>1</td>
<td>1</td>
<td>Any pit, box, or space below grade level, if any part is within a Division 1 or 2, or Zone 1 or 2 classified location</td>
</tr>
<tr>
<td>Underground tank fill opening</td>
<td>1</td>
<td>1</td>
<td>Up to 450 mm (18 in.) above grade level within a horizontal radius of 3.0 m (10 ft) from a loose fill connection, and within a horizontal radius of 1.5 m (5 ft) from a tight fill connection</td>
</tr>
<tr>
<td>Vent — discharging upward</td>
<td>1</td>
<td>0</td>
<td>Area inside of vent piping or opening</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Within 900 mm (3 ft) of open end of vent, extending in all directions</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Area between 900 mm and 1.5 m (3 ft and 5 ft) of open end of vent, extending in all directions</td>
</tr>
<tr>
<td>Drum and container filling — outdoors or indoors</td>
<td>1</td>
<td>0</td>
<td>Area inside the drum or container</td>
</tr>
<tr>
<td>Location</td>
<td>Division</td>
<td>Zone</td>
<td>Extent of Classified Area</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>----------</td>
<td>------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pumps, bleeders, withdrawal fittings</td>
<td>1</td>
<td>1</td>
<td>Within 900 mm (3 ft) of vent and fill openings, extending in all directions.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Area between 900 mm and 1.5 m (3 ft and 5 ft) from vent or fill opening, extending in all directions; also, up to 450 mm (18 in.) above floor or grade level within a horizontal radius of 3.0 m (10 ft) from vent or fill opening</td>
</tr>
<tr>
<td>Pits and sumps</td>
<td>1</td>
<td>1</td>
<td>Entire area within a pit or sump if any part is within a Division 1 or Zone 1 or 2 classified location.</td>
</tr>
<tr>
<td>With adequate mechanical ventilation</td>
<td>2</td>
<td>2</td>
<td>Entire area within a pit or sump if any part is within a Division 1 or Zone 1 or 2 classified location.</td>
</tr>
<tr>
<td>Pits and sumps</td>
<td>2</td>
<td>2</td>
<td>Entire pit or sump.</td>
</tr>
<tr>
<td>Drainage ditches, separators, impounding basins</td>
<td>2</td>
<td>2</td>
<td>Area up to 450 mm (18 in.) above ditch, separator, or basin; also, area up to 450 mm (18 in.) above grade level within 4.5 m (15 ft) horizontally from any edge.</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td>Same as pits and sumps.</td>
</tr>
<tr>
<td>Tank vehicle and tank car</td>
<td>1</td>
<td>0</td>
<td>Area inside of the tank</td>
</tr>
<tr>
<td>Loading through open dome</td>
<td>1</td>
<td>1</td>
<td>Area between 900 mm and 4.5 m (3 ft and 15 ft) from edge of dome, extending in all directions.</td>
</tr>
<tr>
<td>Loading through bottom connections with atmospheric venting</td>
<td>1</td>
<td>1</td>
<td>Area inside of the tank.</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Within 900 mm (3 ft) of point of venting to atmosphere, extending in all directions.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Area between 900 mm and 4.5 m (3 ft and 15 ft) from point of venting to atmosphere, extending in all directions; also, up to 450 mm (18 in.) above grade within a horizontal radius of 3.0 m (10 ft) from point of loading connection</td>
</tr>
<tr>
<td>Loading through closed dome with atmospheric venting</td>
<td>1</td>
<td>0</td>
<td>Area inside of the tank</td>
</tr>
<tr>
<td>Loading through closed dome with vapor control</td>
<td>1</td>
<td>1</td>
<td>Within 900 mm (3 ft) of open end of vent, extending in all directions.</td>
</tr>
<tr>
<td>Loading through closed dome with vapor control</td>
<td>2</td>
<td>2</td>
<td>Area between 900 mm and 4.5 m (3 ft and 15 ft) from open end of vent, extending in all directions; also, within 900 mm (3 ft) of edge of dome, extending in all directions.</td>
</tr>
<tr>
<td>Bottom loading with vapor control or any bottom unloading</td>
<td>2</td>
<td>2</td>
<td>Within 900 mm (3 ft) of point of connection of both fill and vapor lines extending in all directions.</td>
</tr>
<tr>
<td>Bottom loading with vapor control or any bottom unloading</td>
<td>2</td>
<td>2</td>
<td>Within 900 mm (3 ft) of point of connections, extending in all directions; also up to 450 mm (18 in.) above grade within a horizontal radius of 3.0 m (10 ft) from point of connections.</td>
</tr>
<tr>
<td>Storage and repair garage for tank vehicles</td>
<td>1</td>
<td>1</td>
<td>All pits or spaces below floor level.</td>
</tr>
<tr>
<td>Storage and repair garage for tank vehicles</td>
<td>2</td>
<td>2</td>
<td>Area up to 450 mm (18 in.) above floor or grade level for entire storage or repair garage.</td>
</tr>
<tr>
<td>Garages for other than tank vehicles</td>
<td>1</td>
<td></td>
<td>Ordinary.</td>
</tr>
<tr>
<td>Outdoor drum storage</td>
<td>1</td>
<td></td>
<td>If there is any opening to these rooms within the extent of an outdoor classified location, the entire room shall be classified the same as the area classification at the point of the opening.</td>
</tr>
</tbody>
</table>
### Ordinary

<table>
<thead>
<tr>
<th>Inside rooms or storage lockers used for the storage of Class I liquids</th>
<th>2</th>
<th>Entire room or locker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor warehousing where there is no flammable liquid transfer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Ordinary

| If there is any opening to these rooms within the extent of an indoor classified location, the classified location shall extend through the opening to the same extent as if the wall, curb, or partition did not exist. |   |                       |

| If there is any opening to these rooms within the extent of an indoor classified location, the room shall be classified the same as if the wall, curb, or partition did not exist. |   |                       |

### Ordinary

<table>
<thead>
<tr>
<th>See Figure 515.3.</th>
</tr>
</thead>
</table>

1 The release of Class I liquids can generate vapors to the extent that the entire building, and possibly an area surrounding it, should be considered a Class I, Division 2 or Zone 2 location.

2 When classifying extent of area, consideration shall be given to the fact that tank cars or tank vehicles can be spotted at varying points. Therefore, the extremities of the loading or unloading positions shall be used. [30: Table 7.3.3]

**Figure 515.3 Area Classification for a Marine Terminal Handling Flammable Liquids. [30:Figure 29.3.22]**

### Statement of Problem and Substantiation for Public Comment

The term ordinary is not defined for classified locations. The term should be unclassified.

**Related Item**

First Revision No. 3953-NFPA 70-2015 [Section No. 515.3]

### Submitter Information Verification

- **Submitter Full Name:** John Simmons
- **Organization:** Florida East Coast JATC
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Fri Sep 25 20:19:13 EDT 2015

### Committee Statement

- **Committee Action:** Accepted
- **Resolution:** SR-3929-NFPA 70-2015
- **Statement:** The term ordinary is not a defined area but the term unclassified is. Section 3.2.7.3.2 of the NEC Style Manual allows edits to extracted material to make style consistent with the NEC.
Article 516  Spray Application, Dipping, Coating, and Printing Processes Using Flammable or Combustible Materials

Informational Note: Text that is followed by a reference in brackets has been extracted from NFPA 33-2015, Standard for Spray Application Using Flammable and Combustible Materials, or NFPA 34-2015, Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids. Only editorial changes were made to the extracted text to make it consistent with this Code.

Part I. General

516.1  Scope.

This article covers the regular or frequent application of flammable liquids, combustible liquids, and combustible powders by spray operations and the application of flammable liquids, or combustible liquids at temperatures above their flashpoint, by spraying, dipping, coating, printing, or other means.

Informational Note: For further information regarding safeguards for these processes, such as fire protection, posting of warning signs, and maintenance, see NFPA 33-2015, Standard for Spray Application Using Flammable and Combustible Materials, and NFPA 34-2015, Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids. For additional information regarding ventilation, see NFPA 91-2010, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids.

516.2  Definitions.

For the purpose of this article, the following definitions shall apply.

**Limited Finishing Workstation.**
An apparatus that is capable of confining the vapors, mists, residues, dusts, or deposits that are generated by a spray application process and that meets the requirements of Section 14.3 of NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials, but does not meet the requirements of a spray booth or spray room, as herein defined. [33: 3.3.18.1]

**Outdoor Spray Area.**
A spray area that is outside the confines of a building or that has a canopy or roof that does not limit the dissipation of the heat of a fire or dispersion of flammable vapors and does not restrict fire-fighting access and control. For the purpose of this standard, an outdoor spray area can be treated as an unenclosed spray area. [33: 3.3.2.3.1]

**Spray Area.**
Any fully enclosed, partly enclosed, or unenclosed area in which dangerous quantities of flammable or combustible vapors, mists, residues, dusts, or deposits are present due to the operation of spray processes, including (1) any area in the direct path of a spray application process; (2) the interior of a spray booth, spray room, or limited finishing workstation, as herein defined; (3) the interior of any exhaust plenum, eliminator section, or scrubber section; (4) the interior of any exhaust duct or exhaust stack leading from a spray application process; (5) the interior of any air recirculation path up to and including recirculation particulate filters; (6) any solvent concentrator (pollution abatement) unit or solvent recovery (distillation) unit; and (7) the inside of a membrane enclosure. The following are not part of the spray area: (1) fresh air make-up units; (2) air supply ducts and air supply plenums; (3) recirculation air supply ducts downstream of recirculation particulate filters; (4) exhaust ducts from solvent concentrator (pollution abatement) units. [33: 3.3.2.3]

Informational Note: Unenclosed spray areas are locations outside of buildings or are localized operations within a larger room or space. Such are normally provided with some local vapor extraction/ventilation system. In automated operations, the area limits are the maximum area in the direct path of spray operations. In manual operations, the area limits are the maximum area of spray when aimed at 90 degrees to the application surface.

**Spray Booth.**
A power-ventilated enclosure for a spray application operation or process that confines and limits the escape of the material being sprayed, including vapors, mists, dusts, and residues that are produced by the spraying operation and conducts or directs these materials to an exhaust system. [33: 3.3.15]

Informational Note: A spray booth is an enclosure or insert within a larger room used for spray/coating/dipping applications. A spray booth can be fully enclosed or have open front or face and can include separate conveyor entrance and exit. The spray booth is provided with a dedicated ventilation exhaust with supply air from the larger room or from a dedicated air supply.

**Spray Room.**
A power-ventilated fully enclosed room used exclusively for open spraying of flammable or combustible materials. [33: 3.3.16]

**Unenclosed Spray Area.**
Any spray area that is not confined by a limited finishing workstation, spray booth, or spray room, as herein defined. [33: 3.3.2.3.2]
Part II. Open Containers

516.4 Area Classification.

For open containers, supply containers, waste containers, spray gun cleaners, and solvent distillation units that contain Class I liquids that are located in ventilated areas, electrical area classification shall be in accordance with the following:

(1) The area within 915 mm (3 ft) in all directions from any such container or equipment and extending to the floor or grade level shall be classified as Class I, Division 1 or Class I, Zone 1, whichever is applicable. [33: 6.5.5.1]

(2) The area extending 610 mm (2 ft) beyond the Division 1 or Zone 1 location shall be classified as Class I, Division 2 or Class I, Zone 2, whichever is applicable. [33: 6.5.5.1]

(3) The area extending 1525 mm (5 ft) horizontally beyond the area described in 516.4 (b) up to a height of 460 mm (18 in.) above the floor or grade level shall be classified as Class I, Division 2 or Class I, Zone 2, whichever is applicable. [33: 6.5.5.1]

(4) The area inside any tank or container shall be classified as Class I, Division 1 or Class I, Zone 0, whichever is applicable. [33: 6.5.5.1]

(5) Sumps, pits, or below grade channels within 3.5 m (10 ft) horizontally of a vapor source shall be classified as Class I, Division 1 or Zone 1. If the sump, pit, or channel extends beyond 3.5 m (10 ft) from the vapor source, it shall be provided with a vapor stop or it shall be classified as Class I, Division 1 or Zone 1 for its entire length.

For the purposes of electrical area classification, the Division system and the Zone system shall not be intermixed for any given source of release. [33: 6.2.3]

Electrical wiring and utilization equipment installed in these areas shall be suitable for the location, as shown in Figure 516.4.

Figure 516.4 Electrical Area Classification for Class I Liquid Operations Around Open Containers, Supply Containers, Waste Containers, Spray Gun Cleaners, and Solvent Distillation Units. [33: Figure 6.5.5.2]

Part III. Spray Application Processes

516.5 Area Classification.

For spray application processes, the area classification is based on quantities of flammable vapors, combustible mists, residues, dusts, or deposits that are present or might be present in quantities sufficient to produce ignitable or explosive mixtures with air.

(A). Zone Classification of Locations.

(1) Classification of Locations.

The Zone system of electrical area classification shall be applied as follows:

(1) The inside of closed containers or vessels shall be considered a Class I, Zone 0 location.

(2) A Class I, Division 1 location shall be permitted to be alternatively classified as a Class I, Zone 1 location.

(3) A Class I, Division 2 location shall be permitted to be alternatively classified as a Class I, Zone 2 location.

(4) A Class II, Division 1 location shall be permitted to be alternatively classified as a Zone 21 location.

(5) A Class II, Division 2 location shall be permitted to be alternatively classified as a Zone 22 location. [33: 6.2.2]

(2) For the purposes of electrical area classification, the Division system and the Zone system shall not be intermixed for any given source of release. [33: 6.2.3]
In instances of areas within the same facility classified separately, Class I, Zone 2 locations shall be permitted to abut, but not overlap. Class I, Division 2 locations. Class I, Zone 0 or Zone 1 locations shall not abut Class I, Division 1 or Division 2 locations. [70: 505.7(B)] [33: 6.2.4]

Open flames, spark-producing equipment or processes, and equipment whose exposed surfaces exceed the autoignition temperature of the material being sprayed shall not be located in a spray area or in any surrounding area that is classified as Division 2, Zone 2, or Zone 22. [33: 6.2.5]

Exception: This requirement shall not apply to drying, curing, or fusing apparatus.

Any utilization equipment or apparatus that is capable of producing sparks or particles of hot metal and that is located above or adjacent to either the spray area or the surrounding Division 2, Zone 2, or Zone 22 areas shall be of the totally enclosed type or shall be constructed to prevent the escape of sparks or particles of hot metal. [33: 6.2.6]

(B) Class I, Division 1 or Class I, Zone 0 Locations.

The interior of any open or closed container or vessel of a flammable liquid shall be considered Class I, Division 1, or Class I, Zone 0, as applicable:

Informational Note: For additional guidance, see Chapter 6 of NFPA 33-2015, Standard for Spray Application Using Flammable or Combustible Materials.

(C) Class I, Division 1; Class I, Zone 1; Class II, Division 1; or Zone 21 Locations.

The following spaces shall be considered Class I, Division 1; Class I, Zone 1; Class II, Division 1; or Zone 21 locations, as applicable:

1. The interior of spray booths and rooms except as specifically provided in 516.5(D).
2. The interior of exhaust ducts.
3. Any area in the direct path of spray operations.
4. Sumps, pits, or below grade channels within 7.5 m (25 ft) horizontally of a vapor source. If the sump, pit, or channel extends beyond 7.5 m (25 ft) from the vapor source, it shall be provided with a vapor stop or it shall be classified as Class I, Division 1 for its entire length. [34: 6.4.1]
5. All space in all directions outside of but within 900 mm (3 ft) of open containers, supply containers, spray gun cleaners, and solvent distillation units containing flammable liquids.
6. For limited finishing workstations, the area inside the curtains or partitions. (See Figure 516.5(D)(5).)

(D) Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 Locations.

The spaces listed in 516.5(D)(1) through (D)(5) shall be considered Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 as applicable.
(1) **Unenclosed Spray Processes.**

For unenclosed spraying, all space outside of but within 6 m (20 ft) horizontally and 3 m (10 ft) vertically of the Class I, Division 1 or Class I, Zone 1 location as defined in 516.5(A) and not separated from it by partitions. (See Figure 516.5(D)(1) [33: 6.5.1]

*Figure 516.5(D)(1) Electrical Area Classification for Unenclosed Spray Areas. [33:Figure 6.5.1]*

![Diagram of unenclosed spray area](image)
Closed-Top, Open-Face, and Open-Front Spray Booths and Spray Rooms

If spray application operations are conducted within a closed-top, open-face, or open-front booth or room, as shown in Figure 516.5(D)(2), any electrical wiring or utilization equipment located outside of the booth or room but within 915 mm (3 ft) of any opening shall be suitable for Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable. The Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations shown in Figure 516.5(D)(2) shall extend from the edges of the open face or open front of the booth or room.

Figure 516.5(D)(2) Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 Locations Adjacent to a Closed Top, Open Face, or Open Front Spray Booth or Room. [33:Figure 6.5.2]

Open-Top Spray Booths

For spraying operations conducted within an open top spray booth, the space 915 mm (3 ft) vertically above the booth and within 915 mm (3 ft) of other booth openings shall be considered Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 whichever is applicable. [33:6.5.3]

Enclosed Spray Booths and Spray Rooms

For spray application operations confined to an enclosed spray booth or room, electrical area classification shall be as follows: [33:6.5.4]

1. The area within 915 mm (3 ft) of any opening shall be classified as Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 whichever is applicable, as shown in Figure 516.5(D)(4). [33:6.5.4]

2. Where automated spray application equipment is used, the area outside the access doors shall be unclassified provided the door interlock prevents the spray application operations when the door is open.

3. Where exhaust air is permitted to be recirculated, both of the following shall apply:

   4. The interior of any recirculation path from the secondary particulate filters up to and including the air supply plenum shall be classified as Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable.

   5. The interior of fresh air supply ducts shall be unclassified. [33:6.5.4]

6. Where exhaust air is not recirculated, the interior of fresh air supply ducts and fresh air supply plenums shall be unclassified. [33:6.5.4]
(5) Limited Finishing Workstations.

For limited finishing workstations, the area inside the 915 mm (3 ft) space horizontally and vertically beyond the volume enclosed by the outside surface of the curtains or partitions shall be classified as Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22, as shown in Figure 516.5(D)(5).

Figure 516.5(D)(4) Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 Locations Adjacent to an Enclosed Spray Booth or Spray Room. [33 Figure 6.5.4]

Figure 516.5(D)(5) Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 Locations Adjacent to an Enclosed Spray Booth or Spray Room. [33 Figure 14.3.5.1]

516.6 Wiring and Equipment in Class I Locations.
(A) Wiring and Equipment — Vapors.

All electrical wiring and equipment within the Class I location (containing vapor only — not residues) defined in 516.5 shall comply with the applicable provisions of Article 501 or Article 505, as applicable.

(B) Wiring and Equipment — Vapors and Residues.

Unless specifically listed for locations containing deposits of dangerous quantities of flammable or combustible vapors, mists, residues, dusts, or deposits (as applicable), there shall be no electrical equipment in any spray area as herein defined whereon deposits of combustible residue may readily accumulate, except wiring in rigid metal conduit, intermediate metal conduit, Type MI cable, or in metal boxes or fittings containing no taps, splices, or terminal connections. [33: 6.4.2]
Luminaires shall be permitted to be installed as follows:

1. Luminaires, like that shown in Figure 516.6(C)(a), that are attached to the walls or ceiling of a spray area but that are outside any classified area and are separated from the spray area by glass panels shall be suitable for use in unclassified locations. Such fixtures shall be serviced from outside the spray area. [33: 6.6.1]

2. Luminaires, like that shown in Figure 516.6(C)(a), that are attached to the walls or ceiling of a spray area; that are separated from the spray area by glass panels and that are located within a Class I, Division 2; a Class I, Zone 2; a Class II, Division 2; or a Zone 22 location shall be suitable for such location. Such fixtures shall be serviced from outside the spray area. [33: 6.6.2]

3. Luminaires, like that shown in Figure 516.6(C)(b), that are an integral part of the walls or ceiling of a spray area shall be permitted to be separated from the spray area by glass panels that are an integral part of the fixture. Such fixtures shall be listed for use in Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable, and also shall be listed for accumulations of deposits of combustible residues. Such fixtures shall be permitted to be serviced from inside the spray area. [33: 6.6.3]

4. Glass panels used to separate luminaires from the spray area or that are an integral part of the luminaire shall meet the following requirements:
   
   5. Panels for light fixtures or for observation shall be of heat-treated glass, laminated glass, wired glass, or hammer-wired glass and shall be sealed to confine vapors, mists, residues, dusts, and deposits to the spray area. [33: 5.5.1]

   Exception: Listed spray booth assemblies that have vision panels constructed of other materials shall be permitted.

   6. Panels for light fixtures shall be separated from the fixture to prevent the surface temperature of the panel from exceeding 93°C (200°F). [33: 5.5.2]

   7. The panel frame and method of attachment shall be designed to not fail under fire exposure before the vision panel fails. [33: 5.5.3]

Figure 516.6(C)(a) Example of a Luminaire that is Mounted Outside of the Spray Area and is Serviced from Outside the Spray Area. [33: Figure 6.6.1]

Figure 516.6(C)(b) Example of a Luminaire that is an Integral Part of the Spray Area and is Serviced from Inside the Spray Area. [33: Figure 6.6.3]
Portable electric luminaires or other utilization equipment shall not be used in a spray area during spray operations.

Exception No. 1: Where portable electric luminaires are required for operations in spaces not readily illuminated by fixed lighting within the spraying area, they shall be of the type identified for Class I, Division 1 or Class 1, Zone 1 locations where readily ignitable residues may be present. [33: 6.9 Exception]

Exception No. 2: Where portable electric drying apparatus is used in spray booths and the following requirements are met:

(a) The apparatus and its electrical connections are not located within the spray enclosure during spray operations.

(b) Electrical equipment within 450 mm (18 in.) of the floor is identified for Class I, Division 2 or Class I, Zone 2 locations.

(c) All metallic parts of the drying apparatus are electrically bonded and grounded.

(d) Interlocks are provided to prevent the operation of spray equipment while drying apparatus is within the spray enclosure, to allow for a 3-minute purge of the enclosure before energizing the drying apparatus and to shut off drying apparatus on failure of ventilation system.

Electrostatic spraying or detearing equipment shall be installed and used only as provided in 516.10.

Informational Note: For further information, see NFPA 33-2015, Standard for Spray Application Using Flammable or Combustible Materials.

All persons and all electrically conductive objects, including any metal parts of the process equipment or apparatus, containers of material, exhaust ducts, and piping systems that convey flammable or combustible liquids, shall be electrically grounded. [34: 6.8.1]

516.7 Wiring and Equipment Not Within Classified Locations.
(A) Wiring.

All fixed wiring above the Class I and II locations shall be in metal raceways, Type PVC conduit, Type RTRC conduit, or electrical nonmetallic tubing; where cables are used, they shall be Type MI, Type TC, or Type MC cable. Cellular metal floor raceways shall only be permitted to supply ceiling outlets or as extensions to the area below the floor of a Class I or II location. Where cellular metal raceways are used, they shall not have connections leading into or passing through the Class I or II location unless suitable seals are provided.

(B) Equipment.

Equipment that may produce arcs, sparks, or particles of hot metal, such as lamps and lampholders for fixed lighting, cutouts, switches, receptacles, motors, or other equipment having make-and-break or sliding contacts, where installed above a classified location or above a location where freshly finished goods are handled, shall be of the totally enclosed type or be constructed so as to prevent the escape of sparks or hot metal particles.

516.10 Special Equipment.

(A) Fixed Electrostatic Equipment.

This section shall apply to any equipment using electrostatically charged elements for the atomization, charging, and/or precipitation of hazardous materials for coatings on articles or for other similar purposes in which the charging or atomizing device is attached to a mechanical support or manipulator. This shall include robotic devices. This section shall not apply to devices that are held or manipulated by hand. Where robot or programming procedures involve manual manipulation of the robot arm while spraying with the high voltage on, the provisions of 516.10(B) shall apply. The installation of electrostatic spraying equipment shall comply with 516.10(A)(1) through (A)(10). Spray equipment shall be listed. All automatic electrostatic equipment systems shall comply with 516.6(A) through (E).

1. Power and Control Equipment.

Transformers, high-voltage supplies, control apparatus, and all other electrical portions of the equipment shall be installed outside of the Class I location or be of a type identified for the location.

Exception: High-voltage grids, electrodes, electrostatic atomizing heads, and their connections shall be permitted within the Class I location.

2. Electrostatic Equipment.

Electrodes and electrostatic atomizing heads shall be adequately supported in permanent locations and shall be effectively insulated from ground. Electrodes and electrostatic atomizing heads that are permanently attached to their bases, supports, reciprocators, or robots shall be deemed to comply with this section.

3. High-Voltage Leads.

High-voltage leads shall be properly insulated and protected from mechanical damage or exposure to destructive chemicals. Any exposed element at high voltage shall be effectively guarded against accidental contact or grounding.


Goods being coated using this process shall be supported on conveyors or hangers. The conveyors or hangers shall be arranged (1) to ensure that the parts being coated are electrically connected to ground with a resistance of 1 megohm or less and (2) to prevent parts from swinging.

5. Automatic Controls.

Electrostatic apparatus shall be equipped with automatic means that will rapidly de-energize the high-voltage elements under any of the following conditions:

1. Stoppage of ventilating fans or failure of ventilating equipment from any cause
2. Stoppage of the conveyor carrying goods through the high-voltage field unless stoppage is required by the spray process
3. Occurrence of excessive current leakage at any point in the high-voltage system
4. De-energizing the primary voltage input to the power supply


All electrically conductive objects in the spray area, except those objects required by the process to be at high voltage, shall be adequately grounded. This requirement shall apply to paint containers, wash cans, guards, hose connectors, brackets, and any other electrically conductive objects or devices in the area.

Informational Note: For more information on grounding and bonding for static electricity purposes, see NFPA 33-2015, Standard for Spray Application Using Flammable or Combustible Materials; NFPA 34-2015, Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids; and NFPA 77-2007, Recommended Practice on Static Electricity.

7. Isolation.

Safeguards such as adequate booths, fencing, railings, interlocks, or other means shall be placed about the equipment or incorporated therein so that they, either by their location, character, or both, ensure that a safe separation of the process is maintained.
(8) Signs.

Signs shall be conspicuously posted to convey the following:

(1) Designate the process zone as dangerous with regard to fire and accident.
(2) Identify the grounding requirements for all electrically conductive objects in the spray area.
(3) Restrict access to qualified personnel only.

(9) Insulators.

All insulators shall be kept clean and dry.

(10) Other Than Nonincendive Equipment.

Spray equipment that cannot be classified as nonincendive shall comply with (A)(10)(a) and (A)(10)(b).

(a) Conveyors, hangers, and application equipment shall be arranged so that a minimum separation of at least twice the sparking distance is maintained between the workpiece or material being sprayed and electrodes, electrostatic atomizing heads, or charged conductors. Warnings defining this safe distance shall be posted. [33:11.4.1]

(b) The equipment shall provide an automatic means of rapidly de-energizing the high-voltage elements in the event the distance between the goods being painted and the electrodes or electrostatic atomizing heads falls below that specified in (a). [33:11.3.8]

(B) Hand-Spraying Electrostatic Equipment.

This section shall apply to any equipment using electrostatically charged elements for the atomization, charging, or precipitation of flammable and combustible materials for coatings on articles, or for other similar purposes in which the charging or atomizing device is hand-held and manipulated during the spraying operation. Electrostatic hand-spraying equipment and devices used in connection with paint-spraying operations shall be of listed types and shall comply with 516.10(B)(1) through (B)(5).

(1) General.

The high-voltage circuits shall be designed so as not to produce a spark of sufficient intensity to ignite the most readily ignitable of those vapor–air mixtures likely to be encountered, or result in appreciable shock hazard upon coming in contact with a grounded object under all normal operating conditions. The electrostatically charged exposed elements of the handgun shall be capable of being energized only by an actuator that also controls the coating material supply.

(2) Power Equipment.

Transformers, power packs, control apparatus, and all other electrical portions of the equipment shall be located outside of the Class I location or be identified for the location.

Exception: The handgun itself and its connections to the power supply shall be permitted within the Class I location.

(3) Handle.

The handle of the spraying gun shall be electrically connected to ground by a conductive material and be constructed so that the operator in normal operating position is in electrical contact with the grounded handle with a resistance of not more than 1 megohm to prevent buildup of a static charge on the operator's body. Signs indicating the necessity for grounding other persons entering the spray area shall be conspicuously posted.

(4) Electrostatic Equipment.

All electrically conductive objects in the spraying area, except those objects required by the process to be at high voltage shall be electrically connected to ground with a resistance of not more than 1 megohm. This requirement shall apply to paint containers, wash cans, and any other electrical conductive objects or devices in the area. The equipment shall carry a prominent, permanently installed warning regarding the necessity for this grounding feature.

Informational Note: For more information on grounding and bonding for static electricity purposes, see NFPA 33-2015, Standard for Spray Application Using Flammable or Combustible Materials; NFPA 34-2015, Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids; and NFPA 77, 2007, 2014, Recommended Practice on Static Electricity.

(5) Support of Objects.

Objects being painted shall be maintained in electrical contact with the conveyor or other grounded support. Hooks shall be regularly cleaned to ensure adequate grounding of 1 megohm or less. Areas of contact shall be sharp points or knife edges where possible. Points of support of the object shall be concealed from random spray where feasible; and, where the objects being sprayed are supported from a conveyor, the point of attachment to the conveyor shall be located so as to not collect spray material during normal operation.

(C) Powder Coating.

This section shall apply to processes in which combustible dry powders are applied. The hazards associated with combustible dusts are present in such a process to a degree, depending on the chemical composition of the material, particle size, shape, and distribution.
(1) Electrical Equipment and Sources of Ignition.

Electrical equipment and other sources of ignition shall comply with the requirements of Article 502. Portable electric luminaires and other utilization equipment shall not be used within a Class II location during operation of the finishing processes. Where such luminaires or utilization equipment are used during cleaning or repairing operations, they shall be of a type identified for Class II, Division 1 locations, and all exposed metal parts shall be connected to an equipment grounding conductor.

Exception: Where portable electric luminaires are required for operations in spaces not readily illuminated by fixed lighting within the spraying area, they shall be of the type listed for Class II, Division 1 locations where readily ignitable residues may be present.

(2) Fixed Electrostatic Spraying Equipment.

The provisions of 516.10(A) and 516.10(C)(1) shall apply to fixed electrostatic spraying equipment.

(3) Electrostatic Hand-Spraying Equipment.

The provisions of 516.10(B) and 516.10(C)(1) shall apply to electrostatic hand-spraying equipment.

(4) Electrostatic Fluidized Beds.

Electrostatic fluidized beds and associated equipment shall be of identified types. The high-voltage circuits shall be designed such that any discharge produced when the charging electrodes of the bed are approached or contacted by a grounded object shall not be of sufficient intensity to ignite any powder–air mixture likely to be encountered or to result in an appreciable shock hazard.

(a) Transformers, power packs, control apparatus, and all other electrical portions of the equipment shall be located outside the powder-coating area or shall otherwise comply with the requirements of 516.10(C)(1).

Exception: The charging electrodes and their connections to the power supply shall be permitted within the powder-coating area.

(b) All electrically conductive objects within the powder-coating area shall be adequately grounded. The powder-coating equipment shall carry a prominent, permanently installed warning regarding the necessity for grounding these objects.

Informational Note: For more information on grounding and bonding for static electricity purposes, see NFPA 33-2015, Standard for Spray Application Using Flammable or Combustible Materials; NFPA 34-2015, Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids; and NFPA 77-2007, Recommended Practice on Static Electricity.

(c) Objects being coated shall be maintained in electrical contact (less than 1 megohm) with the conveyor or other support in order to ensure proper grounding. Hangers shall be regularly cleaned to ensure effective electrical contact. Areas of electrical contact shall be sharp points or knife edges where possible.

(d) The electrical equipment and compressed air supplies shall be interlocked with a ventilation system so that the equipment cannot be operated unless the ventilating fans are in operation. [33: Chapter 15]

516.16 Grounding.

All metal raceways, the metal armors or metallic sheath on cables, and all non–current-carrying metal parts of fixed or portable electrical equipment, regardless of voltage, shall be grounded and bonded. Grounding and bonding shall comply with 501.30, 502.30, or 505.25, as applicable.

Part IV Spray Application Operations in Membrane Enclosures.

516.18 Membrane Enclosure Use.

Spray application operations within both outdoor and indoor temporary membrane enclosures shall be limited to workpieces that cannot be moved into a spray booth and where open spraying is not practical due to the proximity to other operations, finish quality, or concerns such as the collection of overspray.

(1) Spray application operations and processes within the enclosure shall only be permitted for the workpiece for which the enclosure was erected.

(2) Spray application operations for parts removed from the workpiece shall be conducted in accordance with applicable requirements of this standard.

(3) Membrane enclosures shall be erected for 180 days or less.

(4) Enclosures erected under this chapter shall only be used for the duration of a spray operation at a fixed location which can involve multiple coats for a single workpiece.

(5) Membrane material shall not be reused for any other spray application operations.

(6) Operations conducted within the enclosure other than spray applications shall meet the fire and safety requirements for those operations.

(7) These operations shall not take place while the spray application operation is in progress.

Informational Note: For additional guidance, see Chapter 18 of NFPA 33-2015, Standard for Spray Application Using Flammable or Combustible Materials.
516.20. Location of Temporary Membrane Enclosures.
Temporary membrane enclosures shall be permitted to be located in accordance with 516.20(A) and 516.20(B).

(A). Outside of Buildings.
The spray area shall be separated from permanent structures by a minimum of 4.6 m (15 ft).

(B). Inside of Buildings.
Membrane enclosures for spray painting shall be permitted to be installed in buildings provided all of the requirements 516.21 are met.

Membrane materials shall comply with the following requirements:

1. Material used in a vertical plane for membrane enclosures shall have been tested and passed the NFPA 701-2015, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films, Test 2 requirements.

2. Other than material in a vertical plane, the membrane material shall be listed for installation beneath sprinklers and installed to meet the requirements of 8.15.15 of NFPA 13-2014, Standard for the Installation of Sprinkler Systems.

3. Where a listed membrane material is used, it shall be considered a drop-out ceiling in NFPA 13-2014, Standard for the Installation of Sprinkler Systems, and follow the applicable requirements for those assemblies.

Informational Note: Buildings in which membrane enclosures are installed are provided with automatic sprinkler systems in accordance with the requirements for indoor membrane enclosures of NFPA 33-2015, Standard for Spray Application Using Flammable or Combustible Materials.

516.22. Area Classification for Temporary Membrane Enclosures.
The area classification shall be as given in 516.22(A)(1) through (A)(8) and is illustrated by Figure 516.22.
(A) Classification of Locations.

The zone system of electrical area classification shall be applied as follows:

1. A 1.5 m (5 ft) zone outside of the membrane enclosure shall be considered Class I, Division 2, as shown in Figure 516.22.

2. All lighting, electrical power cords, and any related equipment within the membrane enclosure shall be rated for Class I Division 1 as defined by NFPA 70 when used during spray paint operations.

3. All lighting, electrical power cords, and any related equipment within the 1.5 m (5 ft) distance horizontally from the exterior of the membrane enclosure shall be listed for Class I Division 2 as defined by NFPA 70 when used during spray paint operations.

4. All power to the workpiece shall be removed during spray painting.

5. Workpieces shall be grounded.

6. Scaffolding shall be bonded to the workpiece and grounded to an appropriate grounding rod or other approved method consistent with 6.2.1 referenced requirements.

7. Spray paint equipment shall be grounded.

8. Equipment used to monitor the concentration of solvent vapors shall be calibrated for the solvents used. The calibration frequency shall be per the manufacturer’s recommendations.

Figure 516.22 Electrical Classifications for Temporary Outdoor Membrane Enclosures [33:Figure 18.7.1.1]

516.23 Electrical and Other Sources of Ignition.

Electrical wiring and utilization equipment used in membrane enclosures during spray painting shall comply with 516.5(A)(1).
516.24. **Ventilation.**

Each membrane enclosure shall be provided with mechanical ventilation consistent with the following:

1. The ventilation system shall be designed and installed to ensure that the enclosure is maintained at a pressure that is negative relative to the surrounding environs.

2. The concentration of the vapors and mists in the exhaust stream of the ventilation system during spray operations and ambient air drying operations shall not exceed 10 percent of the lower flammable limit.

3. All spray operations within the membrane enclosure shall cease operations when the concentration of the vapors and mists in the exhaust stream of the ventilation system reaches or exceeds 10 percent of the lower flammable limit.

4. An interlock shall be provided so that the spray apparatus is automatically stopped if the ventilation system fails to maintain the concentration of the vapors and mists in the exhaust stream below 10 percent of the lower flammable limit.

5. Where interlocks cannot be effectively provided for ventilation equipment that uses plant air, large air storage tanks, or equipment that cannot be instantly shut off, an audible alarm upon loss of ventilation that will alert all spray paint operators shall be permitted with authority having jurisdiction approval.

6. Exhaust air shall be taken from one or more points within 300 mm (12 in.) of the floor of the enclosure.

7. An adequate supply of clean make-up air shall be provided per the requirements of NFPA 33-2015, *Standard for Spray Application Using Flammable or Combustible Materials*.

8. The location of both the exhaust and make-up air openings shall be arranged to provide air movement throughout the enclosure and across all portions of the floor to prevent accumulation of flammable vapors.

   Each membrane spray enclosure shall be provided with mechanical ventilation that is capable of confining and removing vapors and mists to a safe location and is capable of confining and controlling combustible residues, dusts, and deposits. The concentration of the vapors and mists in the exhaust stream of the ventilation system shall not exceed 25 percent of the lower flammable limit.

9. Air exhausted from the membrane enclosure shall not be recirculated.

   Air exhausted to the atmosphere from liquid spray operations shall be conducted by ducts directly to the outside of the building. Exhaust ducts shall follow the most direct route to the point of discharge but shall not penetrate a fire wall. The exhaust discharge shall be directed away from any fresh air intakes. The exhaust duct discharge point shall be at least 1830 mm (6 ft) from any exterior wall or roof. The exhaust duct shall not discharge in the direction of any combustible construction that is within 7625 mm (25 ft) of the exhaust duct discharge point, nor shall it discharge in the direction of any unprotected opening in any noncombustible or limited-combustible construction that is within 7625 mm (25 ft) of the exhaust duct discharge point.

516.25. **Drying.**

Membrane enclosures used for spray application of flammable or combustible materials shall not be used for drying, curing, or fusing operations at elevated temperature.

Freshly sprayed workpieces shall be dried only in spaces that are ventilated to prevent the concentration of vapors from exceeding 10 percent of the lower flammable limit.

516.26. **Facilities Compliance Permitting.**

Spray application within temporary membrane enclosures shall be permitted and approved.

Informational Note: Spray application within temporary membrane enclosures can occur only after the requirements of Chapter 18 of NFPA 33-2015, *Standard for Spray Application Using Flammable or Combustible Materials*, are met.

Part V. **Printing, Dipping, and Coating Processes**
516.29 . Classification of Locations.
Classification is based on quantities of flammable vapors, combustible mists, residues, dusts, or deposits that are present or might be present in quantities sufficient to produce ignitable or explosive mixtures with air. Electrical wiring and electrical utilization equipment located adjacent to open processes shall comply with the requirements as follows. Examples of these requirements are illustrated in Figure 516.29(a), Figure 516.29(b), Figure 516.29(c), and Figure 516.29(d).


1. Electrical wiring and electrical utilization equipment located in any sump, pit, or below grade channel that is within 7620 mm (25 ft) horizontally of a vapor source, as defined by this standard, shall be suitable for Class I, Division 1 or Class I, Zone 1 locations. If the sump, pit, or channel extends beyond 7620 mm (25 ft) of the vapor source, it shall be provided with a vapor stop, or it shall be classified as Class I, Division 1 or Class I, Zone 1 for its entire length. [34: 6.4.1]

2. Electrical wiring and electrical utilization equipment located within 1525 mm (5 ft) of a vapor source shall be suitable for Class I, Division 1 or Class I, Zone 1 locations. The space inside a dip tank, ink fountain, ink reservoir, or ink tank shall be classified as Class I, Division 1 or Class I, Zone 0, whichever is applicable.

3. Electrical wiring and electrical utilization equipment located within 915 mm (3 ft) of the Class I, Division 1 or Class I, Zone 1 location shall be suitable for Class I, Division 2 or Class I, Zone 2 locations, whichever is applicable.

4. The space 915 mm (3 ft) above the floor and extending 6100 mm (20 ft) horizontally in all directions from the Class I, Division 1 or Class I, Zone 1 location shall be classified as Class I, Division 2 or Class I, Zone 2, and electrical wiring and electrical utilization equipment located within this space shall be suitable for Class I, Division 2 or Class I, Zone 2 locations, whichever is applicable.

5. This space shall be permitted to be nonclassified for purposes of electrical installations if the surface area of the vapor source does not exceed 0.5 \( m^2 \) (5 ft\(^2\)), the contents of the dip tank, ink fountain, ink reservoir, or ink tank do not exceed 19 L (5 gal), and the vapor concentration during operating and shutdown periods does not exceed 25 percent of the lower flammable limit.

Figure 516.29(a) Electrical Area Classification for Open Dipping and Coating Processes Without Vapor Containment or Ventilation. [34: Figure 6.4(a)]

Figure 516.29(b) Electrical Area Classification for Open Dipping and Coating Processes with Peripheral Vapor Containment and Ventilation — Vapors Confined to Process Equipment. [34: Figure 6.4(b)]
Figure 516.29(c) Electrical Area Classification for Open Dipping and Coating Processes with Partial Peripheral Vapor Containment and Ventilation — Vapors NOT Confined to Process Equipment. [34:Figure 6.4(c)]

Figure 516.29(d) Electrical Area Classification for a Typical Printing Process. [34:Figure 6.4(d)]
**516.35. Areas Adjacent to Enclosed Dipping and Coating Processes.**

Areas adjacent to enclosed dipping and coating processes are illustrated by Figure 516.35 and shall be classified as follows:

1. The interior of any enclosed dipping or coating process or apparatus shall be a Class I, Division 1 or Class I, Zone 1 location, and electrical wiring and electrical utilization equipment located within this space shall be suitable for Class I, Division 1 or Class I, Zone 1 locations, whichever is applicable. The area inside the dip tank shall be classified as Class I, Division 1 or Class I, Zone 0, whichever is applicable.

2. The space within 915 mm (3 ft) in all directions from any opening in the enclosure and extending to the floor or grade level shall be classified as Class I, Division 2 or Class I, Zone 2, and electrical wiring and electrical utilization equipment located within this space shall be suitable for Class I, Division 2 locations or Class I, Zone 2 locations, whichever is applicable.

3. All other spaces adjacent to an enclosed dipping or coating process or apparatus shall be classified as nonhazardous for purposes of electrical installations.

**Figure 516.35 Electrical Area Classification Around Enclosed Dipping and Coating Processes. [34:Figure 6.5]**

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**516.36. Equipment and Containers in Ventilated Areas.**

Open containers, supply containers, waste containers, and solvent distillation units that contain Class I liquids shall be located in areas ventilated in accordance with 516.4.

**516.37. Luminaires.**

For printing, coating and dipping equipment where the process area is enclosed by glass panels that are sealed to confine vapors and mists to the inside of the enclosure, luminaires that are attached to the walls or ceilings of a process enclosure and that are located outside of any classified area shall be permitted to be of general purpose construction. Such luminaires shall be serviced from outside the enclosure.

Luminaires that are attached to the walls or ceilings of a process enclosure, are located within the Class I, Division 2 or Class I, Zone 2 location, and are separated from the process area by glass panels that are sealed to confine vapors and mists shall be suitable for use in that location. Such fixtures shall be serviced from outside the enclosure.

**516.38. Wiring and Equipment Not Within Classified Locations.**
(A) Wiring

All fixed wiring above the Class I and II locations shall be in metal raceways, Type PVC conduit, Type RTRC conduit, or electrical nonmetallic tubing; where cables are used, they shall be Type MI, Type TC, or Type MC cable. Cellular metal floor raceways shall only be permitted to supply ceiling outlets or as extensions to the area below the floor of a Class I or II location. Where cellular metal raceways, are used, they shall not have connections leading into or passing through the Class I or II location unless suitable seals are provided.

(B) Equipment

Equipment that is capable of producing arcs, sparks, or particles of hot metal, such as lamps and lampholders for fixed lighting, cutouts, switches, receptacles, motors, or other equipment having make-and-break or sliding contacts, where installed above a classified location or above a location where freshly finished goods are handled, shall be of the totally enclosed type or be constructed so as to prevent the escape of sparks or hot metal particles.

516.40 Static Electric Discharges

All persons and all electrically conductive objects, including any metal parts of the process equipment or apparatus, containers of material, exhaust ducts, and piping systems that convey flammable or combustible liquids, shall be electrically grounded.

Provision shall be made to dissipate static electric charges from all nonconductive substrates in printing processes.

Informational Note: For additional guidance on reducing the risk of ignition from electrostatic discharges, see NFPA 77-2014, Recommended Practice on Static Electricity.
Exposed Conductive Surfaces.
Those surfaces that are capable of carrying electric current and that are unprotected, unenclosed, or unguarded, permitting personal contact. Paint, anodizing, and similar coatings are not considered suitable insulation, unless they are listed for such use. [99:3.3.47]

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that the Panel clarify the location of the extracted section numbering because the second sentence of the defined term is not contained in the NFPA 99 definition. The Panel should revise the second sentence to comply with the NEC Style Manual with regard to mandatory text.

Related Item
First Revision No. 4237-NFPA 70-2015 [Definition: Exposed Conductive Surfaces.]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
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City:
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Submittal Date: Tue Sep 29 09:39:43 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4214-NFPA 70-2015
Statement: The second sentence is removed from the requirement and relocated as an Informational Note, since this sentence is not mandatory text. “Uninsulated” was inadvertently omitted in the FD.

This action addresses the concerns of the CC.
Patient Care Space.

Any space of a health care facility wherein patients are intended to be examined or treated. [99:3.3.127]

Basic Care (Category 3) Space.

Space in which failure of equipment or a system is not likely to cause injury to the patients, staff, or visitors but can cause patient discomfort. [99:3.3.127.3]

General Care (Category 2) Space.

Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [99:3.3.127.2]

Critical Care (Category 1) Space.

Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [99:3.3.127.1]

Support (Category 4) Space.

Space in which failure of equipment or a system is not likely to have a physical impact on patient care. [99:3.3.127.4]

Informational Note No. 1: The governing body of the facility designates patient care space in accordance with the type of patient care anticipated and with the definitions of the space classification. [99:1.3.4.1]

Informational Note No. 2: Business offices, corridors, lounges, day rooms, dining rooms, or similar areas typically are not classified as patient care space. [99:A.3.3.127]

Informational Note No. 3: Category 1 spaces, formerly known as critical care rooms (spaces), are typically where patients are intended to be subjected to invasive procedures and connected to line operated, patient care–related appliances. Examples include, but are not limited to, special care patient rooms used for critical care, intensive care, and special care treatment rooms such as angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, post-anesthesia care units, trauma rooms, and other similar rooms. [99:A.3.3.127.1]

Informational Note No. 4: Category 2 spaces were formerly known as general care rooms (spaces). Examples include, but are not limited to, inpatient bedrooms, dialysis rooms, in vitro fertilization rooms, procedural rooms, and similar rooms. [99:A.3.3.127.2]

Informational Note No. 5: Category 3 spaces, formerly known as basic care rooms (spaces), are typically where basic medical or dental care, treatment, or examinations are performed. Examples include, but are not limited to, examination or treatment rooms in clinics, medical and dental offices, nursing homes, and limited care facilities. [99:A.3.3.127.3]

Informational Note No. 6: Category 4 spaces were formerly known as support rooms (spaces). Examples of support spaces include, but are not limited to, anesthesia work rooms, sterile supply, laboratories, morgues, waiting rooms, utility rooms, and lounges. [99:A.3.3.127.4]

Additional Proposed Changes

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<td>Request and details to NFPA HEA-FUN Committee for use of parenthetic transition of NFPA 99-extracted terms</td>
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Statement of Problem and Substantiation for Public Comment

Aside from the editorial correction of "ofa" to "of a", this Public Comment is responsive to NEC® Correlating Committee Note CN155 regarding 2017 NEC® First Revision FR4247 for Article 517 [and First Revision FR347 for Section 210.8(B)].

In accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, HAS CONSENTED to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®.

Related Public Comments for This Document

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<th>Related Comment</th>
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<tr>
<td>Public Comment No. 1173-NFPA 70-2015 [Section No. 210.8(B)(3)]</td>
<td>use of terms defined in 517.2</td>
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<td>Public Comment No. 1173-NFPA 70-2015 [Section No. 210.8(B)(3)]</td>
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**Related Item**

- Correlating Committee Note No. 155-NFPA 70-2015 [Definition: Patient Care Space.]
- First Revision No. 4217-NFPA 70-2015 [Section No. 520.48]
- Public Input No. 2838-NFPA 70-2014 [Definition: Patient Care Space.]
- Public Input No. 4488-NFPA 70-2014 [Definition: Patient Care Space.]
- First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]
- Public Input No. 3239-NFPA 70-2014 [Section No. 210.8(B)]

Submitter Information Verification

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- **Submittal Date:** Thu Sep 24 07:57:56 EDT 2015

Committee Statement

- **Committee Action:** Rejected but see related SR
- **Resolution:** SR-4215-NFPA 70-2015
- **Statement:**

  Responsive to Correlating Committee (Public Comment PC 1813), in accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175.

  Accordingly, the 2017 NEC® will use the transitional terminology, as follows: “Critical Care Space (Category 1 Space)”, “General Care Space (Category 2 Space)”, “Basic Care Space (Category 3 Space)”, and “Support Space (Category 4 Space)”.

  CMP-15 intends to modify the 2020 NEC® to use the transitional terminology, as follows: “Category 1 Space (Critical Care Space)”, “Category 2 Space (General Care Space)”, “Category 3 Space (Basic Care Space)”, and “Category 4 Space (Support Space)”.

  CMP-15 intends to modify the 2023 NEC® to use NFPA 99’s terminology directly, as follows: “Category 1 Space”, “Category 2 Space”, “Category 3 Space”, and “Category 4 Space”.

  Relocation of the informational notes, in accordance with Public Comment PC 470, improves readability by immediately following the requirement to which each informational note applies. Although NEC® Style Manual 2.6.1 applies solely to Exceptions, Code-Making Panel 15 recommends to the Correlating Committee that similar guidelines be added to NEC® Style Manual (2.4.3) for Informational Notes as well.
Public Comment No. 1467-NFPA 70-2015 [Definition: Patient Care Space.]

**Patient, Category 1 Care Space.**
Any space of a health care facility wherein patients are intended to be examined or treated. [99:3.3.127]

**Basic, Care Space.**
Space in which failure of equipment or a system is not likely to cause injury to the patients, staff, or visitors but can cause patient discomfort. [99:3.3.127.3]

**General, Care Space.**
Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [99:3.3.127.2]

**Critical, Care (Category 1), Category 1 Care Space.**
Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [99:3.3.127.1]

**Support, Support Space.**
Space in which failure of equipment or a system is not likely to have a physical impact on patient care. [99:3.3.127.4]

Informational Note No. 1: The governing body of the facility designates patient care space in accordance with the type of patient care anticipated and with the definitions of the space classification. [99:1.3.4.1]

Informational Note No. 2: Business offices, corridors, lounges, day rooms, dining rooms, or similar areas typically are not classified as patient care space. [99:A.3.3.127]

Informational Note No.3: Category 1 spaces, formerly known as critical care rooms (spaces), are typically where patients are intended to be subjected to invasive procedures and connected to line operated, patient care–related appliances. Examples include, but are not limited to, special care patient rooms used for critical care, intensive care, and special care treatment rooms such as angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, post-anesthesia care units, trauma rooms, and other similar rooms. [99:A.3.3.127.1]

Informational Note No. 4: Category 2 spaces were formerly known as general care rooms (spaces). Examples include, but are not limited to, inpatient bedrooms, dialysis rooms, in vitro fertilization rooms, procedural rooms, and similar rooms. [99:A.3.3.127.2]

Informational Note No. 5: Category 3 spaces, formerly known as basic care rooms (spaces), are typically where basic medical or dental care, treatment, or examinations are performed. Examples include, but are not limited to, examination or treatment rooms in clinics, medical and dental offices, nursing homes, and limited care facilities. [99:A.3.3.127.3]

Informational Note No. 6: Category 4 spaces were formerly known as support rooms (spaces). Examples of support spaces include, but are not limited to, anesthesia work rooms, sterile supply, laboratories, morgues, waiting rooms, utility rooms, and lounges. [99:A.3.3.127.4]

**Statement of Problem and Substantiation for Public Comment**
The terms "Critical, patient, basic, general" are not in the referenced text in 99. including this term would be confusing to the user. NFPA 99 has specifically moved away from using those terms because they do not adequately describe the space needed.

**Related Public Comments for This Document**

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<td>Public Comment No. 1470-NFPA 70-2015 [Section No. 517.18]</td>
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<td>Public Input No. 4247-NFPA 70-2014 [Annex A]</td>
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**Submitter Information Verification**

Submitter Full Name: CHAD BEEBE
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Submittal Date: Fri Sep 25 12:44:43 EDT 2015
Committee Statement

Committee Action: Rejected

Resolution: In accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175. See the Second Revision created to 517.2 (Patient Care Space).
Public Comment No. 1813-NFPA 70-2015 [Definition: Patient Care Space.]

Patient Care Space.
Any space ofa health care facility wherein patients are intended to be examined or treated. [99:3.3.127]

Basic Care (Category 3) Space.
Space in which failure of equipment or a system is not likely to cause injury to the patients, staff, or visitors but can cause patient discomfort. [99:3.3.127.3]

General Care (Category 2) Space.
Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [99:3.3.127.2]

Critical Care (Category 1) Space.
Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [99:3.3.127.1]

Support (Category 4) Space.
Space in which failure of equipment or a system is not likely to have a physical impact on patient care. [99:3.3.127.4]

Informational Note No. 1: The governing body of the facility designates patient care space in accordance with the type of patient care anticipated and with the definitions of the space classification. [99:1.3.4.1]

Informational Note No. 2: Business offices, corridors, lounges, day rooms, dining rooms, or similar areas typically are not classified as patient care space. [99:A.3.3.127]

Informational Note No.3: Category 1 spaces, formerly known as critical care rooms (spaces), are typically where patients are intended to be subjected to invasive procedures and connected to line operated, patient care–related appliances. Examples include, but are not limited to, special care patient rooms used for critical care, intensive care, and special care treatment rooms such as angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, post-anesthesia care units, trauma rooms, and other similar rooms. [99:A.3.3.127.1]

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Informational Note No. 5: Category 3 spaces, formerly known as basic care rooms (spaces), are typically where basic medical or dental care, treatment, or examinations are performed. Examples include, but are not limited to, examination or treatment rooms in clinics, medical and dental offices, nursing homes, and limited care facilities. [99:A.3.3.127.3]

Informational Note No. 6: Category 4 spaces were formerly known as support rooms (spaces). Examples of support spaces include, but are not limited to, anesthesia work rooms, sterile supply, laboratories, morgues, waiting rooms, utility rooms, and lounges. [99:A.3.3.127.4]

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs Code-Making Panel 15 to give further consideration to the comments expressed in voting on FR 4247. Extracted material must comply with 4.3.2.2 of NEC Style Manual. This action will be considered as a public comment. The preferred method for parenthetical text is to have the new term first with the old term in parenthesis.

Related Item
First Revision No. 4247-NFPA 70-2015 [Definition: Patient Care Space.]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
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Submittal Date: Tue Sep 29 09:40:34 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4215-NFPA 70-2015

Statement: Responsive to Correlating Committee (Public Comment PC 1813), in accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175.

Accordingly, the 2017 NEC® will use the transitional terminology, as follows: “Critical Care Space (Category 1 Space)”, “General Care Space (Category 2 Space)”, “Basic Care Space (Category 3 Space)”, and “Support Space (Category 4 Space)”.

CMP-15 intends to modify the 2020 NEC® to use the transitional terminology, as follows: “Category 1 Space (Critical Care Space)”, “Category 2 Space (General Care Space)”, “Category 3 Space (Basic Care Space)”, and “Category 4 Space (Support Space)”.

CMP-15 intends to modify the 2023 NEC® to use NFPA 99’s terminology directly, as follows: “Category 1 Space”, “Category 2 Space”, “Category 3 Space”, and “Category 4 Space”.

Relocation of the informational notes, in accordance with Public Comment PC 470, improves readability by immediately following the requirement to which each informational note applies. Although NEC® Style Manual 2.6.1 applies solely to Exceptions, Code-Making Panel 15 recommends to the Correlating Committee that similar guidelines be added to NEC® Style Manual (2.4.3) for Informational Notes as well.
Public Comment No. 470-NFPA 70-2015 [ Definition: Patient Care Space. ]

Patient Care Space.
Any space ofa health care facility wherein patients are intended to be examined or treated. [99: 3.3.127]

Informational Note No. 1: The governing body of the facility designates patient care space in accordance with the type of patient care anticipated and with the definitions of the space classification. [99: 1.3.4.1]

Informational Note No. 2: Business offices, corridors, lounges, day rooms, dining rooms, or similar areas typically are not classified as patient care space. [99: A.3.3.127]

Basic Care (Category 3) Space.
Space in which failure of equipment or a system is not likely to cause injury to the patients, staff, or visitors but can cause patient discomfort. [99: 3.3.127.3]

Informational Note: Category 3 spaces, formerly known as basic care rooms (spaces), are typically where basic medical or dental care, treatment, or examinations are performed. Examples include, but are not limited to, examination or treatment rooms in clinics, medical and dental offices, nursing homes, and limited care facilities. [99: A.3.3.127.3]

General Care (Category 2) Space.
Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [99: 3.3.127.2]

Critical Care (Category 1) Space.
Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [99: 3.3.127.1]

Informational Note:
Category 2 spaces were formerly known as general care rooms (spaces). Examples include, but are not limited to, inpatient bedrooms, dialysis rooms, in vitro fertilization rooms, procedural rooms, and similar rooms. [99: A.3.3.127.2]

Support (Category 4) Space.
Space in which failure of equipment or a system is not likely to have a physical impact on patient care. [99: 3.3.127.4]

Informational Note:
Category 4 spaces were formerly known as support rooms (spaces). Examples of support spaces include, but are not limited to, anesthesia work rooms, sterile supply laboratories, morgues, waiting rooms, utility rooms, and lounges. [99: A.3.3.127.4]

Statement of Problem and Substantiation for Public Comment
Relocate Informational Notes.
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4215-NFPA 70-2015
Statement:

Responsive to Correlating Committee (Public Comment PC 1813), in accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175.

Accordingly, the 2017 NEC® will use the transitional terminology, as follows: “Critical Care Space (Category 1 Space)”, “General Care Space (Category 2 Space)”, “Basic Care Space (Category 3 Space)”, and “Support Space (Category 4 Space)”. CMP-15 intends to modify the 2020 NEC® to use the transitional terminology, as follows: “Category 1 Space (Critical Care Space)”, “Category 2 Space (General Care Space)”, “Category 3 Space (Basic Care Space)”, and “Category 4 Space (Support Space)”. CMP-15 intends to modify the 2023 NEC® to use NFPA 99’s terminology directly, as follows: “Category 1 Space”, “Category 2 Space”, “Category 3 Space”, and “Category 4 Space”.

Relocation of the informational notes, in accordance with Public Comment PC 470, improves readability by immediately following the requirement to which each informational note applies. Although NEC® Style Manual 2.6.1 applies solely to Exceptions, Code-Making Panel 15 recommends to the Correlating Committee that similar guidelines be added to NEC® Style Manual (2.4.3) for Informational Notes as well.
Grounding of Receptacles and Fixed Electrical Equipment in Patient Care Spaces.

Wiring in patient care spaces shall comply with 517.13(A) and (B).

(A) Wiring Methods.

All branch circuits serving patient care areas, spaces, shall be provided with an effective ground-fault current path by installation in a metal raceway system, or a cable having a metallic armor or sheath assembly. The metal raceway system, or metallic cable armor, or sheath assembly shall itself qualify as an equipment grounding conductor in accordance with 250.118.

(B) Insulated Equipment Grounding Conductors and Insulated Equipment Bonding Jumpers.

(1) General.

The following shall be directly connected to an insulated copper equipment grounding conductor that is green, clearly identified along its entire length by green insulation, and installed with the branch circuit conductors in the wiring methods as provided in 517.13(A):

(1) The grounding terminals of all receptacles other than isolated ground receptacles

(2) Where receptacles are mounted in metal receptacle outlet boxes, metal device boxes, or metal enclosures, the performance of the connection between the receptacle grounding terminal and the metal box or enclosure shall be equivalent to the performance provided by copper wire sized in accordance with 250.146 and Table 250.122 but no smaller than 12 AWG. [99: 6.3.2.2.2.4]

(3) All non-current-carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts

Exception No. 1: For other than isolated ground receptacles, an insulated equipment bonding jumper that directly connects to the equipment grounding conductor is permitted to connect the box and receptacle(s) to the equipment grounding conductor. Isolated ground receptacles shall be connected in accordance with 517.16.

Exception No. 2: Metal faceplates shall be permitted to be connected to the equipment grounding conductor by means of a metal mounting screw(s) securing the faceplate to a grounded outlet box or grounded wiring device.

Exception No. 3: Luminaires more than 2.3 m (7 1/2 ft) above the floor and switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with 517.13(A) and (B).

(2) Sizing.

Equipment grounding conductors and equipment bonding jumpers shall be sized in accordance with 250.122.

Statement of Problem and Substantiation for Public Comment

The revision to 517.13(B)(1)(1) to exclude isolated ground receptacles is essential to correlate with 517.16(B) as modified by FR4260 and to avoid defeating the isolated grounding of an IG receptacle by miswiring per the 517.16 reference to 517.13(B).

The term "metal receptacle boxes" in revised 517.16(B)(1)(2) is inconsistent with the term "metal outlet boxes" or "metal device boxes" used in the National Electrical Code® NFPA 70 (e.g., "Article 314 Outlet, Device, Pull, and Junction Boxes ...") and the Safety Standard UL 514A under which such metal outlet boxes (for receptacles) are evaluated. In NEC® 517.13(B)(1)(2), a Public Input to use extracted wording from NFPA 99-2015 6.3.2.2.2.4 introduces inconsistency that degrades needlessly the readability of the NEC®.

Furthermore, receptacles are not only flush- or surface-mounted in metal outlet boxes or metal device boxes, but can be panel-mounted in metal enclosures that present the same safety concerns. NEC® 517.13(B)(1) EXPLICITLY recognizes receptacles mounted in metal enclosures and imposes the same grounding requirements as for outlet and device boxes. A Public Input has also been submitted to correct NFPA 99-2018, 6.3.2.2.2.4, identically.

As 517.13(B)(1)(2) was revised in FR4261, it is ambiguous whether 517.13(B)(1)(2) permits equipment bonding jumpers to be sized as copper 12 AWG for 60A, 100A, and 200A receptacles rather than to be unequivocally equivalent to copper 10 AWG, 8 AWG, or 6 AWG, respectively, in accordance with the minimum sizes of NEC® 250.146 and Table 250.122.

Since 517.16(B) encompasses equipment bonding jumpers in addition to equipment grounding conductors, equipment bonding jumpers should be reflected in the subsection title. Because sizing of the equipment bonding jumper is addressed in revised 517.16(B)(1), sizing of equipment bonding jumpers should not be reflected redundantly in 517.16(B)(2). As presently revised, there is a correlation issue because the two requirements conflict for 15 A receptacles.

The grounding conductor’s insulation, not the copper conductor itself, should be green.

Editorial: Use term “patient care spaces” in place of “patient care areas” for consistency throughout NEC® Article 517 and with NFPA 99.
First Revision No. 4261-NFPA 70-2015 [Section No. 517.13]

Submitter Information Verification

Submitter Full Name: BRIAN ROCK
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Street Address:
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State:
Zip:
Submittal Date: Thu Jun 25 15:47:44 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4216-NFPA 70-2015
Statement: The revision to 517.13(B)(1)(1) to exclude isolated ground receptacles is essential to correlate with 517.16(B) as modified by FR4260 and to avoid defeating the isolated grounding feature of an IG receptacle by miswiring per the 517.16 reference to 517.13(B).

The title of 517.16(B) is revised since requirements encompasses equipment bonding jumpers in addition to equipment grounding conductors.

The NFPA 99-extracted requirements has been relocated from 517.16(B)(1)(2) to the Sizing requirement in 517.16(B)(2).

The connection point requirement in revised 517.16(B)(1)(2) is no longer that sizing requirement but clarifies the distinct connection point portion of the requirement. Consequently, the term “metal receptacle boxes” in revised 517.16(B)(1)(2) is revised to be consistent with the term “metal outlet boxes” or “metal device boxes” used in the National Electrical Code® NFPA 70 (e.g., “Article 314 Outlet, Device, Pull, and Junction Boxes ...”).

As 517.13(B)(1)(2) was revised in FR4261 and in accordance with 90.3, it was ambiguous whether 517.13(B)(1)(2) might permit equipment bonding jumpers to be sized as copper 12 AWG for 60A, 100A, and 200A receptacles rather than to be unequivocally equivalent to copper 10 AWG, 8 AWG, or 6 AWG, respectively, in accordance with the minimum sizes of 250.122. The requirement is modified for clarity and usability.

The grounding conductor’s insulation, not the copper conductor itself, should be green.

Exception No.3 is modified to clarify that either 517.13(A) or (B) may be used; it is not required to do both.

Editorial: Use term “patient care spaces” in place of “patient care areas” for consistency throughout NEC® Article 517 and with NFPA 99.
Public Comment No. 847-NFPA 70-2015 [Section No. 517.13]

517.13 Grounding of Receptacles and Fixed Electrical Equipment in Patient Care Spaces.

Wiring in patient care spaces shall comply with 517.13(A) and (B).

(A) Wiring Methods.

All branch circuits serving patient care areas shall be provided with an effective ground-fault current path by installation in a metal raceway system, or a cable having a metallic armor or sheath assembly. The metal raceway system, or metallic cable armor, or sheath assembly shall itself qualify as an equipment grounding conductor in accordance with 250.118.

(B) Insulated Equipment Grounding Conductor and Insulated Equipment Bonding Jumper.

(1) General.

The following shall be directly connected to an insulated copper equipment grounding conductor that is clearly identified using green insulation along its entire length and installed with the branch circuit conductors in the wiring methods as provided in 517.13(A):

(1) The grounding terminals of all receptacles

Where metal receptacle boxes are used,

(2) other than isolated ground receptacles

(3) Where receptacles are mounted in metal outlet boxes, metal device boxes, or metal enclosures, the performance of the connection between the receptacle grounding terminal and the metal box or enclosure shall be equivalent to the performance provided by copper wire sized in accordance with 250.146 and Table 250.122 but no smaller than 12 AWG.

(4) All non–current-carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts

Exception No. 1: An insulated equipment bonding jumper that directly connects to the equipment grounding conductor is permitted to connect the box and receptacle(s) to the equipment grounding conductor.

Exception No. 2: Metal faceplates shall be permitted to be connected to the equipment grounding conductor by means of a metal mounting screw(s) securing the faceplate to a grounded outlet box or grounded wiring device.

Exception No. 3: Luminaires more than 2.3 m (7 1/2 ft) above the floor and switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with 517.13(A) and (B).

(2) Sizing.

Equipment grounding conductors and equipment bonding jumpers shall be sized in accordance with 250.122.

Statement of Problem and Substantiation for Public Comment

The revision to 517.13(B)(1)(1) to exclude isolated ground receptacles is essential to correlate with 517.16(B) as modified by FR4260 and to avoid defeating the isolated grounding of an IG receptacle by miswiring per 517.16 reference to 517.13(B).

The term "metal receptacle boxes" in revised 517.16(B)(1) (2) is inconsistent with the term "metal outlet boxes" or "metal device boxes" used in the National Electrical Code® NFPA 70 (e.g., "Article 314 Outlet, Device, Pull, and Junction Boxes ...") and the Safety Standard UL 514A under which such metal outlet boxes (for receptacles) are evaluated. In NEC® 517.13(B)(1)(2), a Public Input to use extracted wording from NFPA 99-2015 6.3.2.2.2.4 introduces inconsistency that degrades needlessly the readability of the NEC®.

Furthermore, receptacles are not only flush- or-surface-mounted in metal outlet boxes or metal device boxes, but can be panel-mounted in metal enclosures that present the same safety concerns. NEC® 517.13(B)(1) EXPLICITLY recognizes receptacles mounted in metal enclosures and imposes the same grounding requirements as for outlet and device boxes. NFPA 99 needs to be similarly revised.

As 517.13(B)(1)(2) was revised in FR4261, it is ambiguous whether 517.13(B)(1)(2) permits equipment bonding jumpers to be sized as copper 12 AWG for 60A, 100A, and 200A receptacles rather than to be unequivocally equivalent to copper 10 AWG, 8 AWG, or 6 AWG, respectively, in accordance with the minimum sizes of NEC® 250.146 and Table 250.122.

Since 517.16(B) encompasses equipment bonding jumpers in addition to equipment grounding conductors, equipment bonding jumpers should be reflected in the subsection title. Because sizing of the equipment bonding jumper is addressed in revised 517.16(B)(1), sizing of equipment bonding jumpers should not be reflected redundantly in 517.16(B)(2). As presently revised, the two requirements conflict for 15 A receptacles.

The grounding conductor’s insulation, not the copper conductor itself, should be green.

Related Item

First Revision No. 4261-NFPA 70-2015 [Section No. 517.13]

Submitter Information Verification
Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-4216-NFPA 70-2015

Statement: The revision to 517.13(B)(1)(1) to exclude isolated ground receptacles is essential to correlate with 517.16(B) as modified by FR4260 and to avoid defeating the isolated grounding feature of an IG receptacle by miswiring per the 517.16 reference to 517.13(B).

The title of 517.16(B) is revised since requirements encompasses equipment bonding jumpers in addition to equipment grounding conductors.

The NFPA 99-extracted requirements has been relocated from 517.16(B)(1)(2) to the Sizing requirement in 517.16(B)(2).

The connection point requirement in revised 517.16(B)(1)(2) is no longer that sizing requirement but clarifies the distinct connection point portion of the requirement. Consequently, the term "metal receptacle boxes" in revised 517.16(B)(1)(2) is revised to be consistent with the term "metal outlet boxes" or "metal device boxes" used in the National Electrical Code® NFPA 70 (e.g., "Article 314 Outlet, Device, Pull, and Junction Boxes ...”).

As 517.13(B)(1)(2) was revised in FR4261 and in accordance with 90.3, it was ambiguous whether 517.13(B)(1)(2) might permit equipment bonding jumpers to be sized as copper 12 AWG for 60A, 100A, and 200A receptacles rather than to be unequivocally equivalent to copper 10 AWG, 8 AWG, or 6 AWG, respectively, in accordance with the minimum sizes of 250.122. The requirement is modified for clarity and usability.

The grounding conductor’s insulation, not the copper conductor itself, should be green.

Exception No.3 is modified to clarify that either 517.13(A) or (B) may be used; it is not required to do both.

Editorial: Use term “patient care spaces” in place of “patient care areas” for consistency throughout NEC® Article 517 and with NFPA 99.
Public Comment No. 1656-NFPA 70-2015 [ Section No. 517.13(B)(1) ]

(1) General.

The following shall be directly connected to an insulated copper equipment grounding conductor that is green along its entire length and installed with the branch circuit conductors in the wiring methods as provided in 517.13(A):

(1) The grounding terminals of all receptacles

(2) Where metal receptacle boxes are used, the performance of the connection between the receptacle grounding terminal and the metal box shall be equivalent to the performance provided by copper wire no smaller than 12 AWG.

Metal boxes and enclosures containing receptacles

(3) All non–current-carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts

Exception No. 1: An insulated equipment bonding jumper that directly connects to the equipment grounding conductor is permitted to connect the box and receptacle(s) to the equipment grounding conductor.

Exception No. 2: Metal faceplates shall be permitted to be connected to the equipment grounding conductor by means of a metal mounting screw(s) securing the faceplate to a grounded outlet box or grounded wiring device.

Exception No. 3: Luminaires more than 2.3 m (7 1/2 ft) above the floor and switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with 517.13(A), and or (B).

Statement of Problem and Substantiation for Public Comment

Item two is revised to create a coherent statement.

Exception two is revised to allow either (A) or (B) to be used, which is what the original proposal sought. As written by the panel, the exception isn’t excepting anything out, as it just states that I must comply with (A) AND (B), instead of (A) OR (B).

Related Item

First Revision No. 4261-NFPA 70-2015 [Section No. 517.13]

Submitter Information Verification

Submitter Full Name: RYAN JACKSON
Organization: RYAN JACKSON
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Submittal Date: Fri Sep 25 15:54:19 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4216-NFPA 70-2015
Statement: The revision to 517.13(B)(1)(1) to exclude isolated ground receptacles is essential to correlate with 517.16(B) as modified by FR4260 and to avoid defeating the isolated grounding feature of an IG receptacle by miswiring per the 517.16 reference to 517.13(B).

The title of 517.16(B) is revised since requirements encompasses equipment bonding jumpers in addition to equipment grounding conductors.

The NFPA 99-extracted requirements has been relocated from 517.16(B)(1)(2) to the Sizing requirement in 517.16(B)(2).

The connection point requirement in revised 517.16(B)(1)(2) is no longer that sizing requirement but clarifies the distinct connection point portion of the requirement. Consequently, the term "metal receptacle boxes" in revised 517.16(B)(1)(2) is revised to be consistent with the term "metal outlet boxes" or "metal device boxes" used in the National Electrical Code® NFPA 70 (e.g., "Article 514 Outlet, Device, Pull, and Junction Boxes ...").

As 517.13(B)(1)(2) was revised in FR4261 and in accordance with 90.3, it was ambiguous whether 517.13(B)(1)(2) might permit equipment bonding jumpers to be sized as copper 12 AWG for 60A, 100A, and 200A receptacles rather than to be unequivocally equivalent to copper 10 AWG, 8 AWG, or 6 AWG, respectively, in accordance with the minimum sizes of...
250.122. The requirement is modified for clarity and usability.

The grounding conductor’s insulation, not the copper conductor itself, should be green.

Exception No.3 is modified to clarify that either 517.13(A) or (B) may be used; it is not required to do both.

Editorial: Use term “patient care spaces” in place of “patient care areas” for consistency throughout NEC® Article 517 and with NFPA 99.
1) General.

The following shall be directly connected to an insulated copper equipment grounding conductor that is green along its entire length and installed with the branch circuit conductors in the wiring methods as provided in 517.13(A):

1) The grounding terminals of all receptacles

2) Where metal receptacle boxes are used, metal boxes and enclosures containing receptacles, unless the performance of the connection between the receptacle grounding terminal and the metal box shall be equivalent, is equivalent to the performance provided by copper wire no smaller than 12 AWG. [99:6.3.2.2.2.4]

3) All non-current-carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts

Exception No. 1: An insulated equipment bonding jumper that directly connects to the equipment grounding conductor is permitted to connect the box and receptacle(s) to the equipment grounding conductor.

Exception No. 2: Metal faceplates shall be permitted to be connected to the equipment grounding conductor by means of a metal mounting screw(s) securing the faceplate to a grounded outlet box or grounded wiring device.

Exception No. 3: Luminaires more than 2.3 m (7 1/2 ft) above the floor and switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with 517.13(A), and or (B).

Statement of Problem and Substantiation for Public Comment

In 517.13 (B)(1), the three items listed below 517.13 (B)(1) are list items that should follow, the qualifier of the list "The following shall be directly connected.....". As written, (2) does not make sense as a list item. The language used in this proposed revision continues a consistent list. An alternative could be to keep the original 517.13 (B)(1)(2) list item, as written in the 2014 edition, and include an exception as follows: Exception to (2): Metal boxes or enclosures that contains receptacles shall not be required to be directly connected to an insulated equipment ground conductor if the performance of the connection between the receptacle grounding terminal and the metal box or enclosure is equivalent to the performance provided by a copper wire no smaller than #12 AWG.

In 517.13 (B) Exception No. 3: If the exception was intended to require one method of grounding, vs. both, then the exception should be "517.13 (A) OR (B)"

Related Item

First Revision No. 4261-NFPA 70-2015 [Section No. 517.13]

Submitter Information Verification

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Submittal Date: Mon Aug 24 14:31:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4216-NFPA 70-2015
Statement: The revision to 517.13(B)(1)(1) to exclude isolated ground receptacles is essential to correlate with 517.16(B) as modified by FR4260 and to avoid defeating the isolated grounding feature of an IG receptacle by miswiring per the 517.16 reference to 517.13(B).

The title of 517.16(B) is revised since requirements encompasses equipment bonding jumpers in addition to equipment grounding conductors.

The NFPA 99-extracted requirements has been relocated from 517.16(B)(1)(2) to the Sizing requirement in 517.16(B)(2).

The connection point requirement in revised 517.16(B)(1)(2) is no longer that sizing requirement but clarifies the distinct connection point portion of the requirement. Consequently, the term "metal receptacle boxes" in revised 517.16(B)(1)(2)
is revised to be consistent with the term "metal outlet boxes" or "metal device boxes" used in the National Electrical Code® NFPA 70 (e.g., "Article 314 Outlet, Device, Pull, and Junction Boxes ...").

As 517.13(B)(1)(2) was revised in FR4261 and in accordance with 90.3, it was ambiguous whether 517.13(B)(1)(2) might permit equipment bonding jumpers to be sized as copper 12 AWG for 60A, 100A, and 200A receptacles rather than to be unequivocally equivalent to copper 10 AWG, 8 AWG, or 6 AWG, respectively, in accordance with the minimum sizes of 250.122. The requirement is modified for clarity and usability.

The grounding conductor’s insulation, not the copper conductor itself, should be green.

Exception No.3 is modified to clarify that either 517.13(A) or (B) may be used; it is not required to do both.

Editorial: Use term “patient care spaces” in place of “patient care areas” for consistency throughout NEC® Article 517 and with NFPA 99.
## Public Comment No. 1471-NFPA 70-2015 [Section No. 517.16]

517.16 Use of Isolated *Grounding* Receptacles.

(A) An isolated grounding receptacle shall not be installed within a patient care vicinity. [99:6.3.2.2.7.1(B)]

(B) Isolated grounding receptacle(s) used outside of a patient care vicinity shall not defeat the purposes of the safety features of the grounding systems detailed in 517.13.

(1) Isolated grounding receptacles installed in branch circuits for patient care spaces shall be connected to an insulated equipment grounding conductor in accordance with 250.146(D) in addition to the two equipment grounding conductor paths required in 517.13(A) and (B).

(2) The equipment grounding conductor installed for isolated grounding receptacles in patient care areas shall be clearly identified using green insulation with one or more yellow stripes along its entire length.

Informational Note No. 1: This type of installation is typically used where a reduction of electrical noise (electromagnetic interference) is necessary, and parallel grounding paths are to be avoided.

Informational Note No. 2: Care should be taken in specifying a system containing isolated ground receptacles, because the grounding impedance is controlled only by the grounding wires and does not benefit from any conduit or building structure in parallel with the grounding path. [99:A.6.3.2.2.7.1]

### Statement of Problem and Substantiation for Public Comment

The word *Grounding* is used in the body of the text (Not Grounded)

**Related Item**

First Revision No. 4260-NFPA 70-2015 [Section No. 517.16]

### Submitter Information Verification

**Submitter Full Name:** David Dagenais  
**Organization:** Wentworth-Douglass Hospital  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Fri Sep 25 12:52:57 EDT 2015

### Committee Statement

**Committee Action:** Rejected  
**Resolution:** The proposed revisions do not correlate with other NEC references to “Isolated Ground”.

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National Fire Protection Association Report http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
517.16 Use of Isolated Ground Receptacles.

(A) An isolated grounding receptacle shall not be installed within a patient care vicinity. [99:6.3.2.2.7.1(B)]

(B) Isolated grounding receptacle(s) used outside of a patient care vicinity shall not defeat the purposes of the safety features of the grounding systems detailed in 517.13.

(1) Isolated grounding receptacles installed in branch circuits for patient care spaces shall be connected to an insulated equipment grounding conductor in accordance with 250.146(D) in addition to the two equipment grounding conductor paths required in 517.13(A) and (B).

(2) The equipment grounding conductor installed for isolated grounding receptacles in patient care areas shall be clearly identified using green insulation with one or more yellow stripes along its entire length.

Informational Note No. 1: This type of installation is typically used where a reduction of electrical noise (electromagnetic interference) is necessary, and parallel grounding paths are to be avoided. [99:A.6.3.2.2.7.1]

Informational Note No. 2: Care should be taken in specifying a system containing isolated ground receptacles, because the grounding impedance is controlled only by the grounding wires and does not benefit from any conduit or building structure in parallel with the grounding path.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4260 and to correlate with the use of the term “isolated ground receptacle” in 250.146 and 406.3(D).

Related Item
First Revision No. 4260-NFPA 70-2015 [Section No. 517.16]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
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City:
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Zip:
Submittal Date: Tue Sep 29 09:45:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4217-NFPA 70-2015
Statement: This revision provides necessary clarity to First Revision No. 4260-NFPA 70-2015 (Section No. 517.6) and correlates with 517.13.

CMP-15 has clarified that the equipment grounding conductor path referenced in 517.13(B)(1) [green unstriped insulated conductor] shall not be incorrectly terminated to the Isolated Ground receptacle’s grounding terminal. This connection is to be made to the metal box or enclosure to which the Isolated Ground receptacle’s mounting means connects to the strap of the receptacle and bonds the faceplate.

517.16(B)(2) mandates “both” an insulated grounding conductor identified green with yellow stripes that is to be connected to the grounding terminal of the isolated ground receptacle “and” an insulated grounding conductor identified as green (without yellow striping) per NEC® 517.13(B)(1)(1) methods be used for this installation. If the isolated ground conductor is connected to the metal box and the isolated ground terminal, such a connection would negate the isolated grounding of an Isolated Ground receptacle established by NEC® 250.146(D).
Editorial changes include:

Use the term “isolated ground receptacles” for consistency throughout NEC® 517.16 and with NEC® 250.146(D) as directed by the Correlating Committee.

Further, the term “patient care areas” in NEC® 517.16(B)(2) should be consistent with “patient care spaces” now used in Article 517.
(B) Isolated ground receptacle(s) used installed in patient care spaces outside of a patient care vicinity shall not defeat the purposes of the safety features of the grounding systems detailed in 517.13 vicinities shall comply with 517.16(B)(1) and (2).

1. The grounding terminals of isolated ground receptacles installed in branch circuits for patient care spaces shall be connected to an insulated equipment grounding conductor in accordance with 250.146(D) in addition to the two equipment grounding paths required in 517.13(A) and (B).

2. The insulated grounding conductor required in 517.13(B)(1) shall be clearly identified along its entire length by green insulation, with no yellow stripes, and shall not be connected to the grounding terminals of isolated ground receptacles but shall be connected to the box or enclosure indicated in 517.13(B)(1)(2) and to non-current-carrying conductive surfaces of fixed electrical equipment indicated in 517.13(B)(1)(3).

Informational Note No. 1: This type of installation is typically used where a reduction of electrical noise (electromagnetic interference) is necessary, and parallel grounding paths are to be avoided.

Informational Note No. 2: Care should be taken in specifying a system containing isolated ground receptacles, because the grounding impedance is controlled only by the grounding wires and does not benefit from any conduit or building structure in parallel with the grounding path. [99:A.6.3.2.2.7.1]

Statement of Problem and Substantiation for Public Comment

As specified by FR4260, NEC® 517.16(B) is incorrectly correlated with NEC® 517.13(B)(1) as revised by FR4261. The equipment grounding conductor path referenced to NEC® 517.13(B)(1) [green unstriped insulated conductor] of FR4261 is incorrectly terminated to the IG receptacle’s grounding terminal instead of via the metal box or enclosure to the IG receptacle’s mounting means that bonds the faceplate. NEC® 517.16(B)(2) mandates BOTH an insulated grounding conductor identified green with yellow stripes AND an insulated grounding conductor identified as green (without yellow striping) per NEC® 517.13(B)(1)(1) be connected to the isolated ground receptacle's GROUNDING TERMINAL. Such a connection would negate the isolated grounding of an IG receptacle established by NEC® 250.146(D).

Editorial: Use the term "isolated ground receptacles" for consistency throughout NEC® 517.16 and with NEC® 250.146(D) in accordance with Correlating Committee Note 156. Further, the term "patient care areas" in NEC® 517.16(B)(2) should be consistent with "patient care spaces" now used in Article 517.

Related Item

First Revision No. 4260-NFPA 70-2015 [Section No. 517.16]
First Revision No. 4261-NFPA 70-2015 [Section No. 517.13]
Correlating Committee Note No. 156-NFPA 70-2015 [Section No. 517.16]

Submitter Information Verification

Submitter Full Name: BRIAN ROCK
Organization: HUBBELL INCORPORATED
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jun 25 14:59:33 EDT 2015

Committee Statement

Committee: 
Action: Rejected but see related SR
<table>
<thead>
<tr>
<th>Resolution</th>
<th>SR-4217-NFPA 70-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement</td>
<td>This revision provides necessary clarity to First Revision No. 4260-NFPA 70-2015 (Section No. 517.6) and correlates with 517.13.</td>
</tr>
</tbody>
</table>

CMP-15 has clarified that the equipment grounding conductor path referenced in 517.13(B)(1) [green unstriped insulated conductor] shall not be incorrectly terminated to the Isolated Ground receptacle’s grounding terminal. This connection is to be made to the metal box or enclosure to which the Isolated Ground receptacle’s mounting means connects to the strap of the receptacle and bonds the faceplate.

517.16(B)(2) mandates “both” an insulated grounding conductor identified green with yellow stripes that is to be connected to the grounding terminal of the isolated ground receptacle “and” an insulated grounding conductor identified as green (without yellow striping) per NEC® 517.13(B)(1)(1) methods be used for this installation. If the isolated ground conductor is connected to the metal box and the isolated ground terminal, such a connection would negate the isolated grounding of an Isolated Ground receptacle established by NEC® 250.146(D).

Editorial changes include:

Use the term “isolated ground receptacles” for consistency throughout NEC® 517.16 and with NEC® 250.146(D) as directed by the Correlating Committee.

Further, the term “patient care areas” in NEC® 517.16(B)(2) should be consistent with “patient care spaces” now used in Article 517.
(B) Isolated grounding receptacle(s) installed outside of a patient care vicinity shall not defeat the purposes of the safety features of the grounding systems detailed in 517.13.

(1) Isolated grounding terminals of isolated grounding receptacles installed in branch circuits for patient care spaces shall be connected to an insulated equipment grounding conductor in accordance with 250.146(D) in addition to the two equipment grounding conductor paths required in 517.13(A). The insulated grounding conductor required in 517.13(B)(1) shall be clearly identified using green insulation, with no yellow stripes, along its entire length and shall not be connected to the grounding terminals of isolated ground receptacles but shall be connected to the box or enclosure indicated in 517.13 (B)(1)(2) and to non-current-carrying conductive surfaces of fixed electrical equipment indicated in 517.13(B)(1)(3).

(2) The equipment grounding conductor installed for conductor connected to the grounding terminal of isolated grounding receptacles in patient care areas shall be clearly identified using green insulation with one or more yellow stripes along its entire length.

Informational Note No. 1: This type of installation is typically used where a reduction of electrical noise (electromagnetic interference) is necessary, and parallel grounding paths are to be avoided.

Informational Note No. 2: Care should be taken in specifying a system containing isolated ground receptacles, because the grounding impedance is controlled only by the grounding wires and does not benefit from any conduit or building structure in parallel with the grounding path. [99:A.6.3.2.2.7.1]

Statement of Problem and Substantiation for Public Comment

It is unclear by FR4260 where the grounding path of referenced NEC® 517.13(B)(1) [green unstriped conductor] of FR4261 is terminated. Effectively, NEC® 517.16(B)(2) mandates BOTH an insulated grounding conductor identified green with yellow stripes AND an insulated grounding conductor identified as green (without yellow striping) per NEC® 517.13(B)(1)(1) to connect to the isolated ground receptacle's GROUNDING TERMINAL. This is wrong as it would defeat the isolated grounding of an IG receptacle per NEC® 250.146(D).

Editorial: Use term “isolated ground receptacles” for consistency throughout NEC® 517.16 and with NEC® 250.146(D).

Related Item
First Revision No. 4260-NFPA 70-2015 [Section No. 517.16]

Submitter Information Verification
Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 13:05:12 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-4217-NFPA 70-2015
Statement: This revision provides necessary clarity to First Revision No. 4260-NFPA 70-2015 (Section No. 517.6) and correlates with 517.13.

CMP-15 has clarified that the equipment grounding conductor path referenced in 517.13(B)(1) [green unstriped insulated conductor] shall not be incorrectly terminated to the Isolated Ground receptacle’s grounding terminal. This connection is to be made to the metal box or enclosure to which the Isolated Ground receptacle’s mounting means connects to the strap of the receptacle and bonds the faceplate.

517.16(B)(2) mandates “both” an insulated grounding conductor identified green with yellow stripes that is to be connected to the grounding terminal of the isolated ground receptacle “and” an insulated grounding conductor identified...
as green (without yellow striping) per NEC® 517.13(B)(1)(1) methods be used for this installation. If the isolated ground conductor is connected to the metal box and the isolated ground terminal, such a connection would negate the isolated grounding of an Isolated Ground receptacle established by NEC® 250.146(D).

Editorial changes include:

Use the term “isolated ground receptacles” for consistency throughout NEC® 517.16 and with NEC® 250.146(D) as directed by the Correlating Committee.

Further, the term “patient care areas” in NEC® 517.16(B)(2) should be consistent with “patient care spaces” now used in Article 517.
The equipment grounding conductor installed for isolated grounding receptacles in patient care areas shall be clearly identified using green insulation with one or more yellow stripes along its entire length.

Informational Note No. 1: This type of installation is typically used where a reduction of electrical noise (electromagnetic interference) is necessary, and parallel grounding paths are to be avoided.

Informational Note No. 2: Care should be taken in specifying a system containing isolated ground receptacles, because the grounding impedance is controlled only by the grounding wires and does not benefit from any conduit or building structure in parallel with the grounding path. [99: A.6.3.2.2.7.1]

Statement of Problem and Substantiation for Public Comment

Delete Informational Note 1 because an isolated ground installation 'does not' reduce electric noise. I challenge all of the panel members to publically write out and explain this concept. This is just a myth that has been passed along and people accept the concept, but for sure they don't know what it means.

Delete Informational Note 2 because it appears that the panel is concerned that installing such a system is not a good idea. If the system is specified and installed per the NEC than it must be safe.

Related Item

First Revision No. 4260-NFPA 70-2015 [Section No. 517.16]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 16:05:40 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter has not provided any evidence or factual studies to support the claim as stated in the Public Comment. Informational Note No. 2 is extracted material from NFPA 99, Health Care Facilities Code. The submitter is encouraged to provide further material and submit substantiation to the NFPA 99 ELS Committee addressing the concern regarding claims stated in the Public Comment.
The equipment grounding conductor installed for isolated grounding receptacles in patient care areas, care spaces, shall be clearly identified using green insulation with one or more yellow stripes along its entire length.

Informational Note No. 1: This type of installation is typically used where a reduction of electrical noise (electromagnetic interference) is necessary, and parallel grounding paths are to be avoided.

Informational Note No. 2: Care should be taken in specifying a system containing isolated ground receptacles, because the grounding impedance is controlled only by the grounding wires and does not benefit from any conduit or building structure in parallel with the grounding path. [99:A.6.3.2.2.7.1]

Statement of Problem and Substantiation for Public Comment

The text at 517.16(B)(2) references a patient care "area." By Article 517 definitions, is this not a patient care "space?" CMP-15 has gone to great lengths in the past few Code cycles to change terms like "patient care areas" to "patient care spaces" to reflect NFPA 99 terms in the NEC. This is small, but will aid in that effort.

Related Item

First Revision No. 4260-NFPA 70-2015 [Section No. 517.16]
Public Input No. 3059-NFPA 70-2014 [Section No. 517.16]

Submitter Information Verification

Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 18 17:42:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4217-NFPA 70-2015
Statement: This revision provides necessary clarity to First Revision No. 4260-NFPA 70-2015 (Section No. 517.6) and correlates with 517.13.

CMP-15 has clarified that the equipment grounding conductor path referenced in 517.13(B)(1) [green unstriped insulated conductor] shall not be incorrectly terminated to the Isolated Ground receptacle’s grounding terminal. This connection is to be made to the metal box or enclosure to which the Isolated Ground receptacle’s mounting means connects to the strap of the receptacle and bonds the faceplate.

517.16(B)(2) mandates “both” an insulated grounding conductor identified green with yellow stripes that is to be connected to the grounding terminal of the isolated ground receptacle “and” an insulated grounding conductor identified as green (without yellow striping) per NEC® 517.13(B)(1)(1) methods be used for this installation. If the isolated ground conductor is connected to the metal box and the isolated ground terminal, such a connection would negate the isolated grounding of an Isolated Ground receptacle established by NEC® 250.146(D).

Editorial changes include:

Use the term “isolated ground receptacles” for consistency throughout NEC® 517.16 and with NEC® 250.146(D) as directed by the Correlating Committee.

Further, the term “patient care areas” in NEC® 517.16(B)(2) should be consistent with “patient care spaces” now used in Article 517.
Public Comment No. 765-NFPA 70-2015 [Section No. 517.16(B)(2)]

(2)
The equipment grounding conductor installed for to the grounding terminal of isolated grounding receptacles in patient care areas shall be clearly identified using green insulation with one or more yellow stripes along its entire length.

Informational Note No. 1: This type of installation is typically used where a reduction of electrical noise (electromagnetic interference) is necessary, and parallel grounding paths are to be avoided.

Informational Note No. 2: Care should be taken in specifying a system containing isolated ground receptacles, because the grounding impedance is controlled only by the grounding wires and does not benefit from any conduit or building structure in parallel with the grounding path. [99:A.6.3.2.2.7.1]

Statement of Problem and Substantiation for Public Comment

Changing the language as shown will provide clear instructions to installers and inspectors that the isolated equipment grounding conductor connected to the grounding terminal of the receptacle is required to have green insulation with a yellow stripe.

Related Item

First Revision No. 4260-NFPA 70-2015 [Section No. 517.16]

Submitter Information Verification

Submitter Full Name: GARY BECKSTRAND
Organization: UTAH ELECTRICAL JATC
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 19 11:44:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4217-NFPA 70-2015
Statement: This revision provides necessary clarity to First Revision No. 4260-NFPA 70-2015 (Section No. 517.6) and correlates with 517.13.

CMP-15 has clarified that the equipment grounding conductor path referenced in 517.13(B)(1) [green unstriped insulated conductor] shall not be incorrectly terminated to the Isolated Ground receptacle’s grounding terminal. This connection is to be made to the metal box or enclosure to which the Isolated Ground receptacle’s mounting means connects to the strap of the receptacle and bonds the faceplate.

517.16(B)(2) mandates “both” an insulated grounding conductor identified green with yellow stripes that is to be connected to the grounding terminal of the isolated ground receptacle “and” an insulated grounding conductor identified as green (without yellow stripping) per NEC® 517.13(B)(1)(1) methods be used for this installation. If the isolated ground conductor is connected to the metal box and the isolated ground terminal, such a connection would negate the isolated grounding of an Isolated Ground receptacle established by NEC® 250.146(D).

Editorial changes include:

Use the term “isolated ground receptacles” for consistency throughout NEC® 517.16 and with NEC® 250.146(D) as directed by the Correlating Committee.

Further, the term “patient care areas” in NEC® 517.16(B)(2) should be consistent with “patient care spaces” now used in Article 517.
Public Comment No. 1483-NFPA 70-2015 [Section No. 517.17(A)]

(A) Applicability.

The requirements of 517.17 shall apply to hospitals, and other buildings (including multiple-occupancy buildings) with critical care (Category 1) spaces or utilizing electrical life-support equipment, and buildings that provide the required essential utilities or services for the operation of critical care (Category 1) spaces or electrical life-support equipment.

Statement of Problem and Substantiation for Public Comment

For consistency with NFPA 99 the terms "critical, basic, general" etc should be removed which is no longer used in the standard to describe function of spaces.

Related Item

First Revision No. 4262-NFPA 70-2015 [Section No. 517.17(A)]

Submitter Information Verification

Submitter Full Name: CHAD BEEBE
Organization: ASHE AHA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:05:31 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: In accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175. See the Second Revision created to 517.2 (Patient Care Space).
517.18 General Care (Category 2) Spaces.

(A) Patient Bed Location.

Each patient bed location shall be supplied by at least two branch circuits, one from the critical branch and one from the normal system. All branch circuits from the normal system shall originate in the same panelboard. The electrical receptacles or the cover plate for the electrical receptacles supplied from the critical branch shall have a distinctive color or marking so as to be readily identifiable and shall also indicate the panelboard and branch-circuit number supplying them.

Branch circuits serving patient bed locations shall not be part of a multiwire branch circuit.

Exception No. 1: Branch circuits serving only special purpose outlets or receptacles, such as portable X-ray outlets, shall not be required to be served from the same distribution panel or panels.

Exception No. 2: The requirements of 517.18(A) shall not apply to patient bed locations in clinics, medical and dental offices, and outpatient facilities; psychiatric, substance abuse, and rehabilitation hospitals; sleeping rooms of nursing homes; and limited care facilities meeting the requirements of 517.10(B)(2).

Exception No. 3: A general care (Category 2) patient bed location served from two separate transfer switches on the critical branch shall not be required to have circuits from the normal system.

(B) Patient Bed Location Receptacles.

Each patient bed location shall be provided with a minimum of eight receptacles. They shall be permitted to be of the single, duplex, or quadruplex type or any combination of the three. All receptacles shall be listed “hospital grade” and shall be so identified. The grounding terminal of each receptacle shall be connected to an insulated copper equipment grounding conductor sized in accordance with Table 250.122.

Exception No. 1: The requirements of 517.18(B) shall not apply to psychiatric, substance abuse, and rehabilitation hospitals meeting the requirements of 517.10(B)(2).

Exception No. 2: Psychiatric security rooms shall not be required to have receptacle outlets installed in the room.

Informational Note: It is not intended that there be a total, immediate replacement of existing non–hospital grade receptacles. It is intended, however, that non–hospital grade receptacles be replaced with hospital grade receptacles upon modification of use, renovation, or as existing receptacles need replacement.

(C) Designated General Care (Category 2) Pediatric Locations.

Receptacles that are located within the patient rooms, bathrooms, playrooms, and activity rooms of pediatric units or spaces with similar risk as determined by the governing body, other than nurseries, shall be listed tamper-resistant or shall employ a listed tamper-resistant cover. [99:6.3.2.6.2(F)]
<table>
<thead>
<tr>
<th><strong>Committee Action:</strong></th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resolution:</strong></td>
<td>In accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175. See the Second Revision created to 517.2 (Patient Care Space).</td>
</tr>
</tbody>
</table>
517.18 General Care (Category 2) Spaces.

(A) Patient Bed Location.

Each patient bed location shall be supplied by at least two branch circuits, one from the critical branch and one from the normal system. All branch circuits from the normal system shall originate in the same panelboard. The electrical receptacles or the cover plate for the electrical receptacles supplied from the critical branch shall have a distinctive color or marking so as to be readily identifiable and shall also indicate the panelboard and branch-circuit number supplying them.

Branch circuits serving patient bed locations shall not be part of a multiwire branch circuit.

Exception No. 1: Branch circuits serving only special purpose outlets or receptacles, such as portable X-ray outlets, shall not be required to be served from the same distribution panel or panels.

Exception No. 2: The requirements of 517.18(A) shall not apply to patient bed locations in clinics, medical and dental offices, and outpatient facilities; psychiatric, substance abuse, and rehabilitation hospitals; sleeping rooms of nursing homes; and limited care facilities meeting the requirements of 517.10(B)(2).

Exception No. 3: A general care (Category 2) patient bed location served from two separate transfer switches on the critical branch shall not be required to have circuits from the normal system.

(B) Patient Bed Location Receptacles.

Each patient bed location shall be provided with a minimum of eight receptacles. They shall be permitted to be of the single, duplex, or quadruplex type or any combination of the three. All receptacles shall be listed “hospital grade” and shall be so identified. The grounding terminal of each receptacle shall be connected to an insulated copper equipment grounding conductor sized in accordance with Table 250.122.

Exception No. 1: The requirements of 517.18(B) shall not apply to psychiatric, substance abuse, and rehabilitation hospitals meeting the requirements of 517.10(B)(2).

Exception No. 2: Psychiatric security rooms shall not be required to have receptacle outlets installed in the room.

Informational Note: It is not intended that there be a total, immediate replacement of existing non–hospital grade receptacles. It is intended, however, that non–hospital grade receptacles be replaced with hospital grade receptacles upon modification of use, renovation, or as existing receptacles need replacement.

(C) Designated General Care (Category 2) Pediatric Locations.

Receptacles that are located within the patient rooms, bathrooms, playrooms, and activity rooms of pediatric units or spaces with similar risk as determined by the governing body, other than nurseries, shall be listed tamper-resistant or shall employ a listed tamper-resistant cover. [99:6.3.2.2.6.2(F)]

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4266 and the Panel clarify the title of 517.18(C) with regard to extracted information from NFPA 99.

Related Item

First Revision No. 4266-NFPA 70-2015 [Section No. 517.18]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 09:46:51 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CMP-15 is unable to determine the intent of the NEC Correlating Committee.
<table>
<thead>
<tr>
<th><strong>Public Comment No. 328-NFPA 70-2015 [Section No. 517.18(C)]</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Designated General Care (Category 2) Pediatric Locations.</strong></td>
</tr>
<tr>
<td>Receptacles that are located within the patient rooms, bathrooms, playrooms, exam rooms, lobbies, hallways, and activity rooms of pediatric units/hospitals/clinics, or spaces with similar risk as determined by the governing body, other than nurseries, shall be listed tamper-resistant or shall employ a listed tamper-resistant cover. [99:6.3.2.2.6.2(F)]</td>
</tr>
</tbody>
</table>

**Statement of Problem and Substantiation for Public Comment**

Being that in a hospital specially servicing the needs of children, they are likely to be in most all areas of a pediatric hospital or clinic, especially common areas such as cafeteria, lobby, halls, etc. By requiring tamper-resistant receptacles throughout will lessen the chance of a child suffering burns or electrician.

**Related Item**

Public Input No. 1-NFPA 70-2013 [Section No. 310.15(B)(3)]

**Submitter Information Verification**

- **Submitter Full Name**: Joe Figueiredo
- **Organization**: St Christophers Hospital for Children
- **Street Address**: 
- **City**: 
- **State**: 
- **Zip**: 
- **Submittal Date**: Fri Jul 31 10:50:18 EDT 2015

**Committee Statement**

- **Committee Action**: Rejected
- **Resolution**: The current section is extracted material. The Panel suggests the submitter provide this information as a Public Input to the NFPA 99, Health Care Facilities Code, ELS as a proposed change.
Sections 517.19, 517.19

517.19 Critical Care (Category 1) Spaces.

(A) Patient Bed Location Branch Circuits.

Each patient bed location shall be supplied by at least two branch circuits, one or more from the critical branch and one or more circuits from the normal system. At least one branch circuit from the critical branch shall supply an outlet(s) only at that bed location.

The electrical receptacles or the cover plates for the electrical receptacles supplied from the life safety and critical branches shall have a distinctive color or marking so as to be readily identifiable. [99:6.4.2.2.6.2(C)]

All branch circuits from the normal system shall be from a single panelboard. Critical branch receptacles shall be identified and shall also indicate the panelboard and circuit number supplying them.

The branch circuit serving patient bed locations shall not be part of a multiwire branch circuit.

Exception No. 1: Branch circuits serving only special-purpose receptacles or equipment in critical care (Category 1) spaces shall be permitted to be served by other panelboards.

Exception No. 2: Critical care (Category 1) spaces served from two separate critical branch transfer switches shall not be required to have circuits from the normal system.

(B) Patient Bed Location Receptacles.

(1) Minimum Number and Supply.

Each patient bed location shall be provided with a minimum of 14 receptacles, at least one of which shall be connected to either of the following:

(1) The normal system branch circuit required in 517.19(A)

(2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same patient bed location

(2) Receptacle Requirements.

The receptacles required in 517.19(B)(1) shall be permitted to be single, duplex, or quadruplex type or any combination thereof. All receptacles shall be listed “hospital grade” and shall be so identified. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor.

(C) Operating Room Receptacles.
(1) Minimum Number and Supply.
Each operating room shall be provided with a minimum of 36 receptacles divided between at least two branch circuits. At least 12 receptacles, but no more than 24, shall be connected to either of the following:
(1) The normal system branch circuit required in 517.19(A)
(2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same location

(2) Receptacle Requirements.
The receptacles shall be permitted to be of the locking or nonlocking type, single, duplex, or quadruplex types or any combination of the three.
All nonlocking-type receptacles shall be listed hospital grade and so identified. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor.

(D) Patient Care Vicinity Grounding and Bonding (Optional).
A patient care vicinity shall be permitted to have a patient equipment grounding point. The patient equipment grounding point, where supplied, shall be permitted to contain one or more listed grounding and bonding jacks. An equipment bonding jumper not smaller than 10 AWG shall be used to connect the grounding terminal of all grounding-type receptacles to the patient equipment grounding point. The bonding conductor shall be permitted to be arranged centrically or looped as convenient.
Informational Note: Where there is no patient equipment grounding point, it is important that the distance between the reference grounding point and the patient care vicinity be as short as possible to minimize any potential differences.

(E) Equipment Grounding and Bonding.
Where a grounded electrical distribution system is used and metal feeder raceway or Type MC or MI cable that qualifies as an equipment grounding conductor in accordance with 250.118 is installed, grounding of enclosures and equipment, such as panelboards, switchboards, and switchgear, shall be ensured by one of the following bonding means at each termination or junction point of the metal raceway or Type MC or MI cable:
(1) A grounding bushing and a continuous copper bonding jumper, sized in accordance with 250.122, with the bonding jumper connected to the junction enclosure or the ground bus of the panel
(2) Connection of feeder raceways or Type MC or MI cable to threaded hubs or bosses on terminating enclosures
(3) Other approved devices such as bonding-type locknuts or bushings. Standard locknuts shall not be used for bonding.

(F) Additional Protective Techniques in Critical Care (Category 1) Spaces (Optional).
Isolated power systems shall be permitted to be used for critical care (Category 1) spaces, and, if used, the isolated power system equipment shall be listed as isolated power equipment. The isolated power system shall be designed and installed in accordance with 517.160.
Exception: The audible and visual indicators of the line isolation monitor shall be permitted to be located at the nursing station for the area being served.

(G) Isolated Power System Equipment Grounding.
Where an isolated ungrounded power source is used and limits the first-fault current to a low magnitude, the equipment grounding conductor associated with the secondary circuit shall be permitted to be run outside of the enclosure of the power conductors in the same circuit.
Informational Note: Although it is permitted to run the grounding conductor outside of the conduit, it is safer to run it with the power conductors to provide better protection in case of a second ground fault.

(H) Special-Purpose Receptacle Grounding.
The equipment grounding conductor for special-purpose receptacles, such as the operation of mobile X-ray equipment, shall be extended to the reference grounding points of branch circuits for all locations likely to be served from such receptacles. Where such a circuit is served from an isolated ungrounded system, the grounding conductor shall not be required to be run with the power conductors; however, the equipment grounding terminal of the special-purpose receptacle shall be connected to the reference grounding point.
517.19 Critical Care (Category 1) Spaces.
(A) Patient Bed Location Branch Circuits.

Each patient bed location shall be supplied by at least two branch circuits, one or more from the critical branch and one or more circuits from the normal system. At least one branch circuit from the critical branch shall supply an outlet(s) only at that bed location.

The electrical receptacles or the cover plates for the electrical receptacles supplied from the life safety and critical branches shall have a distinctive color or marking so as to be readily identifiable. [99:6.4.2.2.6.2(C)]

All branch circuits from the normal system shall be from a single panelboard. Critical branch receptacles shall be identified and shall also indicate the panelboard and circuit number supplying them.

The branch circuit serving patient bed locations shall not be part of a multiwire branch circuit.

Exception No. 1: Branch circuits serving only special-purpose receptacles or equipment in critical care (Category 1) spaces shall be permitted to be served by other panelboards.

Exception No. 2: Critical care (Category 1) spaces served from two separate critical branch transfer switches shall not be required to have circuits from the normal system.

(B) Patient Bed Location Receptacles.

(1) Minimum Number and Supply.

Each patient bed location shall be provided with a minimum of 14 receptacles, at least one of which shall be connected to either of the following:

(1) The normal system branch circuit required in 517.19(A)

(2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same patient bed location

(2) Receptacle Requirements.

The receptacles required in 517.19(B)(1) shall be permitted to be single, duplex, or quadruplex type or any combination thereof. All receptacles shall be listed “hospital grade” and shall be so identified. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor.

(C) Operating Room Receptacles.
Minimum Number and Supply.

Each operating room shall be provided with a minimum of 36 receptacles divided between at least two branch circuits. At least 12 receptacles, but no more than 24, shall be connected to either of the following:

1. The normal system branch circuit required in 517.19(A)
2. A critical branch circuit supplied by a different transfer switch than the other receptacles at the same location

Receptacle Requirements.

The receptacles shall be permitted to be of the locking or nonlocking type, single, duplex, or quadruplex types or any combination of the three.

All nonlocking-type receptacles shall be listed hospital grade and so identified. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor.

Patient Care Vicinity Grounding and Bonding (Optional).

A patient care vicinity shall be permitted to have a patient equipment grounding point. The patient equipment grounding point, where supplied, shall be permitted to contain one or more listed grounding and bonding jacks. An equipment bonding jumper not smaller than 10 AWG shall be used to connect the grounding terminal of all grounding-type receptacles to the patient equipment grounding point. The bonding conductor shall be permitted to be arranged centrally or looped as convenient.

Informational Note: Where there is no patient equipment grounding point, it is important that the distance between the reference grounding point and the patient care vicinity be as short as possible to minimize any potential differences.

Equipment Grounding and Bonding.

Where a grounded electrical distribution system is used and metal feeder raceway or Type MC or MI cable that qualifies as an equipment grounding conductor in accordance with 250.118 is installed, grounding of enclosures and equipment, such as panelboards, switchboards, and switchgear, shall be ensured by one of the following bonding means at each termination or junction point of the metal raceway or Type MC or MI cable:

1. A grounding bushing and a continuous copper bonding jumper, sized in accordance with 250.122, with the bonding jumper connected to the junction enclosure or the ground bus of the panel
2. Connection of feeder raceways or Type MC or MI cable to threaded hubs or bosses on terminating enclosures
3. Other approved devices such as bonding-type locknuts or bushings. Standard locknuts shall not be used for bonding.

Isolated Power System Equipment Grounding.

Where an isolated ungrounded power source is used and limits the first-fault current to a low magnitude, the equipment grounding conductor associated with the secondary circuit shall be permitted to be run outside of the enclosure of the power conductors in the same circuit.

Informational Note: Although it is permitted to run the grounding conductor outside of the conduit, it is safer to run it with the power conductors to provide better protection in case of a second ground fault.

Special-Purpose Receptacle Grounding.

The equipment grounding conductor for special-purpose receptacles, such as the operation of mobile X-ray equipment, shall be extended to the reference grounding points of branch circuits for all locations likely to be served from such receptacles. Where such a circuit is served from an isolated ungrounded system, the grounding conductor shall not be required to be run with the power conductors; however, the equipment grounding terminal of the special-purpose receptacle shall be connected to the reference grounding point.

Statement of Problem and Substantiation for Public Comment

For consistency with NFPA 99 the terms "critical, basic, general" etc should be removed which is no longer used in the standard to describe function of spaces.

Related Item
First Revision No. 4267-NFPA 70-2015 [Section No. 517.19]

Submitter Information Verification

Submitter Full Name: CHAD BEEBE
Organization: ASHE AHA
Street Address:
Committee Statement

Committee Action: Rejected

Resolution: In accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175. See the Second Revision created to 517.2 (Patient Care Space).
517.21  Ground-Fault Circuit-Interrupter Protection for Personnel.

Ground-fault circuit-interrupter protection for personnel shall not be required for receptacles installed in those critical-care (Category 1) spaces where the toilet and basin are installed within the patient room.

Statement of Problem and Substantiation for Public Comment

For consistency with NFPA 99 the terms "critical, basic, general" etc should be removed which is no longer used in the standard to describe function of spaces.

Related Item
First Revision No. 4264-NFPA 70-2015 [Section No. 517.21]

Submitter Information Verification

Submitter Full Name: CHAD BEEBE
Organization: ASHE AHA
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Fri Sep 25 12:59:00 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: In accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175. See the Second Revision created to 517.2 (Patient Care Space).
Public Comment No. 1488-NFPA 70-2015 [Section No. 517.29(A)]

(A) Applicability.

The requirements of Part III, 517.29 through 517.30, shall apply to critical care (Category 1) and general care (Category 2) hospitals, category 2 spaces, and other health care facilities, spaces, using Type 1 essential electrical systems where patients are sustained by electrical life-support equipment.

Informational Note No. 1: For performance, maintenance, and testing requirements of essential electrical systems in hospitals, see NFPA 99-2015, Health Care Facilities Code. For installation of centrifugal fire pumps, see NFPA 20-2013, Standard for the Installation of Stationary Pumps for Fire Protection.

Informational Note No. 2: For additional information on Type 1 and Type 2 essential electrical systems, see NFPA 99-2015, Health Care Facilities Code.

Statement of Problem and Substantiation for Public Comment

For consistency with NFPA 99 the terms "critical, basic, general" etc should be removed which is no longer used in the standard to describe function of spaces.

Related Item
First Revision No. 4271-NFPA 70-2015 [Section No. 517.30]

Submitter Information Verification

Submitter Full Name: CHAD BEEBE
Organization: ASHE AHA
Street Address:
City:
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Zip:
Submittal Date: Fri Sep 25 13:10:00 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: In accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175. See the Second Revision created to 517.2 (Patient Care Space).
Critical care (Category 1) spaces shall be served only by a Type 1 essential electrical system. [99:6.3.2.2.10.1]

Statement of Problem and Substantiation for Public Comment

For consistency with NFPA 99 the terms "critical, basic, general" etc should be removed which is no longer used in the standard to describe function of spaces.

Related Item
First Revision No. 4271-NFPA 70-2015 [Section No. 517.30]

Submitter Information Verification

Submitter Full Name: CHAD BEEBE
Organization: ASHE AHA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:11:32 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: In accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175. See the Second Revision created to 517.2 (Patient Care Space).
517.30 Sources of Power.

(A) Two Independent Power Sources.

Essential electrical systems shall have a minimum of the following two independent sources of power: a normal source generally supplying the entire electrical system and one alternate source(s) for use when the normal source is interrupted. \[99:6.4.1.1.4\]

(B) Types of Power Sources.

(1) Where the normal source consists of generating units on the premises, the alternate source shall be either another generating set or an external utility service. \[99:6.4.1.1.5\]

(2) Fuel Cell Systems.

Fuel cell systems shall be permitted to serve as the alternate source for all or part of an essential electrical system, provided the following conditions apply:

1. Installation shall comply with NFPA 853, Standard for installation of Stationary Fuel Cell Power Systems.
2. \(N\) units shall be provided where \(N\) units have sufficient capacity to supply the demand load of the portion of the system served.
3. System shall be able to assume loads within 10 seconds of loss of normal power source.
4. System shall have a continuing source of fuel supply, together with sufficient on-site fuel storage for the essential system type.
5. A connection shall be provided for a portable diesel generator to supply life safety and critical portions of the distribution system. \[99:6.4.1.1.7(1) through (5)\]

- Fuel cell systems shall be listed for emergency system use.

(C) Location of Essential Electrical System Components.

Essential electrical system components shall be located to minimize interruptions caused by natural forces common to the area (e.g., storms, floods, earthquakes, or hazards created by adjoining structures or activities). Installations of electrical services shall be located to reduce possible interruption of normal electrical services resulting from similar causes as well as possible disruption of normal electrical service due to internal wiring and equipment failures. Feeders shall be located to provide physical separation of the feeders of the alternate source and from the feeders of the normal electrical source to prevent possible simultaneous interruption.

Informational Note: Facilities in which the normal source of power is supplied by two or more separate central station-fed services experience greater than normal electrical service reliability than those with only a single feed. Such a dual source of normal power consists of two or more electrical services fed from separate generator sets or a utility distribution network that has multiple power input sources and is arranged to provide mechanical and electrical separation so that a fault between the facility and the generating sources is not likely to cause an interruption of more than one of the facility service feeders.

Statement of Problem and Substantiation for Public Comment

The text as written in the first revision does not match the extracted text from NFPA 99 6.4.1.1.7. This change aligns this section with the extracted text with consideration to the NEC MOS.

Related Item

First Revision No. 4276-NFPA 70-2015 [Section No. 517.35]

Submitter Information Verification

Submitter Full Name: CHAD BEEBE
Organization: ASHE AHA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:16:10 EDT 2015
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4225-NFPA 70-2015
Statement: The NFPA 99 requirement for installation compliance with NFPA 853 was inadvertently omitted and 517.30(A) is revised accordingly.

The requirement for fuel cell systems being listed for emergency use is specifically retained. This requirement is clearly outside of the cited extracted text for NFPA 70-2017, and the same requirement has been explicitly added to 6.4.1.1.7 per First Revision FR 19 of NFPA 99-2018, where wording has been revised accordingly. Furthermore, this is a requirement pertaining to the installation of equipment. In accordance with Standards Council Decision SD-11-7, NFPA 70 Code-Making Panel 15 has authority to set installation requirements of equipment in health care facilities.

This action meets the intent of the CC PC-1817 relative to “or more”.
The number of transfer switches to be used shall be based on reliability and design. Each branch of the essential electrical system shall have one or more transfer switches. Transfer equipment shall meet the requirements in 700.5(A), (B), and (C) where commercially available.

One transfer switch and downstream distribution system shall be permitted to serve one or more branches in a facility with a maximum demand on the essential electrical system of 150 kVA.

Informational Note No. 1: See NFPA 99-2015, Health Care Facilities Code, 6.4.3.2, Transfer Switches; 6.4.2.1.5, Automatic Transfer Switch Features; 6.4.2.1.5.15, Nonautomatic Transfer Switch Features; and 6.4.2.1.7, Nonautomatic Transfer Device Features.

Informational Note No. 2: See Informational Note Figure 517.31(a).

Informational Note No. 3: See Informational Note Figure 517.31(b).

Statement of Problem and Substantiation for Public Comment

The 2015 NFPA 99 at (6.4.2.2.1.5) states that Article 700 shall only apply to the life safety branch.
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4218-NFPA 70-2015
Statement: NFPA 99:6.4.2.2.1.5 states that NFPA 70, Article 700 shall only apply to the life safety branch. CMP-15 deletes the last sentence added in the FR, ("Only Transfer equipment on the life safety branch shall meet the requirements in 700.5(A), (B), and (C) where commercially available.") as it not consistent with the requirements of NFPA 99.
Public Comment No. 675-NFPA 70-2015 [Section No. 517.31(C)(3)]

(3) Mechanical Protection of the Essential Electrical System.

The wiring of the life safety and critical branches shall be mechanically protected. Where installed as branch circuits in patient care spaces, the installation shall comply with the requirements of 517.13(A) and (B). Only the following wiring methods shall be permitted:

1. Nonflexible metal raceways, Type MI cable, Type RTRC marked with the suffix –XW, or Schedule 80 PVC conduit. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.

2. Where encased in not less than 50 mm (2 in.) of concrete, Schedule 40 PVC conduit, flexible nonmetallic or jacketed metallic raceways, or jacketed metallic cable assemblies listed for installation in concrete. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.

3. Listed metal sheathed cable assemblies where installed in accordance with 300.4 and not subject to physical damage.

4. Listed flexible metal raceways and listed metal sheathed cable assemblies in any of the following:
   5. Where used in listed prefabricated medical headwalls
   6. In listed office furnishings
   7. Where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage
   8. Where necessary for flexible connection to equipment
   9. For equipment that requires a flexible connection due to movement, vibration, or operation
   10. Luminaires installed in rigid ceiling structures where there is no access above the ceiling space after the luminaire is installed.

11. Flexible power cords of appliances or other utilization equipment connected to the emergency system.

12. Cables for Class 2 or Class 3 systems permitted by Part VI of this Article, with or without raceways.

Informational Note: See 517.13 for additional grounding requirements in patient care areas.

Statement of Problem and Substantiation for Public Comment

The Panel statement concerning product Standards and performance does not address the factual information provided by PI 341 and the original proposal from the 2014 Code Revision offering that the present Product Standard and Product Performance is adequate for the application and is proven through its approval for the use since the 2005 NEC.

Since these wiring methods have been providing acceptable service and performance since the 2005 NEC where it is fished, the concern seems to be the rigors of installation in new construction. The installation of these wiring methods in hospital construction is no more severe or damaging than their installation in any other building construction or job site where these cables are extensively used. Listed metal sheathed cable assemblies installed in accordance with the NEC 300.4 and where not subject to physical damage provides protection against mechanical damage for the Emergency System and has been doing so since the 2005 NEC.

All wiring methods can be damaged if installed in inappropriate locations. Type MC cable offers a comparable level of protection to that provided by EMT in ordinary locations and the environment of hospital construction and operation.

There is no need for a special construction of MC where used in normal construction. A higher level of performance for the cable where exposed to severe physical damage may be appropriate but is not
necessary where installed in ordinary locations such as in floors, walls, and ceilings. The requirements in 300.4 provide protection against normal physical damage during construction and operation in general locations.

Related Item
Public Input No. 341-NFPA 70-2014 [Global Input]
Public Input No. 2757-NFPA 70-2014 [Section No. 517.30(C)(3)]

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<tbody>
<tr>
<td><strong>Submitter Full Name:</strong> Phil Simmons</td>
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<tr>
<td><strong>Affiliation:</strong> National Armored Cable Manufacturers Association</td>
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<td><strong>Street Address:</strong></td>
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<td><strong>Submittal Date:</strong> Wed Sep 16 01:08:21 EDT 2015</td>
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<td><strong>Committee Action:</strong> Rejected</td>
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<tr>
<td><strong>Resolution:</strong> Between the 2014 and 2017 NEC Revision Cycles, the Chairman of the NEC Correlating Committee instituted a Task Group made up of members of CMP-15, CMP-7, members of the Correlating Committee and other interested parties. The purpose and charge of this committee was to resolve a series of public comments regarding the use of MC cable in these situations. The committee was directed to compare the performance of this new MC cable to the published product standards for this new cable. During the course of their work it was learned that product standards do not currently exist for this cable, so the Task Group was not able to entirely complete the task charged to the group. The group reported back to the CC that until product standards were available, the task group was incomplete, however the task group did suggest that should product standards become available they would be happy to complete their work, and they suggested that any action proposed by the Task Group be vetted through CMP-7 for their review, before sent to CMP-15 for action. This Task Group is still working and awaiting appropriate product standards. The course of action outlined by the CC and the Task Group must be implemented before considering the approval of this new cable in these most critical of applications.</td>
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</table>
Public Comment No. 868-NFPA 70-2015 [Section No. 517.31(C)(3)]

(3) Mechanical Protection of the Essential Electrical System.

The wiring of the life safety and critical branches shall be mechanically protected. Where installed as branch circuits in patient care spaces, the installation shall comply with the requirements of 517.13(A) and (B). Only the following wiring methods shall be permitted:

1. Nonflexible metal raceways, Type MI cable, Type RTRC marked with the suffix –XW, or Schedule 80 PVC conduit. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.

2. Where encased in not less than 50 mm (2 in.) of concrete, Schedule 40 PVC conduit, flexible nonmetallic or jacketed metallic raceways, or jacketed metallic cable assemblies listed for installation in concrete. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.

3. Listed flexible metal raceways and listed metal sheathed cable assemblies in any of the following:
   4. Where used in listed prefabricated medical headwalls
   5. In listed office furnishings
   6. Where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage
   7. Where necessary for flexible connection to equipment
   8. For equipment that requires a flexible connection due to movement, vibration, or operation
   9. Luminaires installed in rigid ceiling structures where there is no access above the ceiling space after the luminaire is installed.

10. Flexible power cords of appliances or other utilization equipment connected to the emergency system.

11. Cables for Class 2 or Class 3 systems permitted by Part VI of this Article, with or without raceways.

12. Listed MC cable identified as providing crush, impact and penetration circuit protection performance comparable to electrical metallic tubing.

Informational Note: See 517.13 for additional grounding requirements in patient care areas.

Statement of Problem and Substantiation for Public Comment

Type MC cable as shown in previous UL Fact Finding Reports can be constructed to provide enhanced mechanical protection comparable to EMT while maintaining ground path integrity before, during and after installation.

Related Item

Public Input No. 338-NFPA 70-2014 [Global Input]

Submitter Information Verification

Submitter Full Name: Charles Mercier
Organization: Southwire Company
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 15:31:09 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Between the 2014 and 2017 NEC Revision Cycles, the Chairman of the NEC Correlating Committee instituted a Task Group made up of members of CMP-15, CMP-7, members of the Correlating Committee and other interested parties. The purpose and charge of this committee was to resolve a series of public comments regarding the use of MC cable in these situations. The committee was directed to compare the performance of this new MC cable to the published product standards for this new cable. During the course of their work it was learned that product standards do not currently exist for this cable, so the Task Group was not able to entirely complete the task charged to the group. The group reported back to the CC that until product standards were available, the task group was incomplete, however the task group did suggest...
that should product standards become available they would be happy to complete their work, and they suggested that any action proposed by the Task Group be vetted through CMP-7 for their review, before sent to CMP-15 for action. This Task Group is still working and awaiting appropriate product standards. The course of action outlined by the CC and the Task Group must be implemented before considering the approval of this new cable in these most critical of applications.
Public Comment No. 1497-NFPA 70-2015 [Section No. 517.34(A)]

(A) Task Illumination and Selected Receptacles.

The critical branch of the essential electrical system shall supply power for task illumination, fixed equipment, selected receptacles, and special power circuits serving the following areas and functions related to patient care:

1. Critical care (Category 1), spaces that utilize anesthetizing gases, task illumination, selected receptacles, and fixed equipment

2. The isolated power systems in special environments

3. Patient care spaces, task illumination, and selected receptacles in the following:
   a. Infant nurseries
   b. Medication preparation areas
   c. Pharmacy dispensing areas
   d. Selected acute nursing areas
   e. Psychiatric bed areas (omit receptacles)
   f. Ward treatment rooms
   g. Nurses' stations (unless adequately lighted by corridor luminaires)

4. Additional specialized patient care task illumination and receptacles, where needed

5. Nurse call systems

6. Blood, bone, and tissue banks

7. Telephone and data equipment rooms and closets

8. Task illumination, selected receptacles, and selected power circuits for the following:
   a. General care (Category 2) beds
      i. Category 2 beds (at least one duplex receptacle in each patient bedroom)
      ii. Aniographic labs
      iii. Cardiac catheterization labs
      iv. Coronary care units
      v. Hemodialysis rooms or areas
      vi. Emergency room treatment areas (selected)
      vii. Human physiology labs
      viii. Intensive care units
      ix. Postoperative recovery rooms (selected)

Statement of Problem and Substantiation for Public Comment

For consistency with NFPA 99 the terms "critical, basic, general" etc should be removed which is no longer used in the standard to describe function of spaces.

Related Item
First Revision No. 4274-NFPA 70-2015 [Section No. 517.33]

Submitter Information Verification

Submitter Full Name: CHAD BEEBE
Organization: ASHE AHA
Street Address: 
City:
Committee Statement

<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
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</table>

Resolution: In accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175. See the Second Revision created to 517.2 (Patient Care Space).
Public Comment No. 1716-NFPA 70-2015 [Section No. 517.34(B)]

(B) Switching.
It shall be permitted to control task illumination on the critical branch.

Statement of Problem and Substantiation for Public Comment

This is not needed NFPA 99 permits this and A above is a extract.

Related Item
First Revision No. 4274-NFPA 70-2015 [Section No. 517.33]

Submitter Information Verification

Submitter Full Name: David Dagenais
Organization: Wentworth-Douglass Hospital
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 17:38:56 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Permitting switched task illumination circuits provides important coordination with NFPA 99. CMP-15 notes that the Public Comment 1716 relates to 517.33(B) and not 517.34(B).
The equipment branch shall be installed and connected to the alternate power source such that the equipment described in
517.35(A) is automatically restored to operation at appropriate time-lag intervals following the energizing of the essential
electrical system. Its arrangement shall also provide for the subsequent connection of equipment described in 517.35(B).

Exception: For essential electrical systems under 150 kVA, deletion of the time-lag intervals feature for delayed automatic
connection to the equipment system shall be permitted.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that this First Revision be reconsidered with regard to the deletion of the term "or more" and to
correlate with FR 4279. Section 3.2.7.3.2 of the NFPA style manual requires the "context of the original material not be compromised or
violated."

Related Item
First Revision No. 4276-NFPA 70-2015 [Section No. 517.35]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 09:50:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4225-NFPA 70-2015
Statement: The NFPA 99 requirement for installation compliance with NFPA 853 was inadvertently omitted and 517.30(A) is revised
accordingly.

The requirement for fuel cell systems being listed for emergency use is specifically retained. This requirement is clearly
outside of the cited extracted text for NFPA 70-2017, and the same requirement has been explicitly added to 6.4.1.1.7 per
First Revision FR 19 of NFPA 99-2018, where wording has been revised accordingly. Furthermore, this is a requirement
pertaining to the installation of equipment. In accordance with Standards Council Decision SD-11-7, NFPA 70
Code-Making Panel 15 has authority to set installation requirements of equipment in health care facilities.

This action meets the intent of the CC PC-1817 relative to "or more".
Public Comment No. 1665-NFPA 70-2015 [Section No. 517.42(A)]

(A) General.

Essential electrical systems for nursing homes and limited care facilities shall be divided into the following two branch
circuits branches, the life safety branch and the equipment branch. [99:A.6.5.2.2.1.2]

The division between the branches shall occur at transfer switches where more than one transfer switch is required.

Informational Note No. 1: Essential electrical systems are comprised of two separate branches capable of supplying a
limited amount of lighting and power service, which is considered essential for the protection of life and safety and
effective operation of the institution during the time normal electrical service is interrupted for any reason.

Informational Note No. 2: For more information see NFPA 99-2015, Health Care Facilities Code [99:A.6.5.2.1.1]

Statement of Problem and Substantiation for Public Comment

Requiring the essential systems to be two branch circuits is unnecessarily limiting. Similar to the language of 517.30(B) the separation is
simply into two branches.

Related Item
First Revision No. 4277-NFPA 70-2015 [Section No. 517.41]

Submitter Information Verification

Submitter Full Name: MARCUS SAMPSON
Organization: MINNESOTA DEPARTMENT OF LABOR & INDUSTRY
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:02:43 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4219-NFPA 70-2015
Statement: This revision correlates with the requirement in NFPA 99. CMP-15 editorially corrects the extract references to
NFPA 99.
Public Comment No. 1713-NFPA 70-2015 [Section No. 517.42(B)]

(B) Transfer Switches.

The number of transfer switches to be used shall be based on reliability, design, and load considerations.  

(1) Each branch of the essential electrical system shall have one or more transfer switches. Transfer equipment shall only meet the requirements in 700.5(A), (B), and (C) where commercially available.

(2) One transfer switch shall be permitted to serve one or more branches or systems in a facility with a continuous load on the switch of 150 kVA (120 kW) or less.

Informational Note No. 1: See NFPA 99-2015, Health Care Facilities Code, 6.5.3.2, Transfer Switch Operation Type II; 6.4.2.1.5, Automatic Transfer Switch Features; and 6.4.2.1.7, Nonautomatic Transfer Device Features.

Informational Note No. 2: See Informational Note Figure 517.42(a).

Informational Note No. 3: See Informational Note Figure 517.42(b).

Informational Note Figure 517.42(a) Nursing Home and Limited Health Care Facilities — Minimum Requirement (greater than 150 kVA) for Transfer Switch Arrangement.

Informational Note Figure 517.42(b) Nursing Home and Limited Health Care Facilities — Minimum Requirement (150 kVA or less) for Transfer Switch Arrangement.

Statement of Problem and Substantiation for Public Comment

The 2015 NFPA 99 at (6.4.2.2.1.5) states that Article 700 shall only apply to the life safety branch.

Related Item

First Revision No. 4277-NFPA 70-2015 [Section No. 517.41]
<table>
<thead>
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<tr>
<td><strong>Resolution:</strong></td>
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<tr>
<td><strong>Statement:</strong></td>
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</tbody>
</table>
(A) **Delayed Automatic Connection.**

The following equipment shall be permitted to be connected to the equipment branch and shall be arranged for delayed automatic connection to the alternate power source:

1. Task illumination and selected receptacles in the following:
   - Patient care spaces
   - Medication preparation areas
   - Pharmacy dispensing areas
   - Nurses’ stations (unless adequately lighted by corridor luminaires)

2. **Supply, return, and exhaust ventilating systems for air-borne infectious isolation rooms.**

3. **Sump pumps and other equipment required to operate for the safety of major apparatus and associated control systems and alarms.**

4. **Smoke control and stair pressurization systems.**

5. **Kitchen hood supply and/or exhaust systems, if required to operate during a fire in or under the hood.**

6. **Nurse call systems [99: 6.5.2.2.3.3]**

**Statement of Problem and Substantiation for Public Comment**

This is not extracted from 99 correctly, item 1 should have 2,3,4,5 as a subset.

**Related Item**

First Revision No. 4278-NFPA 70-2015 [Section No. 517.43]

**Submitter Information Verification**

**Submitter Full Name:** David Dagenais

**Organization:** Wentworth-Douglass Hospital

**Submittal Date:** Fri Sep 25 17:43:07 EDT 2015

**Committee Statement**

**Committee Action:** Rejected but see related SR

**Resolution:** SR-4229-NFPA 70-2015

**Statement:** This revision correlates with the requirement extracted from NFPA 99.
Public Comment No. 1525-NFPA 70-2015 [Section No. 517.45]

517.45 Essential Electrical Systems for Other Health Care Facilities.

(A) Essential Electrical Distribution.
If required by the governing body, the essential electrical distribution system for basic care (Category 3) patient care spaces shall be comprised of an alternate power system capable of supplying a limited amount of lighting and power service for the orderly cessation of procedures during a time normal electrical service is interrupted.


(B) Electrical Life Support Equipment.
Where electrical life support equipment is required, the essential electrical distribution system shall be as described in 517.29 through 517.30.

(C) Critical Care (Category 1) Patient Care Spaces.
Where critical patient care (Category 1) spaces are present, the essential electrical distribution system shall be as described in 517.29 through 517.30.

(D) General Care (Category 2) Patient Care Spaces.
Where general care (Category 2) patient care spaces are present, the essential electrical distribution system shall be as described in 517.40 through 517.45.

(E) Power Systems.
If required, alternate power sources acceptable to the governing body shall comply with the requirements of NFPA 99-2015, Health Care Facilities Code.

Statement of Problem and Substantiation for Public Comment

For consistency with NFPA 99 the terms "critical, basic, general" etc should be removed which is no longer used in the standard to describe function of spaces.

Related Item
First Revision No. 4280-NFPA 70-2015 [Section No. 517.45]

Submitter Information Verification

Submitter Full Name: CHAD BEEBE
Organization: ASHE AHA
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Fri Sep 25 13:37:37 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: In accordance with 4.3.3 of the National Electrical Code® Style Manual and 2.3.2.11 of the Manual of Style for NFPA Technical Committee Documents regarding extracted materials, the consent of the NFPA 99 Fundamentals Technical Committee, as the committee responsible for the source document, was sought and obtained to use parenthetic references between specific older and current NFPA 99 terminology during a transition to current NFPA 99 terminology in the National Electrical Code®. [Ref. Minutes of NFPA Technical Committee on Fundamentals (HEA-FUN), August 13, 2015, Item 7] This written permission is documented in the attachments submitted with Public Comment PC 1175. See the Second Revision created to 517.2 (Patient Care Space).
(2) Design and Installation.

Where an isolated power system is utilized, the isolated power equipment shall be listed and labeled as isolated power equipment, and the isolated power system shall be designed and installed in accordance with 517.160.

Additional Proposed Changes

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<thead>
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<th>Description</th>
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<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item

Public Input No. 915-NFPA 70-2014 [Section No. 517.61(A)(2)]
First Revision No. 4203-NFPA 70-2015 [Section No. 517.61(A)(2)]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
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<tr>
<td><strong>Statement:</strong></td>
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Public Comment No. 1272-NFPA 70-2015 [Section No. 517.63(E)]

(E) Location of Isolated Power Systems.
Where an isolated power system is utilized, the isolated power equipment shall be listed and labeled as isolated power equipment. Isolated power system equipment and its supply circuit shall be permitted to be located in an anaesthetizing location, provided it is installed above a hazardous (classified) location or in an other-than-hazardous (classified) location.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

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Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item

Public Input No. 916-NFPA 70-2014 [Section No. 517.63(E)]
First Revision No. 4204-NFPA 70-2015 [Section No. 517.63(E)]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
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Public Comment No. 1818-NFPA 70-2015 [Section No. 517.71(C)]

(C) Over 2000-Volt Supply.
Circuits and equipment operated on a supply circuit of over 2000 volts shall comply with Article 490.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that this First Revision be reconsidered. Code-making Panel 9 did not change the title of Article 490 and its scope covers equipment over 1000 volts.

Related Item
First Revision No. 4205-NFPA 70-2015 [Section No. 517.71(C)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 09:51:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4230-NFPA 70-2015
Statement: CMP-15 makes this revision to correlate with Article 490.
Adapter.
A device used to adapt a circuit from one configuration of an attachment plug or receptacle to another configuration with the same current rating.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs that the panel reconsider the definition of “adapter” related to multiple different uses of the term throughout Article 520.

Related Item
First Revision No. 4212-NFPA 70-2015 [New Definition after Definition: Two-Fer]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 09:53:47 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-4227-NFPA 70-2015
Statement: The Correlating Committee correctly pointed out a conflict between First Revision addition of “adapter” definition and other uses of “adapter” in article 520. This Second Revision change to the definition of “Two-Fer” (the only conflicting use of “adapter”) is required to correct that conflict.
Section 520.9, Branch Circuits.

A branch circuit of any size supplying one or more receptacles shall be permitted to supply stage set lighting. The voltage rating of the receptacles shall be not less than the circuit voltage. Receptacle ampere ratings and branch-circuit conductor ampacity shall be not less than the branch-circuit overcurrent device ampere rating. Table 210.21(B)(2) and Section 210.23 shall not apply. Section 210.8(B) shall be permitted but not required.

Statement of Problem and Substantiation for Public Comment

This comment retains the current requirements. No justification was made for increasing the requirements in this Article imposed by changes in 210.8(B).

Related Item

First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: Kenneth Vannice
Organization: [ Not Specified ]
Affiliation: USITT Engineering Commission
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 01:47:58 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4203-NFPA 70-2015
Statement: Section 210.8(B)(3)(d) was changed in the First Revision to add requirements for GFCI protection on all outdoor branch circuits. No technical substantiation was provided to warrant the addition of these requirements to section 520.9. In addition, due to the nature of the equipment used in venues covered by article 520 such as phase-controlled dimmed branch circuits, there is typically no practical way to comply with the new requirements of section 210.8(B)(3)(d).
520.21 General.
Fixed stage switchboards shall comply with 520.21(1) through (4):

(1) Fixed stage switchboards shall be listed and labeled.

(2) Fixed stage switchboards shall be readily accessible but shall not be required to be located on or adjacent to the stage. Multiple fixed stage switchboards shall be permitted at different locations.

(3) A fixed stage switchboard shall contain overcurrent protective devices for all branch circuits supplied by that switchboard.

(4) A fixed stage switchboard shall be permitted to supply both stage and non-stage equipment.

Additional Proposed Changes

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Related Item

Public Input No. 917-NFPA 70-2014 [Section No. 520.21]
First Revision No. 4209-NFPA 70-2015 [Section No. 520.21]
## Submitter Information Verification

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<tr>
<th><strong>Submitter Full Name</strong></th>
<th>JEFFREY FECTEAU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td>UNDERWRITERS LABORATORIES LLC</td>
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<tr>
<td><strong>Affiliation</strong></td>
<td>UL</td>
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<td>Thu Sep 24 17:34:01 EDT 2015</td>
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## Committee Statement

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<td><strong>Resolution</strong></td>
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<tr>
<td><strong>Statement</strong></td>
<td>Labeling of listed equipment harmonizes the NEC with requirements of Nationally Recognized Testing Laboratories and provides a valuable tool for users and AHJ’s.</td>
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Identification of Conductors in Multiconductor Extra-Hard-Usage Cords and Cables.

Grounded (neutral) conductors shall be white without stripe or shall be identified by a distinctive white marking at their terminations. Grounding conductors shall be green with or without yellow stripe or shall be identified by a distinctive green marking at their terminations.

Table 520.44(C)(3) Ampacity of Listed Extra-Hard-Usage Cords and Cables with Temperature Ratings of 75°C (167°F) and 90°C (194°F)* [Based on Ambient Temperature of 30°C (86°F)]

<table>
<thead>
<tr>
<th>Size (AWG)</th>
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<th>90°C (194°F)</th>
<th>Maximum Rating of Overcurrent Device</th>
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<td>28</td>
<td>15</td>
</tr>
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<td>12</td>
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<tr>
<td>2</td>
<td>133</td>
<td>152</td>
<td>80</td>
</tr>
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*Ampacity shown is the ampacity for multiconductor cords and cables where only three copper conductors are current-carrying as described in 400.5. If the number of current-carrying conductors in a cord or cable exceeds three and the load diversity is a minimum of 50 percent or less, the ampacity of each conductor shall be reduced as shown in the following table:

Table 520.44(C)(3)(a) Ampacity Adjustment Factors for More Than Three Current-Carrying Conductors in a Cord or Cable Where Load Diversity Is 50% or Less

<table>
<thead>
<tr>
<th>Number of Conductors</th>
<th>Percent of Ampacity Value in Table 520.44(C)(3)</th>
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<tbody>
<tr>
<td>4–6</td>
<td>80</td>
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<tr>
<td>7–24</td>
<td>70</td>
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<td>25–42</td>
<td>60</td>
</tr>
<tr>
<td>43 and above</td>
<td>50</td>
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Note: Ultimate insulation temperature. In no case shall conductors be associated together in such a way with respect to the kind of circuit, the wiring method used, or the number of conductors such that the temperature limit of the conductors is exceeded.

A neutral conductor that carries only the unbalanced current from other conductors of the same circuit need not be considered as a current-carrying conductor.

In a 3-wire circuit consisting of 2-phase conductors and the neutral conductor of a 4-wire, 3-phase, wye-connected system, the neutral conductor carries approximately the same current as the line-to-neutral currents of the other conductors and shall be considered to be a current-carrying conductor.

On a 4-wire, 3-phase wye circuit where the major portion of the load consists of nonlinear loads, there are harmonic currents in the neutral conductor. Therefore, the neutral conductor shall be considered to be a current-carrying conductor.

Informational Note: For the purposes of Table 520.44(C)(3)(a), load diversity is the percentage of the total current of all simultaneously energized circuits fed by the cable to the sum of the ampacity ratings of all circuits in that cable.

Statement of Problem and Substantiation for Public Comment

The phrase "... load diversity is a minimum of 50% or less, ..." is somewhat self-contradictory. Clarifying the language to read "... load diversity of 50% or less, ..." was the intention of the Panel in the FR.

Related Item
First Revision No. 4210-NFPA 70-2015 [Section No. 520.44(C)(3)]
Public Input No. 742-NFPA 70-2014 [Section No. 520.44(C)(3)]

Submitter Information Verification
Submitter Full Name: Mitchell Hefter
Organization: Philips Lighting
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Affiliation: Illuminating Engineering Society

Committee Statement

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<th>Illuminating Engineering Society</th>
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<td>Submittal Date:</td>
<td>Wed Sep 23 22:40:59 EDT 2015</td>
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Identification of Conductors in Multiconductor Extra-Hard-Usage Cords and Cables.

Grounded (neutral) conductors shall be white without stripe or shall be identified by a distinctive white marking at their terminations. Grounding conductors shall be green with or without yellow stripe or shall be identified by a distinctive green marking at their terminations.

Table 520.44(C)(3) Ampacity of Listed Extra-Hard-Usage Cords and Cables with Temperature Ratings of 75°C (167°F) and 90°C (194°F)* [Based on Ambient Temperature of 30°C (86°F)]

<table>
<thead>
<tr>
<th>Size (AWG)</th>
<th>Temperature Rating of Cords and Cables</th>
<th>Maximum Rating of Overcurrent Device</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75°C (167°F)</td>
<td>90°C (194°F)</td>
</tr>
<tr>
<td>14</td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td>12</td>
<td>32</td>
<td>35</td>
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<td>10</td>
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<td>47</td>
</tr>
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<td>8</td>
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<tr>
<td>4</td>
<td>101</td>
<td>114</td>
</tr>
<tr>
<td>2</td>
<td>133</td>
<td>152</td>
</tr>
</tbody>
</table>

*Ampacity shown is the ampacity for multiconductor cords and cables where only three copper conductors are current-carrying as described in 400.5. If the number of current-carrying conductors in a cord or cable exceeds three and the load diversity is a minimum of 50 percent or less, the ampacity of each conductor shall be reduced as shown in the following table:

Table 520.44(C)(3)(a) Ampacity Adjustment Factors for More Than Three Current-Carrying Conductors in a Cord or Cable Where Load Diversity Is 50% or Less

<table>
<thead>
<tr>
<th>Number of Conductors</th>
<th>Percent of Ampacity Value in Table 520.44(C)(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4–6</td>
<td>80</td>
</tr>
<tr>
<td>7–24</td>
<td>70</td>
</tr>
<tr>
<td>25–42</td>
<td>60</td>
</tr>
<tr>
<td>43 and above</td>
<td>50</td>
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</tbody>
</table>

Note: Ultimate insulation temperature. In no case shall conductors be associated together in such a way with respect to the kind of circuit, the wiring method used, or the number of conductors such that the temperature limit of the conductors is exceeded.

A neutral conductor that carries only the unbalanced current from other conductors of the same circuit need not be considered as a current-carrying conductor.

In a 3-wire circuit consisting of two phase conductors and the neutral conductor of a 4-wire, 3-phase, wye-connected system, the neutral conductor carries approximately the same current as the line-to-neutral currents of the other conductors and shall be considered to be a current-carrying conductor.

On a 4-wire, 3-phase wye circuit where the major portion of the load consists of nonlinear loads, there are harmonic currents in the neutral conductor. Therefore, the neutral conductor shall be considered to be a current-carrying conductor.

Informational Note: For the purposes of Table 520.44(C)(3)(a), load diversity is the percentage of the total current of all simultaneously energized circuits fed by the cable to the sum of the ampacity ratings of all circuits in that cable.

Statement of Problem and Substantiation for Public Comment

There was a typo in the editing of the panel action creating the First Revision. This is supposed to address two of the three phases in a 3-phase, 4-wire feed, i.e., not all of the phases. This is not addressing a 2-phase circuit. This edit corrects the error.

Related Item
First Revision No. 4210-NFPA 70-2015 [Section No. 520.44(C)(3)]
Public Input No. 742-NFPA 70-2014 [Section No. 520.44(C)(3)]

Submitter Information Verification
Submitter Full Name: Mitchell Hefter
Organization: Philips Lighting
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4205-NFPA 70-2015
Statement:

In the asterisk note following Table 520.44(C)(3), the removal of "a minimum of" is an editorial change to correct self-contradictory wording inadvertently inserted in the First Revision. "2-phase" rather than "two phase" was inserted in the FR. The change corrects that error.
Public Comment No. 1279-NFPA 70-2015 [Section No. 520.48]

520.48 Curtain Machines.
Curtain machines shall be listed and labeled.

Additional Proposed Changes

<table>
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<th>Description</th>
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<tbody>
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Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
Public Input No. 918-NFPA 70-2014 [Section No. 520.48]
First Revision No. 4217-NFPA 70-2015 [Section No. 520.48]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
Committee Statement

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<td>SR-4206-NFPA 70-2015</td>
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<td>Statement:</td>
<td>Labeling of listed equipment harmonizes the NEC with requirements of Nationally Recognized Testing Laboratories and provides a valuable tool for users and AHJ’s.</td>
</tr>
</tbody>
</table>
Public Comment No. 1166-NFPA 70-2015 [Section No. 520.68(B)]

(B) Conductor Ampacity.

The ampacity of conductors shall be as given in 400.5, except multiconductor, listed, extra-hard usage portable cords that are not in direct contact with equipment containing heat-producing elements shall be permitted to have their ampacity determined by Table 520.44(C)(3). Maximum load current in any conductor with an ampacity determined by Table 520.44(C)(3) shall not exceed the values in Table 520.44(C)(3). Where the ampacity adjustment factors of Table 520.44(C)(3)(a) are applied for more than three current-carrying conductors in a portable cord, the load diversity shall be 50 percent or less.

Exception: Where alternate conductors are allowed in 520.68(A)(3), their ampacity shall be as given in the appropriate table in this Code for the types of conductors employed.

Statement of Problem and Substantiation for Public Comment

Editorial correction - the Exception refers to the wrong section. 520.68(A)(4) was 520.68(A)(3) prior to insertion of the current 520.68(A)(3) ‘Luminaire Supply Cords.’ This edit corrects the reference.

Related Item
First Revision No. 4227-NFPA 70-2015 [Section No. 520.68(B)]
Public Input No. 746-NFPA 70-2014 [Section No. 520.68(B)]

Submitter Information Verification
Submitter Full Name: Mitchell Hefter
Organization: Philips Lighting
Affiliation: Illuminating Engineering Society
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 23:20:38 EDT 2015

Committee Statement
Committee Action: Accepted
Resolution: SR-4207-NFPA 70-2015
Statement: This Second Revision corrects an incorrect reference.
Public Comment No. 806-NFPA 70-2015 [Definition: Operator.]

Operator (as related to carnivals, circuses, fairs and similar events).
The individual responsible for starting, stopping, and controlling an amusement ride or supervising a concession.

Statement of Problem and Substantiation for Public Comment

All NFPA definitions are incorporated without change or comment into the NFPA Glossary of terms which simply indicates the code or standard where the definition originates. The definition of operator in the NEC can refer to multiple occupations and is not unique to article 525. If the panel wants to identify it in a different way, that would still comply with the concept that "operator" is too generic a term to stay as a definition that applies solely to a carnival operator.

Related Item

Public Input No. 2448-NFPA 70-2014 [Definition: Operator.]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City: 
State: 
Zip: 
Submittal Date: Sun Sep 20 19:53:05 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The definition of "Operator" is inherently limited to article 525 venues due to its location in 525.2 as well as by the wording of the definition itself. The parenthetical modification of the definition proposed by the commenter is not needed, as it is clear as currently written.
Portable Structures (as related to carnivals, circuses, fairs and similar events)

Units designed to be moved including, but not limited to, amusement rides, attractions, concessions, tents, trailers, trucks, and similar units.

Statement of Problem and Substantiation for Public Comment

All NFPA definitions are incorporated without change or comment into the NFPA Glossary of terms which simply indicates the code or standard where the definition originates. The definition of portable structures in the NEC can refer to multiple structures and is not unique to article 525. If the panel wants to identify it in a different way, that would still comply with the concept that "portable structures" is too generic a term to stay as a definition that applies solely to carnival portable structures.

Related Item

Public Input No. 2450-NFPA 70-2014 [Definition: Portable Structures.]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 19:59:31 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The definition of “Portable Structure” is inherently limited to article 525 venues due to its location in 525.2 as well as by the wording of the definition itself. The parenthetical modification of the definition proposed by the commenter is not needed, as it is clear as currently written.
525.23  Ground-Fault Circuit-Interrupter (GFCI) Protection.

Where GFCI protection is provided through the use of GFCI receptacles, and the branch circuits supplying receptacles utilize flexible cord, the receptacles shall be identified for portable use.

(A) Where GFCI Protection Is Required.

GFCI protection for personnel shall be provided for the following:

(1) All 125-volt, single-phase, 15- and 20-ampere non-locking-type receptacles used for disassembly and reassembly or readily accessible to the general public

(2) Equipment that is readily accessible to the general public and supplied from a 125-volt, single-phase, 15- or 20-ampere branch circuit

The GFCI shall be permitted to be an integral part of the attachment plug or located in the power-supply cord within 300 mm (12 in.) of the attachment plug. Listed cord sets incorporating GFCI for personnel shall be permitted.

(B) Where GFCI Protection Is Not Required.

Receptacles that are not accessible from grade level and that only facilitate quick disconnecting and reconnecting of electrical equipment shall not be required to be provided with GFCI protection. These receptacles shall be of the locking type.

(C) Where GFCI Protection Is Not Permitted.

Egress lighting shall not be protected by a GFCI.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to new initial paragraph in 525.23 relative to the first level subdivision numbering and titles to comply with 2.1.5.3 of the NEC Style Manual.

Related Item

First Revision No. 4225-NFPA 70-2015 [Section No. 525.23]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 09:59:51 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4208-NFPA 70-2015
Statement: Per the Correlating Committee comment, this Second Revision alters the section numbering in order to comply with the NEC Style Manual. CMP-15 adds a first level title. The term “receptacles” is changed to “GFCI protection…listed, labeled and” for clarity.
530.23 Branch Circuits.
A branch circuit of any size supplying one or more receptacles shall be permitted to supply stage set lighting loads. Section 210.8 (B) shall be permitted but not required.

Statement of Problem and Substantiation for Public Comment

This comment retains the current requirements. No justification was made for increasing the requirements in this Article due to changes in 210.8(B).

Related Item
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: Kenneth Vannice
Organization: [ Not Specified ]
Affiliation: USITT Engineering Commission
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 01:57:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4209-NFPA 70-2015
Statement: Section 210.8(B)(3)(d) was changed in the First Revision to add requirements for GFCI protection on all outdoor branch circuits. No technical substantiation was provided to warrant the addition of these requirements to section 530.23. In addition, due to the nature of the equipment used in venues covered by article 530 such as phase-controlled dimmed branch circuits, there is typically no practical way to comply with the new requirements of section 210.8(B)(3)(d).
Public Comment No. 1282-NFPA 70-2015 [Section No. 540.20]

540.20 Listing Requirements.
Projectors and enclosures for arc, xenon, and incandescent lamps and rectifiers, transformers, rheostats, and similar equipment shall be listed and labeled.

Additional Proposed Changes

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As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item

Public Input No. 919-NFPA 70-2014 [Section No. 540.20]
First Revision No. 4229-NFPA 70-2015 [Section No. 540.20]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
## Committee Statement

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540.32 Listing Requirements.
Projection equipment shall be listed and labeled.

Additional Proposed Changes

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Related Item

Public Input No. 920-NFPA 70-2014 [Section No. 540.32]
First Revision No. 4230-NFPA 70-2015 [Section No. 540.32]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
### Committee Statement

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Article 547 Agricultural Buildings, Structures and Premises

547.1 Scope.
The provisions of this article shall apply to the following agricultural buildings, structures, or that part of a building, structure, or adjacent areas of similar or like nature as specified in 547.1(A) or (B).

(A) Excessive Dust and Dust with Water.
Agricultural buildings or structures where excessive dust and dust with water may accumulate, including all areas of poultry, livestock, and fish confinement systems, where litter dust or feed dust, including mineral feed particles, may accumulate.

(B) Corrosive Atmosphere.
Agricultural buildings or structures where a corrosive atmosphere exists. Such buildings or structures include areas where the following conditions exist:

1. Poultry and animal excrement may cause corrosive vapors.
2. Corrosive particles may combine with water.
3. The area is damp and wet by reason of periodic washing for cleaning and sanitizing with water and cleansing agents.
4. Similar conditions exist.

547.2 Definitions.
**Distribution Point.**

An electrical supply point from which service drops, service conductors, feeders, or branch circuits to buildings or structures utilized under single management are supplied.

Informational Note No. 1: Distribution points are also known as the center yard pole, meterpole, or the common distribution point.

Informational Note No. 2: The service point as defined in Article 100 is typically at the distribution point.

**Equipotential Plane.**

An area where wire mesh or other conductive elements are embedded in or placed under concrete, bonded to all metal structures and fixed nonelectrical equipment that may become energized, and connected to the electrical grounding system to minimize voltage differences within the plane and between the planes, the grounded equipment, and the earth.

**Site-Isolating Device.**

A disconnecting means installed at the distribution point for the purposes of isolation, system maintenance, emergency disconnection, or connection of optional standby systems.

547.3 Other Articles.

For buildings and structures not having conditions as specified in 547.1, the electrical installations shall be made in accordance with the applicable articles in this Code.

547.4 Surface Temperatures.

Electrical equipment or devices installed in accordance with the provisions of this article shall be installed in a manner such that they will function at full rating without developing surface temperatures in excess of the specified normal safe operating range of the equipment or device.

547.5 Wiring Methods.

(A) Wiring Systems.

Types UF, NMC, copper SE cables, jacketed Type MC cable, rigid nonmetallic conduit, liquidtight flexible nonmetallic conduit, or other cables or raceways suitable for the location, with approved termination fittings, shall be the wiring methods employed. The wiring methods of Article 502, Part II, shall be permitted for areas described in 547.1(A).

Informational Note: See 300.7, 352.44, and 355.44 for installation of raceway systems exposed to widely different temperatures.

(B) Mounting.

All cables shall be secured within 200 mm (8 in.) of each cabinet, box, or fitting. Nonmetallic boxes, fittings, conduit, and cables shall be permitted to be mounted directly to any building surface covered by this article without maintaining the 6 mm (¼ in.) airspace in accordance with 300.6(D).

(C) Equipment Enclosures, Boxes, Conduit Bodies, and Fittings.

(1) Excessive Dust.

Equipment enclosures, boxes, conduit bodies, and fittings installed in areas of buildings where excessive dust may be present shall be designed to minimize the entrance of dust and shall have no openings (such as holes for attachment screws) through which dust could enter the enclosure.

(2) Damp or Wet Locations.

In damp or wet locations, equipment enclosures, boxes, conduit bodies, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the enclosure, box, conduit body, or fitting. In wet locations, including normally dry or damp locations where surfaces are periodically washed or sprayed with water, boxes, conduit bodies, and fittings shall be listed for use in wet locations and equipment enclosures shall be weatherproof.

(3) Corrosive Atmosphere.

Where wet dust, excessive moisture, corrosive gases or vapors, or other corrosive conditions may be present, equipment enclosures, boxes, conduit bodies, and fittings shall have corrosion resistance properties suitable for the conditions.

Informational Note No. 1: See Table 110.28 for appropriate enclosure type designations.

Informational Note No. 2: Aluminum and magnetic ferrous materials may corrode in agricultural environments.

(D) Flexible Connections.

Where necessary to employ flexible connections, dusttight flexible connectors, liquidtight flexible metal conduit, liquidtight flexible nonmetallic conduit, or flexible cord listed and identified for hard usage shall be used.

(E) Physical Protection.

All electrical wiring and equipment subject to physical damage shall be protected.

(F) Separate Equipment Grounding Conductor.

Where an equipment grounding conductor is installed underground within a location falling under the scope of Article 547, it shall be insulated.

Informational Note: For further information on aluminum and copper-clad aluminum conductors, see 250.120(B).
(G) Receptacles.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations listed in (1) through (4) shall have ground-fault circuit-interrupter protection:

(1) Areas having an equipotential plane
(2) Outdoors
(3) Damp or wet locations
(4) Dirt confinement areas for livestock

547.6 Switches, Receptacles, Circuit Breakers, Controllers, and Fuses.

Switches, including pushbuttons, relays, and similar devices, receptacles, circuit breakers, controllers, and fuses, shall be provided with enclosures as specified in 547.5(C).

547.7 Motors.

Motors and other rotating electrical machinery shall be totally enclosed or designed so as to minimize the entrance of dust, moisture, or corrosive particles.

547.8 Luminaires.

Luminaires shall comply with 547.8(A) through (C).

(A) Minimize the Entrance of Dust.

Luminaires shall be installed to minimize the entrance of dust, foreign matter, moisture, and corrosive material.

(B) Exposed to Physical Damage.

Luminaires exposed to physical damage shall be protected by a suitable guard.

(C) Exposed to Water.

Luminaires exposed to water from condensation, building cleansing water, or solution shall be listed for use in wet locations.

547.9 Electrical Supply to Building(s) or Structure(s) from a Distribution Point.

A distribution point shall be permitted to supply any building or structure located on the same premises. The overhead electrical supply shall comply with 547.9(A) and (B), or with 547.9(C). The underground electrical supply shall comply with 547.9(C).

(A) Site-Isolating Device.

Site-isolating devices shall comply with 547.9(A)(1) through (A)(10).

(1) Where Required.

A site-isolating device shall be installed at the distribution point where two or more buildings or structures are supplied from the distribution point.

(2) Location.

The site-isolating device shall be pole-mounted and be not less than the height above grade required by 230.24 for the conductors it supplies.

(3) Operation.

The site-isolating device shall simultaneously disconnect all ungrounded service conductors from the premises wiring.

(4) Bonding Provisions.

The site-isolating device enclosure shall be connected to the grounded circuit conductor and the grounding electrode system.

(5) Grounding.

At the site-isolating device, the system grounded conductor shall be connected to a grounding electrode conductor.

(6) Rating.

The site-isolating device shall be rated for the calculated load as determined by Part V of Article 220.

(7) Overcurrent Protection.

The site-isolating device shall not be required to provide overcurrent protection.

(8) Accessibility.

The site-isolating device shall be capable of being remotely operated by an operating handle installed at a readily accessible location. The operating handle of the site-isolating device, when in its highest position, shall not be more than 2.0 m (6 ft 7 in.) above grade or a working platform.

(9) Series Devices.

An additional site-isolating device for the premises wiring system shall not be required where a site-isolating device meeting all applicable requirements of this section is provided by the serving utility as part of their service requirements.
(10) Marking.

A site-isolating device shall be permanently marked to identify it as a site-isolating device. This marking shall be located on the operating handle or immediately adjacent thereto.

(B) Service Disconnecting Means and Overcurrent Protection at the Building(s) or Structure(s).

Where the service disconnecting means and overcurrent protection are located at the building(s) or structure(s), the requirements of 547.9(B)(1) through (B)(3) shall apply.

(1) Conductor Sizing.

The supply conductors shall be sized in accordance with Part V of Article 220.

(2) Conductor Installation.

The supply conductors shall be installed in accordance with the requirements of Part II of Article 225.

(3) Grounding and Bonding.

For each building or structure, grounding and bonding of the supply conductors shall be in accordance with the requirements of 250.32, and the following conditions shall be met:

(1) The equipment grounding conductor is not smaller than the largest supply conductor if of the same material, or is adjusted in size in accordance with the equivalent size columns of Table 250.122 if of different materials.

(2) The equipment grounding conductor is connected to the grounded circuit conductor and the site-isolating device enclosure at the distribution point.

(C) Service Disconnecting Means and Overcurrent Protection at the Distribution Point.

Where the service disconnecting means and overcurrent protection for each set of feeders or branch circuits are located at the distribution point, the feeders or branch circuits to buildings or structures shall comply with the provisions of 250.32 and Article 225, Parts I and II.

Informational Note: Methods to reduce neutral-to-earth voltages in livestock facilities include supplying buildings or structures with 4-wire single-phase services, sizing 3-wire single-phase service and feeder conductors to limit voltage drop to 2 percent, and connecting loads line-to-line.

(D) Identification.

Where a site is supplied by more than one distribution point, a permanent plaque or directory shall be installed at each of these distribution points denoting the location of each of the other distribution points and the buildings or structures served by each.

547.10 Equipotential Planes and Bonding of Equipotential Planes.

The installation and bonding of equipotential planes shall comply with 547.10(A) and (B). For the purposes of this section, the term livestock shall not include poultry.

(A) Where Required.

Equipotential planes shall be installed where required in (A)(1) and (A)(2).

(1) Indoors.

Equipotential planes shall be installed in confinement areas with concrete floors where metallic equipment is located that may become energized and is accessible to livestock.

(2) Outdoors.

Equipotential planes shall be installed in concrete slabs where metallic equipment is located that may become energized and is accessible to livestock.

The equipotential plane shall encompass the area where the livestock stands while accessing metallic equipment that may become energized.

(B) Bonding.

Equipotential planes shall be connected to the electrical grounding system. The bonding conductor shall be solid copper, insulated, covered or bare, and not smaller than 8 AWG. The means of bonding to wire mesh or conductive elements shall be by pressure connectors or clamps of brass, copper, copper alloy, or an equally substantial approved means. Slatted floors that are supported by structures that are a part of an equipotential plane shall not require bonding.

Informational Note No. 1: Methods to establish equipotential planes are described in American Society of Agricultural and Biological Engineers (ASABE) EP473.2-2001, Equipotential Planes in Animal Containment Areas.

Informational Note No. 2: Methods for safe installation of livestock waterers are described in American Society of Agricultural and Biological Engineers (ASABE) EP342.3-2010, Safety for Electrically Heated Livestock Waterers.

Informational Note No. 3: Low grounding electrode system resistances may reduce voltage differences in livestock facilities.

Statement of Problem and Substantiation for Public Comment

This Comment on the Public Input is not necessarily intended to add clarity as the Panel Statement presumes. It is intended to add to the accuracy of the Article title and scope. Article 547 covers much more than is indicated in the present title and scope.
For example, 547.9 includes structures as well as buildings.  
547.2 defines the Site Isolation device. This obviously includes the site (premises) and is not limited to an agricultural building.  
547.10(A)(2) refers to outdoor areas, not only an agricultural building.

**Related Item**

Public Input No. 4345-NFPA 70-2014 [Article 547]

**Submitter Information Verification**

*Submitter Full Name:* Phil Simmons  
*Organization:* Simmons Electrical Services

**Committee Statement**

*Committee Action:* Rejected  
*Resolution:* CMP 19 recommends to Correlating Committee they make no change to the title. CMP 19 rejects the text change because the existing language adequately covers structures.
TITLE OF NEW CONTENT 547.5(H) Voltage Regulation. (New)

If a voltage range is provided by the equipment manufacturer, feeder and branch circuit conductors shall be sized to provide voltage at the equipment within the range that is required by the manufacturer. In addition, feeder and branch-circuit conductors shall be sized so the voltage at the end of the feeder conductor is not lower than 97% of that at the service or source and for branch circuits, not lower than 95% of that at the service or source at the furthest outlet. Calculations shall be based on circuit loading at 80 percent of the rating of the overcurrent device.

Statement of Problem and Substantiation for Public Comment

It is important for safe and proper operation that conductors be sized properly to provide voltage within the operating range as determined by the manufacturer. While some may opine that this is a requirement of 110.3(B), the rule is not obvious and stating the requirement here will help ensure safe and proper operation of equipment.

Related Item
Public Input No. 4323-NFPA 70-2014 [New Section after 547.5(G)]

Submitter Information Verification

Submitter Full Name: TRAVIS LINDSEY
Organization: TLC SERVICES
Street Address: [Redacted]
City: [Redacted]
State: [Redacted]
Zip: [Redacted]
Submittal Date: Fri Sep 25 12:06:40 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The informational notes in NEC Articles 210 and 215 address this issue and are consistent with NEC 90.1 (A) and (B) stating the NEC is not to be used as a design manual and the electrical system is not always adequate but safe.
Public Comment No. 1160-NFPA 70-2015 [Section No. 547.5(A)]

(A) Wiring Systems.

Types UF, NMC, copper SE cables, jacketed Type MC cable, rigid nonmetallic conduit, liquidtight flexible nonmetallic conduit, or other cables or raceways suitable for the location, with approved termination fittings, shall be the wiring methods employed. The wiring methods of Article 502, Part II, shall be permitted for areas described in 547.1(A).

Informational Note: See 300.7, 352.44, and 355.44 for installation of raceway systems exposed to widely different temperatures.

Statement of Problem and Substantiation for Public Comment

The panel statement indicated that:
"There have been multiple instances in agricultural environments where wrapped outer conductor of the AL SE cable has corroded to failure within a foot or two of the connection."

Since only copper SE cable is currently allowed by the NEC, it is apparent that the observed failed installations were not code compliant. If they were not code compliant in the wiring method used, it is likely that they were non-code compliant in other installation details, leading to the observed failures. Both aluminum and copper conductors, when installed in accordance with the NEC, have proven to perform well in agricultural installations.

Related Item

Public Input No. 3540-NFPA 70-2014 [Section No. 547.5(A)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 23:00:09 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There have been multiple instances in agricultural environments where AL SE cable has failed in a corrosive environment.
Public Comment No. 797-NFPA 70-2015 [Section No. 547.5(F)]

(F) Separate Equipment Grounding Conductor.
Where an equipment grounding conductor is installed underground within a location falling under the scope of Article 547, it shall be insulated and identified for the environment. The underground portion of the conductor shall not be spliced.

Informational Note: For further information on aluminum and copper-clad aluminum conductors, see 250.120(B).

Statement of Problem and Substantiation for Public Comment

It is critically important that the integrity of the equipment grounding conductor that is installed underground in Agricultural Buildings and/or structures where harsh and often corrosive conditions exist be maintained. The choice of the term "identified" is important to ensuring this safety. The word "identified" is defined in Article 100 and means "Recognizable as suitable for the specific purpose, function, use, environment, application, and so forth, where described in a particular Code requirement."

The proposed last sentence is also critical to safety of the installation of equipment grounding conductors that are installed underground under the Scope of Article 547. There are no wire splice insulation systems that are identified or listed for these harsh environments. This includes Sealed Wire-Connector Systems as no mention is made in the Guide Information for use of these systems in corrosive environments.

Related Item
Public Input No. 4336-NFPA 70-2014 [Section No. 547.5(F)]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 19:01:49 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CMP 19 does not see the need to have specialized direct burial requirements for underneath agricultural environments. Conductors and splices identified for direct burial should be suitable for this application.
547.5(H) Voltage Regulation.
If a voltage range is provided by the equipment manufacturer, feeder and branch circuit conductors shall be sized to provide voltage at the equipment within the range that is required by the manufacturer. In addition, feeder and branch-circuit conductors shall be sized so the voltage at the end of the feeder conductor is not lower than 97% of that at the service or source and for branch circuits, not lower than 95% of that at the service or source at the furthest outlet. Calculations shall be based on circuit loading at 80 percent of the rating of the overcurrent device.

Statement of Problem and Substantiation for Public Comment
This Proposal and Comment must be accepted to provide an installation that has the practicable safeguards envisioned in 90.1(A) of the NEC. Proper sizing of the feeder and branch circuit conductors will help resolve the "tingle-voltage" problem that is so damaging to many agricultural buildings.

Related Item
Public Input No. 4323-NFPA 70-2014 [New Section after 547.5(G)]

Submitter Information Verification
Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 19:23:19 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The informational notes in NEC Articles 210 and 215 address this issue and are consistent with NEC 90.1 (A) and (B) stating the NEC is not to be used as a design manual and the electrical system is not always adequate but safe.
Manufactured Home.

A structure, transportable in one or more sections, which in the traveling mode is 2.4 m (8 ft) or more in width or 12.2 m (40 ft) or more in length, or when erected on site is 29.77 m² (320 ft²) or more. When not transportable, it is built on a permanent chassis and is designed to be used as a dwelling with or without a permanent foundation, whether or not connected to the utilities, and includes plumbing, heating, air conditioning, and electrical systems contained therein. The term manufactured home shall include any structure that meets all the requirements of this paragraph except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the regulatory agency. Calculations used to determine the number of square meters (square feet) in a structure are based on the structure's exterior dimensions and include all expandable rooms, cabinets, and other projections containing interior space, but do not include bay windows [501:1.2.14]. For the purpose of this Code and unless otherwise indicated, the term mobile home includes manufactured homes and excludes park trailers defined in Article 552.4.

A structure, transportable in one or more sections, that, in the traveling mode, is 2.4 m (8 ft) or more in width or 12.2 m (40 ft) or more in length, or, when erected on site, is 29.7 m² (320 ft²) or more and that is built on a permanent chassis and is designed to be used as a dwelling, with or without a permanent foundation, whether or not connected to the utilities, and includes plumbing, heating, air conditioning, and electrical systems contained therein connected therein.

Informational Note No. 1: See the applicable building code for definition of the term permanent foundation.

Informational Note No. 2: See 24 CFR Part 3280, Manufactured Home Construction and Safety Standards, of the Federal Department of Housing and Urban Development, for additional information on the definition.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that the panel reconsider the definition of “Manufactured Home” in this first revision to comply with the NEC Style Manual. Additionally, the Correlating Committee directs the panel to revise the defined term to remove redundant text.

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5406-NFPA 70-2015
Statement: The definition is consistent with NFPA 501 (Standard on Manufactured Housing).
Public Comment No. 530-NFPA 70-2015 [Section No. 550.4(D)]

(550.6) Listed or Listed and Labeled.

All electrical materials, devices, appliances, fittings, and other equipment shall be listed or listed and labeled by a qualified testing agency and shall be connected in an approved manner when installed.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

The committee statement; “See Information Note to definition of “Listed” in Article 100. “Listed or Labeled” should remain,” informational notes are not enforceable.

Additionally, the committee did not address the renumbering of this section.

As stated previously in the PI, “or” gives an option, by stating “and” this provides the AHJ with language on how to determine if a product is actually listed. Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue. There are many instances where the AHJ is provided documentation in the absence of a label such as a Certificate of Compliance or a printed version of an online certification directory to establish that a product is listed.

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
<table>
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<tr>
<td><strong>Submitter Full Name:</strong> JEFFREY FECTEAU</td>
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<tr>
<td><strong>Organization:</strong> UNDERWRITERS LABORATORIES LLC</td>
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<tr>
<td><strong>Affiliation:</strong> UL</td>
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**Committee Statement**

- **Committee Action:** Rejected but see related SR
- **Resolution:** SR-5405-NFPA 70-2015
- **Statement:** CMP 19 doesn’t agree with renumbering the section. However, the revision of the current section to add the word “and” is appropriate for enforceability and to clarify the intent of the panel.
Public Comment No. 1823-NFPA 70-2015 [Section No. 550.13(B)]

(B) Ground-Fault Circuit Interrupters (GFCI).
All 125-volt, single-phase, 15- and 20-ampere receptacle outlets installed outdoors, in compartments accessible from outside the unit, or in bathrooms (including receptacles in luminaires), receptacle outlets serving countertops in kitchens, receptacle outlets located within 1.8 m (6 ft) of any sink and dishwasher outlets shall have GFCI protection.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs that the panel reconsider the text for word clarity with regard to the phrase “outlets located within 1.8m (6ft) of any sink and dishwasher outlets shall have GFCI protection”.

Related Item
First Revision No. 5402-NFPA 70-2015 [Section No. 550.13(B)]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 10:03:39 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-5414-NFPA 70-2015
Statement: The proposed changes add enforceability and clarity to the section.
Public Comment No. 273-NFPA 70-2015 [Section No. 550.13(G)]

(G) Receptacle Outlets Not Required.
Receptacle outlets shall not be required in the following locations:

1. In the wall space occupied by built-in kitchen or wardrobe cabinets
2. In the wall space behind doors that can be opened fully against a wall surface
3. In room dividers of the lattice type that are less than 2.5 m (8 ft) long, not solid, and within 150 mm (6 in.) of the floor
4. In the wall space afforded by bar-type counters

Statement of Problem and Substantiation for Public Comment

I feel that the receptacle spacing requirements found in Article 210 are relevant to this type of dwelling location. Thus, I would recommend removing list item (2) so that these spacing requirements are used during the layout of receptacles in these environments. It is typically the only receptacle that remains accessible for uses such as vacuuming due to the amount of furniture within these areas. Most receptacles in these areas end up behind furniture and makes it difficult for the homeowner to access.

Related Item
Public Input No. 1119-NFPA 70-2014 [Section No. 550.13(G)]

Submitter Information Verification
Submitter Full Name: Joseph Wages
Organization: International Association of E
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 20 08:58:34 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Wall space behind doors is unusable for receptacle placement and the Public Comment does not improve safety.
Public Comment No. 1142-NFPA 70-2015 [Section No. 550.15(H)]

(H) Under-Chassis Wiring (Exposed to Weather).

Where outdoor or under-chassis line-voltage (120 volts, nominal, or higher) wiring is exposed, it shall be protected by a conduit or raceway listed identified for use in wet locations. The conductors shall be listed for use in wet locations. Where wiring is exposed to physical damage, it shall be protected by a raceway, conduit, or other means.

Statement of Problem and Substantiation for Public Comment

Raceways are not listed for use in wet locations, but they are identified as suitable for the use by permission within the applicable Code article (352.10(D), 358.10(C), etc.).

Related Item
First Revision No. 5403-NFPA 70-2015 [Section No. 550.15(H)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 22:18:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5407-NFPA 70-2015
Statement: Raceways are identified as suitable for the use by permission within the applicable Code article. The format was changed per the NEC Style Manual.
(H) Under-Chassis Wiring (Exposed to Weather).
Where outdoor or under-chassis line-voltage (120 volts, nominal, or higher) wiring is exposed, it shall be protected by a conduit or raceway listed for use in wet locations. The conductors shall be listed for use in wet locations. Where wiring is exposed to physical damage, it shall be protected by a raceway, conduit, or other means.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that the panel reconsider FR 5403 and provide clarity and differentiate between wet locations and where exposed to physical damage by creating subdivisions in accordance with the NEC Style Manual.

Related Item
First Revision No. 5403-NFPA 70-2015 [Section No. 550.15(H)]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 10:18:10 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-5407-NFPA 70-2015
Statement: Raceways are identified as suitable for the use by permission within the applicable Code article. The format was changed per the NEC Style Manual.
(B) Mobile Homes and Manufactured Homes.

All 120-volt branch circuits that supply 15- and 20-ampere outlets installed in those rooms and areas identified in 210.12(A) shall comply with 210.12.

Statement of Problem and Substantiation for Public Comment

IEC's position is to reword 550.25(B) - FR 5404)

As the result of the action taken by Panel 2 on 210.12(A) the list of rooms and locations has been deleted in the First Draft. Panel 18 needs to follow suit and remove the lists of rooms and areas.

Related Item
First Revision No. 5404-NFPA 70-2015 [Section No. 550.25(B)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 19 15:13:35 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-5403-NFPA 70-2015
Statement: The new revisions are consistent with the action taken on 210.12(A) by Panel 2 to eliminate the list of rooms and locations in the First Draft.
(B) Materials and Equipment.
Electrical materials, devices, appliances, fittings, and other equipment installed in, intended for use in, or attached to the recreational vehicle shall be listed and labeled. All products shall be used only in the manner in which they have been tested and found suitable for the intended use.

Additional Proposed Changes

<table>
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<tr>
<th>File Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
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</table>

Statement of Problem and Substantiation for Public Comment

Listings do not specify labeling as defined by the NEC; labeling requirements are determined by the certification organization.

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item

Public Input No. 921-NFPA 70-2014 [Section No. 551.40(B)]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
| Committee  | Accepted |
| Resolution | SR-5402-NFPA 70-2015 |
| Statement  | CMP 19 proposes language for clarity and uniformity throughout the Code and to promote enforceability so that only products bearing the certification mark of the certifier are to be considered as certified/listed. |
Public Comment No. 607-NFPA 70-2015 [ Sections 551.46(C)(1), 551.46(C)(2), 551.46(C)(3), 551.46(C)(4) ]

(1) Units with One 15-Ampere Branch Circuit.

Recreational vehicles having only one 15-ampere branch circuit as permitted by 551.42(A) shall have an attachment plug that shall be 2-pole, 3-wire grounding type, rated 15 amperes, 125 volts, listed or conforming to the configuration shown in Figure 551.46(C)(1).

Informational Note: Complete details of this configuration can be found in ANSI/NEMA WD 6-2002, Standard for Dimensions of Attachment Plugs and Receptacle, Figure 5.15.

Figure 551.46(C)(1) Configurations for Grounding-Type Receptacles and Attachment Plug Caps Used for Recreational Vehicle Supply Cords and Recreational Vehicle Lots.

<table>
<thead>
<tr>
<th>Receptacles</th>
<th>Caps</th>
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<tr>
<td>125-V, 20-A, 3-wire, grounding type</td>
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</tr>
<tr>
<td>20-A, 125-V, 2-pole, 3-wire, grounding type</td>
<td></td>
</tr>
<tr>
<td>125-V, 15-A, 2-pole, 3-wire, grounding type</td>
<td></td>
</tr>
<tr>
<td>30-A, 125-V, 2-pole, 3-wire, grounding type</td>
<td></td>
</tr>
<tr>
<td>50-A, 125/250-V, 3-pole, 4-wire, grounding type</td>
<td></td>
</tr>
</tbody>
</table>

(2) Units with One 20-Ampere Branch Circuit.

Recreational vehicles having only one 20-ampere branch circuit as permitted in 551.42(B) shall have an attachment plug that shall be 2-pole, 3-wire grounding type, rated 20 amperes, 125 volts, listed or conforming to the configuration shown in Figure 551.46(C)(1).

Informational Note: Complete details of this configuration can be found in ANSI/NEMA WD 6-2002, National Electrical Manufacturers Association’s Standard for Dimensions of Attachment Plugs and Receptacles, Figure 5.20.

(3) Units with Two to Five 15- or 20-Ampere Branch Circuits.

Recreational vehicles wired in accordance with 551.42(C) shall have an attachment plug that shall be 2-pole, 3-wire grounding type, rated 30 amperes, 125 volts, listed or conforming to the configuration shown in Figure 551.46(C)(1) intended for use with units rated at 30 amperes, 125 volts.

Informational Note: Complete details of this configuration can be found in ANSI/NEMA WD 6-2002, National Electrical Manufacturers Association’s Standard for Dimensions of Attachment Plugs and Receptacles, Figure TT.

(4) Units with 50-Ampere Power-Supply Assembly.

Recreational vehicles having a power-supply assembly rated 50 amperes as permitted by 551.42(D) shall have a 3-pole, 4-wire grounding-type attachment plug rated 50 amperes, 125/250 volts, listed or conforming to the configuration shown in Figure 551.46(C)(1).

Informational Note: Complete details of this configuration can be found in ANSI/NEMA WD 6-2002, Standard for Dimensions of Attachment Plugs and Receptacles, Figure 14.50.

Statement of Problem and Substantiation for Public Comment

As Kent Perkins stated in his Public Input, RV consumers are needing more and more service from their 120 V electrical system. This increase in service demands could also be addressed by allowing new technology and better systems to be implemented. In the most recent review cycle the committee responsible for NFPA 302 made changes intended to allow for cable connectors that do not meet current NEMA WD-6 designs. This change was intended to emphasize function and safety over configuration in shore power. To quote the Kim McCartney’s statement “There has been a tremendous advance in the safety of shore power cable connectors that do not meet current NFPA 70 designs for shore power cables. We tried to address the issue of fires in these inlet connectors at the last re-write of
NFPA 302 but there are still a significant number of boat fires resulting from the decades old terminal connections. The newer pin and plug smart plugs will prevent these fires.” We would like to reference this change when referring to all applications. It is in the best interest of the end user to provide safer products that are listed or labeled by a qualified testing agency, as is referenced in the newly revised NFPA 302 10.19.2.1.

Related Item
Public Input No. 1179-NFPA 70-2014 [Section No. 551.71]

Submitter Information Verification
Submitter Full Name: KENNETH R SMITH
Organization: SMARTPLUG SYSTEMS LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 11 14:06:22 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The current configurations in NFPA 70 Section 551.46 provide consistency and safety within the industry by standardizing connector configurations.
551.71 Type Receptacles Provided.

Every recreational vehicle site with electrical supply shall be equipped with recreational vehicle site supply equipment with at least one 20-ampere, 125-volt receptacle. A minimum of 20 percent of existing and 40 percent of all new recreational vehicle sites, with electrical supply, shall each be equipped with a 50-ampere, 125/250-volt receptacle conforming to the configuration as identified in Figure 551.46(C)(1). Every recreational vehicle site equipped with a 50-ampere receptacle shall also be equipped with a 30-ampere, 125-volt receptacle conforming to Figure 551.46(C)(1). These electrical supplies shall be permitted to include additional receptacles that have configurations in accordance with 551.81. A minimum of 70 percent of all recreational vehicle sites with electrical supply shall each be equipped with a 30-ampere, 125-volt receptacle conforming to Figure 551.46(C)(1). This supply shall be permitted to include additional receptacle configurations conforming to 551.81. The remainder of all recreational vehicle sites with electrical supply shall be equipped with one or more of the receptacle configurations conforming to 551.81. Dedicated tent sites with a 15- or 20-ampere electrical supply shall be permitted to be excluded when determining the percentage of recreational vehicle sites with 30- or 50-ampere receptacles.

Additional receptacles shall be permitted for the connection of electrical equipment outside the recreational vehicle within the recreational vehicle park.

All 125-volt, single-phase, 15- and 20-ampere receptacles shall have listed ground-fault circuit-interrupter protection for personnel. The GFCI devices used in RV site electrical equipment are not required to be weather or tamper resistant in accordance with 406.9 and 406.12.

Informational Note: The percentage of 50 ampere sites required by 551.71 may be inadequate for seasonal recreational vehicle sites serving a higher percentage of recreational vehicles with 50 ampere electrical systems. In that type of recreational vehicle park, the percentage of 50 ampere sites could approach 100 percent.

Statement of Problem and Substantiation for Public Comment

Remove confusion as to the intent of new 40% requirement. 40% was intended for only new construction sites

Related Item

First Revision No. 5411-NFPA 70-2015 [Section No. 551.71]

Submitter Information Verification

Submitter Full Name: WADE ELLIOTT
Organization: UTILITY SERVICES GROUP INC
Affiliation: ARVC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 17:10:52 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5408-NFPA 70-2015
Statement: CMP 19 re-formatted the text for readability. CMP 19 added language to clarify the of 40 percent requirement for new installations.
551.71 Type. Receptacles Provided.

(A) 20-Ampere. Every recreational vehicle site with electrical supply shall be equipped with recreational vehicle site supply equipment with at least one 20-ampere, 125-volt receptacle.

(B) 30-Ampere. A minimum of 70 percent of all recreational vehicle sites with electrical supply shall each be equipped with a 30-ampere, 125-volt receptacle conforming to 551.46(C)(1). This supply shall be permitted to include additional receptacle configurations conforming to 551.81. The remainder of all recreational vehicle sites with electrical supply shall be equipped with one or more of the receptacle configurations conforming to 551.81.

(C) 50-Ampere. A minimum of 40 percent of all new recreational vehicle sites, with electrical supply, shall each be equipped with a 50-ampere, 125/250-volt receptacle conforming to the configuration as identified in Figure 551.46(C)(1). Every recreational vehicle site equipped with a 50-ampere receptacle shall also be equipped with a 30-ampere, 125-volt receptacle conforming to Figure 551.46(C)(1). These electrical supplies shall be permitted to include additional receptacles that have configurations in accordance with 551.81. A minimum of 70 percent of all recreational vehicle sites with electrical supply shall each be equipped with a 30-ampere, 125-volt receptacle conforming to Figure 551.46(C)(1). This supply shall be permitted to include additional receptacle configurations conforming to 551.81. The remainder of all recreational vehicle sites with electrical supply shall be equipped with one or more of the receptacle configurations conforming to 551.81.

(D) Tent Sites. Dedicated tent sites with a 15- or 20-ampere electrical supply shall be permitted to be excluded when determining the percentage of recreational vehicle sites with 30- or 50-ampere receptacles.

(E) Additional Receptacles. Additional receptacles shall be permitted for the connection of electrical equipment outside the recreational vehicle within the recreational vehicle park.

(F) GFCI Protection. All 125-volt, single-phase, 15- and 20-ampere receptacles shall have listed ground-fault circuit-interrupter protection for personnel. The GFCI devices used in RV site electrical equipment are not required to be weather or tamper resistant in accordance with 406.9 and 406.12.

Informational Note: The percentage of 50 ampere sites required by 551.71 may be inadequate for seasonal recreational vehicle sites serving a higher percentage of recreational vehicles with 50 ampere electrical systems. In that type of recreational vehicle park, the percentage of 50 ampere sites could approach 100 percent.

Statement of Problem and Substantiation for Public Comment

It is difficult to understand the Panel's Statement. It is almost always an improvement in readability and usability to break up a long paragraph that contains multiple requirements into multiple paragraphs organized by rating of receptacle with titles. The Panel hopefully will recognize that there are no technical changes made in the PI or this Comment. The existing text has been cut and pasted into the list format with titles added.

Related Item
Public Input No. 3968-NFPA 70-2014 [Section No. 551.71]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 16:24:16 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5408-NFPA 70-2015
Statement: CMP 19 re-formatted the text for readability. CMP 19 added language to clarify the of 40 percent requirement for new installations.
551.72 Distribution System.

(A) Systems.
Distribution systems shall provide the voltage and have a capacity for the receptacles provided in the recreational vehicle (RV) site supply equipment as calculated according to 551.73 and shall have an ampacity not less than 30 amperes. Systems permitted include 120 volts, 1-phase; 120/240 volts, 1-phase; and 120/208 volts, 1-phase.

(B) Three-Phase Systems.
Feeders from 208Y/120-volt, 3-phase systems shall be permitted to include two ungrounded conductors and shall include one grounded conductor and one equipment grounding conductor. So far as practicable, the loads shall be equally distributed on the 3-phase system.

(C) Receptacles.
Receptacles rated at 50 amperes shall be supplied from a branch circuit of the voltage class and rating of the receptacle. Other recreational vehicle sites with 125-volt, 20- and 30-ampere receptacles shall be permitted to be derived from any grounded distribution system that supplies 120-volt, single-phase power. The neutral conductors shall not be reduced in size below the size of the ungrounded conductors for the site distribution.

(D) Neutral Conductors.
Neutral conductors shall be permitted to be reduced in size below the minimum required size of the ungrounded conductors for 240-volt, line-to-line, permanently connected loads only.

Informational Note No. 1: Due to the long circuit lengths typical in most recreational vehicle parks, feeder conductor sizes found in the ampacity tables of Article 310 may be inadequate to maintain the voltage regulation suggested in 215.2(A)(1). The total circuit voltage drop is a sum of the voltage drops of each serial circuit segment, where the load for each segment is calculated using the load that segment sees and the demand factors shown in Table 551.73(A).

Informational Note No. 2: The requirements to size wire at 125 percent of maximum load of 210.19(A)(1) and 215.2(A)(1) (branch circuits and feeder circuits) do not apply to RV site supply circuits as they are not continuous loads.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that the panel reconsider FR 5412 to provide clarity. The term "branch circuit of the voltage class" is undefined in the NEC and may conflict with the new item (B). The requirement to prohibit neutral reduction may create confusion since the term "site distribution" is undefined.

The panel is also directed to revise the text of the informational notes to remove language that contains requirements accordance with the NEC Style Manual.

The Correlating Committee also recommends clarification of the phrases "serial circuit segment" and "calculated using the load that segment sees" in Informational Note No. 1.

Related Item
First Revision No. 5412-NFPA 70-2015 [Section No. 551.72]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 10:20:52 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5410-NFPA 70-2015
| Statement:          | CMP-19 agrees with the Public Comment from the Correlating Committee with the editorial change in Informational Notes 1 and 2 and edits the text for clarity. |
Public Comment No. 850-NFPA 70-2015 [Section No. 551.73(B)]

(B) , Transformers and Secondary Panelboards.

For the purpose of this Code, where the park service exceeds 240 volts, transformers and secondary panelboards shall be treated as services.

Statement of Problem and Substantiation for Public Comment

The Panel Statement in response to the Public Input is incorrect. The definition of "Service" in NEC Article 100 states, "The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served." The service conductors terminate and end at the service disconnecting means.

Section 551.73(B) is incorrect for several reasons and should be deleted:
1. "For the purpose of this Code", Article 551 cannot apply to the entire Code only to the equipment and installations under the scope of Article 551.
2. "Where the park service exceeds 240 volts, transformers and secondary panelboards shall be treated as services." Take at the look at the definition of "Service" and "Service equipment" in Article 100.
3. Transformers and conductors on the load side of overcurrent protection are feeders as defined in Article 100.
4. Overcurrent protection for transformers is provided in Article 450, not by the serving utility as if the equipment is located on the supply side of the "Service Point".
5. Overcurrent protection rules for the conductors are in Article 240 as this is Premises Wiring as defined in Article 100.

Do us all a favor and delete this erroneous section!

Related Item
Public Input No. 4028-NFPA 70-2014 [Section No. 551.73]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 13:12:15 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-5409-NFPA 70-2015
Statement: CMP 19 agrees that these transformer secondary conductors and panelboards are not services.
551.74 Overcurrent Protection.

(A) Conductors. Overcurrent protection of conductors shall be provided in accordance with Article 240.

(B) Power Outlet Rating and Overcurrent Protection. All power outlets shall have a rating not less than the minimum feeder capacity required for the load calculated in accordance with Part VI of this Article. Power outlets shall be protected by an overcurrent protective device having a rating not greater than that of the power outlet. This overcurrent protective device shall be located within or at any point on the supply side of the power outlet.

Statement of Problem and Substantiation for Public Comment

Overcurrent protection of conductors is provided for in Article 240. However, overcurrent protection for power outlets is not provided in Article 240 or in Article 408. The Power Outlet includes internal bussing very similar to Panelboards. However there is no requirement in the NEC that the bussing in power outlets be protected within their current-carrying capability. This Public Input and Comment intend to "plug this hole". Without a doubt, if the Power Outlet were a panelboard, overcurrent protection is required. See 408.36. Surely, the Panel cannot expect us to believe that adding overcurrent protection ahead of a listed power outlet would in any way degrade the Listing of the product. Additional overcurrent protection on the supply side of the power outlet enhances safety. It is very common to see overcurrent protection rated at 200 to 250 amperes or greater ahead of the feeder that supplies power outlets that are rated at 100 amperes or less. This makes no sense from a safety standpoint. Again, if the power outlet were a panelboard, overcurrent protection within the rating of the panelboard would be required. Why not for power outlets?

Related Item
Public Input No. 4345-NFPA 70-2014 [Article 547]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 15:58:41 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CMP 19 recognizes there has been no history of problems with the current use of power outlets without additional feeder overcurrent protection.
551.80(C) Voltage Regulation. (New)

If a voltage range is provided by the equipment manufacturer, feeder and branch circuit conductors shall be sized to provide voltage at the equipment within the range that is required by the manufacturer. In addition, feeder and branch-circuit conductors shall be sized so the voltage at the end of the feeder conductor is not lower than 97% of that at the service or source and for branch circuits, not lower than 95% of that at the service or source at the furthest outlet. Calculations shall be based on circuit loading at 80 percent of the rating of the overcurrent device.

Statement of Problem and Substantiation for Public Comment

It is important for safe and proper operation that conductors be sized properly to provide voltage within the operating range as determined by the manufacturer. While some may opine that this is a requirement of 110.3(B), the rule is not obvious and stating the requirement here will help ensure safe and proper operation of equipment. It is very common for feeder conductors for RV Park electrical systems to be lengthy so it is important that the conductors be sized properly so the RV electrical systems will perform safely.

Related Item

Public Input No. 4326-NFPA 70-2014 [New Section after 551.80(B)]

Submitter Information Verification

Submitter Full Name: TRAVIS LINDSEY
Organization: TLC SERVICES
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 11:47:00 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The informational notes in NEC Articles 210 and 215 address this issue and are consistent with NEC 90.1 (A) and (B) stating the NEC is not to be used as a design manual and the electrical system is not always adequate but safe.
551.80(C) Voltage Regulation. (New)
If a voltage range is provided by the equipment manufacturer, feeder and branch circuit conductors shall be sized to provide voltage at the equipment within the range that is required by the manufacturer. In addition, feeder and branch-circuit conductors shall be sized so the voltage at the end of the feeder conductor is not lower than 97% of that at the service or source and for branch circuits, not lower than 95% of that at the service or source at the furthest outlet. Calculations shall be based on circuit loading at 80 percent of the rating of the overcurrent device.

Statement of Problem and Substantiation for Public Comment
It is important for safe and proper operation that conductors be sized properly to provide voltage within the operating range as determined by the manufacturer of the Recreational Vehicle. All manufacturers are required to include the voltage the RV is intended to operate at.
It is very common for feeder conductors for RV Park electrical systems to be lengthy so it is important that the conductors be sized properly so the RV electrical systems will perform safely.

Related Item
Public Input No. 4326-NFPA 70-2014 [New Section after 551.80(B)]

Submitter Information Verification
Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 17:30:01 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The informational notes in NEC Articles 210 and 215 address this issue and are consistent with NEC 90.1 (A) and (B) stating the NEC is not to be used as a design manual and the electrical system is not always adequate but safe.
Method of Connecting Expandable Units.

The method of connecting expandable units to the main body of the park trailer shall comply with the following as applicable:

(1) Cord-and-Plug Connected.

Cord-and-plug connections shall comply with 552.48(O)(1) (a) through (O)(1)(d).

(1) (a) That portion of a branch circuit that is installed in an expandable unit shall be permitted to be connected to the portion of the branch circuit in the main body of the vehicle by means of an attachment plug and cord listed for hard usage. The cord and its connections shall comply with all provisions of Article 400 and shall be considered as a permitted use under 400.10. Where the attachment plug and cord are located within the park trailer’s interior, use of plastic thermoset or elastomer parallel cord Type SPT-3, SP-3, or SPE shall be permitted.

(2) (b) Where the receptacle provided for connection of the cord to the main circuit is located on the outside of the vehicle park trailer, it shall be protected with a ground-fault circuit interrupter for personnel and be listed for wet locations. A cord located on the outside of a park trailer shall be identified for outdoor use.

(3) (c) Unless removable or stored within the park trailer interior, the cord assembly shall have permanent provisions for protection against corrosion and mechanical damage while the park trailer is in transit.

(4) (d) The attachment plug and cord shall be installed so as not to permit exposed live attachment plug pins.

(2) Direct Wires Connected.

That portion of a branch circuit that is installed in an expandable unit shall be permitted to be connected to the portion of the branch circuit in the main body of the park trailer by means of flexible cord installed in accordance with 552.48(O)(2)(a) through (O)(2)(f) or other approved wiring method.

(1) (a) The flexible cord shall be listed for hard usage and for use in wet locations.

(2) (b) The flexible cord shall be permitted to be exposed on the underside of the vehicle.

(3) (c) The flexible cord shall be permitted to pass through the interior of a wall or floor assembly or both a maximum concealed length of 600 mm (24 in.) before terminating at an outlet or junction box.

(4) (d) Where concealed, the flexible cord shall be installed in nonflexible conduit or tubing that is continuous from the outlet or junction box inside the park trailer to a weatherproof outlet box, junction box, or strain relief fitting listed for use in wet locations that is located on the underside of the park trailer. The outer jacket of flexible cord shall be continuous into the outlet or junction box.

(5) (e) Where the flexible cord passes through the floor to an exposed area inside of the park trailer, it shall be protected by means of conduit and bushings or equivalent.

(6) (f) Where subject to physical damage, the flexible cord shall be protected with RMC, IMC, Schedule 80 PVC, reinforced thermosetting resin conduit (RTRC) listed for exposure to physical damage, or other approved means and shall extend at least 150 mm (6 in.) above the floor. A means shall be provided to secure the flexible cord where it enters the park trailer.

Statement of Problem and Substantiation for Public Comment

Numbered lists in 558.42(O)(1) and 558.42(O)(2) are changed to lettering per NFPA Style Guidelines. In 558.42(O)(1)(b), the term “park trailer” replaces “vehicle” for consistency in terminology throughout 552.48(O).

Related Item
First Revision No. 5433-NFPA 70-2015 [Section No. 552.48(O)]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 13:22:23 EDT 2015

Committee Statement
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<tr>
<td>Resolution:</td>
<td>SR-5404-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement:</td>
<td>The paragraph has been reformatted to comply with the NEC Style Manual. The term park trailer replaces vehicle for consistency in terminology.</td>
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Public Comment No. 1826-NFPA 70-2015 [Section No. 552.48(O)(2)]

(2) Direct Wires Connected.

That portion of a branch circuit that is installed in an expandable unit shall be permitted to be connected to the portion of the branch circuit in the main body of the park trailer by means of flexible cord installed in accordance with 552.48(O)(2)(1) through (O)(2)(6) or other approved wiring method.

(1) The flexible cord shall be listed for hard usage and for use in wet locations.

(2) The flexible cord shall be permitted to be exposed on the underside of the vehicle.

(3) The flexible cord shall be permitted to pass through the interior of a wall or floor assembly or both a maximum concealed length of 600 mm (24 in.) before terminating at an outlet or junction box.

(4) Where concealed, the flexible cord shall be installed in nonflexible conduit or tubing that is continuous from the outlet or junction box inside the park trailer to a weatherproof outlet box, junction box, or strain relief fitting listed for use in wet locations that is located on the underside of the park trailer. The outer jacket of flexible cord shall be continuous into the outlet or junction box.

(5) Where the flexible cord passes through the floor to an exposed area inside of the park trailer, it shall be protected by means of conduit and bushings or equivalent.

(6) Where subject to physical damage, the flexible cord shall be protected with RMC, IMC, Schedule 80 PVC, reinforced thermosetting resin conduit (RTRC) listed for exposure to physical damage, or other approved means and shall extend at least 150 mm (6 in.) above the floor. A means shall be provided to secure the flexible cord where it enters the park trailer.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee also recommends clarification of the phrases “serial circuit segment” and “calculated using the load that segment sees” in Informational Note No. 1.

Related Item
First Revision No. 5433-NFPA 70-2015 [Section No. 552.48(O)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 10:23:05 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There currently is no Informational Note No. 1 within 552.48(O)(2). CMP 19 notes similar action in PC 1825, referencing 551.72.
Public Comment No. 733-NFPA 70-2015 [ New Article after 555 ]

TITLE OF NEW CONTENT
555.xx(new) Precautionary Signage for recreational swimming in Marinas and Boatyards

Permanent safety signs shall be installed to give adequate notice of electrical shock hazard risks to persons using or swimming near a boat dock or marina. The signs shall be clearly visible from all approaches to a marina or boatyard facility. The signs shall state "WARNING - POTENTIAL WATER SHOCK HAZARD - SWIMMING IS DISCOURAGED"

Statement of Problem and Substantiation for Public Comment

The concept of precautionary signage proposed in PI-4565 and portions of PI-3248 should have been accepted by the Panel but with the wording now proposed for 555.xx(new). A complete prohibition of swimming in marinas and boatyards is beyond the scope of NFPA 70 but I believe precautionary signage to alert people in a marina or boatyard is within the scope of NFPA 70 and is a needed requirement to alert the public to a potential issue they may not even know exists.

Related Item
Public Input No. 4565-NFPA 70-2014 [New Article after 555]
Public Input No. 3248-NFPA 70-2014 [New Section after 555.3]

Submitter Information Verification

Submitter Full Name: John Goodsell
Organization: Hubbell Incorporated
Street Address:
City:
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Zip:
Submittal Date: Fri Sep 18 07:38:58 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5411-NFPA 70-2015
Statement: The posting of signage will alert personnel coming into the vicinity of the potential for shock hazards. Numerous Electric Shock Drowning (including electrocution in the water) deaths and injuries have been documented and investigated over the last decade. In all cases these accidents would have been prevented if the victims did not swim in the water around boats and docks using AC electrical power.
555.1 Scope.

This article covers the installation of wiring and equipment in the areas comprising fixed or floating piers, wharves, docks, and other areas in marinas, boatyards, boat basins, boathouses, yacht clubs, boat condominiums, docking facilities associated with one-family dwellings, two-family dwellings, multifamily dwellings, and residential condominiums; any multiple docking facility or similar occupancies; and facilities that are used, or intended for use, for the purpose of repair, berthing, launching, storage, or fueling of small craft and the moorage of floating buildings.


Statement of Problem and Substantiation for Public Comment

The Correlating Committee advises that article titles are the responsibility of the Correlating Committee and the Correlating Committee directs the panel to reconsider the title change for Article 555 (FR 5438). The title to Article 555 should be changed to recognize that these docking facilities are both commercial and non-commercial as noted in the Panel action on FR 5435 in 555.1.

Related Item

First Revision No. 5438-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 14:18:39 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5412-NFPA 70-2015
Statement: CMP 19 recognizes that including both commercial and non-commercial docking facilities adds clarity to the title.
555.3 Ground-Fault Protection.
The overcurrent protective devices that supply the marina, boat yards, and noncommercial docking facilities shall have
ground-fault protection not exceeding 100 mA at the main and feeder panels, and 30 mA at the power pedestals.

Additional Proposed Changes

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<th>Description</th>
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<td>In_Water_Shock_Hazard_Final_Compiled_author_sheet.pdf</td>
<td>USCG Study 2008 &quot;Inwater Shock Hazard Mitigation Strategies&quot;.</td>
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Statement of Problem and Substantiation for Public Comment

As I understand it, the reason for moving to the 30ma max level is the recent NFPA Study "Assessment of Hazardous Voltage/Current in Marinas, Boatyards and Floating Buildings". The study (uploaded for this input) recommended the 30ma trip level at the point of service for the boats (the power pedestals). This is a conservative reduction of the maximum level of 100mA recommended by the 2008 USCG Study (also uploaded). The reasons for the ABYC recommendation were based on consistency with European standards, and that 30mA would be low enough not to create lethal gradients in the water around boats or docks with current leaks.

In reality, 100mA is also low enough to prevent lethal gradients as is documented in the USCG Study. No lethal gradients were detected when leakage levels below 100mA were evaluated. The leak rate used for most of the testing was 3 amps. The study confirmed the linear relationship of voltage, voltage gradients and currents allowing analysis to be based on the 3 amps of current physically introduced into the water for testing.

Using 30mA ground fault protection at the power pedestals (for the entire pedestal or for each receptacle overcurrent protection device) would provide adequate protection from dangerous voltage gradients. However, if this low level is extended to feeder breakers and main panel breakers, the cumulative small leakage from a number of boats could cause the entire dock or even entire marina to be deenergized when there may not be a dangerous condition present. This issue will be become magnified and significant in any saltwater application.

The main issue is in marina management. When the 30mA GFP for the main breaker trips, what is the marina operator to do? There will be no indication of which boat(s) caused the trips. There could be hundreds of boats to sort out, all without power until the leakage is found/corrected. It could be caused by 30 boats each leaking 1 mA into the water, none of which would present a danger to anyone in the water near the boat. Putting protection closest to the sources will enable quick sorting of the offending boats/pedestals allowing the majority of boats to maintain power. This will make ground fault protection "manageable" at marinas and boatyards.

The major drawback to exclusively protecting at the boat/pedestal is that there will be no protection for the wiring between the main service and the pedestal itself. More than half the accidents recorded on the Electric Shock Drowning List we maintain (uploaded) occurred upstream of the pedestal receptacle itself. Placing GFPs at the feeder panel and main breaker will provide the necessary protection for this section of the wiring.

Since 100mA was recommended in the USCG Study as the maximum GFP trip level, it would be wise to consider using this level as the trip point for feeders and main breakers in marinas ALONG WITH the GFP protection at the pedestal receptacles. This way all the wiring would be protected, and it would not be a management issue to find the source of any leaks causing trips. The other consideration with this strategy is the use of trip times to effect "selective tripping" of the breakers. In Selective Tripping, the breaker closest to the fault trips first, and the farthest trips last. This can be done with leakage trip settings however the trip times must be considered. For example, if a 1 amp leak develops on a boat, we would desire the pedestal breaker to trip before the main breaker, even though the trip levels of both are exceeded. This can be accomplished by analyzing the design criteria of protection devices selected for use.

The recommended change to 555.3 (30mA to 100mA) would significantly reduce the management burden associated with finding the leakage source if an operator chooses to install protection in the feeders or mains instead of at the pedestal. Installing 30mA protection at the feeders or mains will be unsustainable in a saltwater marina application. In our experience we have found that most all marinas have significantly more than 30mA cumulative leakage at any given time, especially those in saltwater.

Maintaining the level at 100mA would provide for safety, and at the same time improve the ability to manage faults throughout the marina. It allows the operators some flexibility as they seek the guidance of knowledgable industry personnel in the best selection for their marina applications.
Committee Statement

Committee Action: Rejected
Resolution: CMP 19 recognizes the 30mA ground-fault limit is consistent with that recommended in the Fire Protection Research Foundation report, “Assessment of Hazardous Voltage/Current in Marinas, Boatyards and Floating Buildings.”
TITLE OF NEW CONTENT  
(B) Voltage Regulation. (New)

Type your content here ...

(A) Maximum Voltage. Yard and pier distribution systems shall not exceed 1000 volts phase to phase.

If a voltage range is provided by the equipment manufacturer, feeder and branch circuit conductors shall be sized to provide voltage at the equipment within the range that is required by the manufacturer. In addition, feeder and branch-circuit conductors shall be sized so the voltage at the end of the feeder conductor is not lower than 97% of that at the service or source and for branch circuits, not lower than 95% at the furthest outlet of that at the service or source. Calculations shall be based on circuit loading at 80 percent of the rating of the overcurrent device.

Statement of Problem and Substantiation for Public Comment

The public deserves to have equipment that will provide reasonable operation for both safety and comfort. Where manufacturers are now worldwide it is important for safe and proper operation that conductors be sized properly to provide voltage within a standard operating range. When determined by the manufacturer, most offshore manufacturers have very low standards and would not require consideration for voltage minimums.

Related Item

Public Input No. 4327-NFPA 70-2014 [Section No. 555.4]

Submitter Information Verification

Submitter Full Name: TRAVIS LINDSEY
Organization: TLC SERVICES
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 11:16:00 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The informational notes in NEC Articles 210 and 215 would address this issue and is consistent with NEC 90.1 (A) and (B) stating the NEC is not to be used as a design manual and the electrical system is not always adequate but safe.
Public Comment No. 978-NFPA 70-2015 [Section No. 555.4]

555.4 Distribution System.

(A) General. Yard and pier distribution systems shall not exceed 1000 volts phase to phase.

555.4(B) Voltage Regulation. If a voltage range is provided by the equipment manufacturer, feeder and branch circuit conductors shall be sized to provide voltage at the equipment within the range that is required by the manufacturer. In addition, feeder and branch-circuit conductors shall be sized so the voltage at the end of the feeder conductor is not lower than 97% of that at the service or source and for branch circuits, not lower than 95% at the furthest outlet of that at the service or source. Calculations shall be based on circuit loading at 80 percent of the rating of the overcurrent device.

Statement of Problem and Substantiation for Public Comment

It is important for safe and proper operation that conductors be sized properly to provide voltage within the operating range as determined by the manufacturer. It is very common for feeder conductors for marina and boatyard electrical systems to be lengthy so it is important that the conductors be sized properly so the electrical systems will perform safely.

Related Item

Public Input No. 4327-NFPA 70-2014 [Section No. 555.4]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 17:39:44 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The informational notes in NEC Articles 210 and 215 would address this issue and is consistent with NEC 90.1 (A) and (B) stating the NEC is not to be used as a design manual and the electrical system is not always adequate but safe.
TITLE OF NEW CONTENT

555.24 Prohibition on Recreation Swimming in Marinas and Boatyards

(A) Recreation swimming shall be prohibited within the confines of marinas and boatyards. This includes areas around docks and other structures using AC power for any purpose (boats, dock services, lighting, etc.).

(B) Signs shall be posted to warn the public and facility personnel of the danger associated with swimming within the confines of a marina using AC power. These signs shall be visible from all approaches to a marina or boatyard facility. They shall be visible to the extent that they can be read before approaching within approx 25 yds of the marina. They shall include, at a minimum, the words “DANGER, NO SWIMMING, Electrical currents may present.”

(C) Precautions for water operations other than recreational (e.g., dock or boat maintenance) shall be taken to protect those engaging in such activities. These precautions shall be specified by the marina or boatyard operator and may include actions such as securing power to certain boats and docks and requiring protective equipment for workers (e.g., wetsuits, gloves).

(D) The marina or boatyard operator shall monitor and enforce the recreational swimming prohibition.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

Swimming in marinas and boatyards presents a significant danger of Electric Shock Drowning (ESD) to people engaging in that activity. The just-released final NFPA study report (Assessment of Hazardous Voltage/Current in Marinas, Boatyard and Floating Buildings, November 5, 2014) stated:

“ABYC recommends that no recreational swimming at any time take place in a marina environment. Part of an effective plan against ESD will include a no swimming policy and “NO SWIMMING” signs posted throughout the facility. This will also prevent possible injury due to boat traffic, harmful marine life, etc.”

A prohibition on recreational swimming, along with appropriate danger/warning signage, would keep scores of people out of the water, significantly enhancing public safety.

It is recognized that in-water inspection and maintenance activities will still be required in marinas and boatyards. Professionals involved in these activities should be protected to the maximum extent feasible. Actions such as disconnecting shore connections to boats at and near the work location, securing power to docks or sections of docks, and wearing protective equipment (such as wet suits) can be used to provide adequate protection for maintenance personnel.

The general public does not have an understanding of the potential electrical dangers present within the confines of marinas and boatyards. Marina and boatyard operators clearly have a responsibility to provide protection from electrical hazards as is stated in NFPA 303:

“A.5.1 Electrical systems and electrical equipment in the marina and boatyard require special consideration because of the existence of some, or all, of the following conditions:

(5) Locations where electrical equipment and facilities are used by persons not under the control of the management, many of whom are unfamiliar with the possible hazards associated with such use and the means to avoid them — those persons need to be protected from electrical hazards when they are on the land, on boats, in storage.
Numerous Electric Shock Drowning (including electrocution in the water) deaths and injuries have been documented and investigated over the last decade. In all cases these accidents would have been prevented if the victims did not swim in the water around boats and docks using AC electrical power. A review of accidents, supported by recent in-water testing has shown that death and injury only occur in the immediate vicinity of the fault source (5-10 foot range). The latest Electric Shock Drowning List is attached.

Ground fault protection was added as 555.3 in the 2011 NEC. This safety enhancement should be viewed as protection for those who accidentally enter the water, and not as a "green light" for recreational swimming activities in marinas and boatyards.

Eliminating recreational swimming in the immediate vicinity of boats and docks using AC electrical power will protect the public against the dangers associated with using electrical power in marinas and boatyards. The warnings provided by signage, along with enforcement by marina and boatyard operators will save lives and prevent injuries to the public. Staying out of the water would have prevented ALL injuries and deaths from electricity to people swimming around docks and marinas.

Related Item
Public Input No. 4565-NFPA 70-2014 [New Article after 555]

Submitter Information Verification
Submitter Full Name: DEAN HUNTER
Organization: MINNESOTA DEPARTMENT OF LABOR
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 28 11:23:10 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-5411-NFPA 70-2015
Statement: The posting of signage will alert personnel coming into the vicinity of the potential for shock hazards. Numerous Electric Shock Drowning (including electrocution in the water) deaths and injuries have been documented and investigated over the last decade. In all cases these accidents would have been prevented if the victims did not swim in the water around boats and docks using AC electrical power.
(G) Splices.

A box, conduit body, or other enclosure, with a cover installed, shall be required for all splices except where:

1. The circuit conductors being spliced are all from nonmetallic multiconductor cord or cable assemblies, provided that the equipment grounding continuity is maintained with or without the box.

2. The circuit conductors being spliced are all from metal sheathed cable assemblies terminated in listed fittings that mechanically secure the cable sheath to maintain effective electrical continuity.

Statement of Problem and Substantiation for Public Comment

The proposed revision is to clarify that 590.4(G)(1) applies only to splices of cord/cable assemblies that have a "nonmetallic" jacket. Clarity is needed.

Related Item
First Revision No. 616-NFPA 70-2015 [Section No. 590.4(G)]
Public Input No. 2847-NFPA 70-2014 [Section No. 590.4(G)]

Submitter Information Verification
Submitter Full Name: James Dollard
Organization: IBEW Local Union 98
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City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 10:06:21 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-606-NFPA 70-2015
Statement: The addition of "nonmetallic" ensures that (1) applies to splices of multiconductor cords or cable assemblies with a nonmetallic jacket.
(J) Support.

Cable assemblies and flexible cords and cables shall be supported in place at intervals that ensure that they will be protected from physical damage. Support shall be in the form of staples, cable ties, straps, or similar type fittings installed so as not to cause damage. Cable assemblies and flexible cords and cables installed as branch circuits or feeders shall not be installed on the floor or on the ground. Extension cords shall not be required to comply with 590.4(J). Vegetation shall not be used for support of overhead spans of branch circuits or feeders.

Exception: For holiday lighting in accordance with 590.3(B), where the conductors or cables are arranged with strain relief devices, tension take-up devices, or other approved means to avoid damage from the movement of the live vegetation, trees shall be permitted to be used for support of overhead spans of branch-circuit conductors or cables.

Statement of Problem and Substantiation for Public Comment

590.4(J) prohibits flexible cords and cables from being laid on the floor or ground for temporary installations. Adequate support is needed to minimize the possibility of damage to the wiring method during its temporary period of use, and support and physical protection is appropriate for temporary wiring methods such as NM cable that are not rated for the rough service of a construction or demolition site. However, hard usage and extra-hard usage cables are manufactured to remain intact while laid on the ground or floor and used in rough service, and where so marked, in wet locations. Some hard usage and extra-hard usage cables are extremely large and heavy and are impractical to hang from cable ties, straps, or similar fittings. Attempting to support large cables above grade could also create a greater hazard by forcing the use of stanchions to suspend heavy cables across large construction or demolition sites, or placing long runs of large, high-ampacity cable in plastic cable protectors (Yellow Jacket®) where heat retention may be damaging to the cable’s insulation.

This proposal was previously rejected (ref Public Input No. 1981-NFPA 70-2014) with Committee Statement of “Section 590.2(A) states “except as specifically modified in this article, all other requirements of this Code for permanent wiring shall apply to temporary wiring installations.” Since extension cords, multiconductor cords, and multiconductor cables that are hard usage or extra hard usage are already permitted for this application, inclusion in 590.4(J) for these cords and cables are not necessary.”

A Technical Question was submitted to NFPA 9/15/2015, and Mark Cloutier NFPA Senior Electrical Engineer responded in part, “After discussions within our group the language in 590.2 is correct in that other requirements in the code apply unless amended by Article 590. However, the new language in 590.4(J) in the NEC 2014 clearly amends any permissive rules that in previous editions allowed the use of cords in the application you described and now prohibits flexible cords and cables installed as branch circuits and feeders from being installed on the floor or on the ground.” Mr. Cloutier’s response supports the position stated in Public Input No. 1981-NFPA 70-2014.

I respectfully resubmit a proposal to modify the language of 590.4(J) to reinstate the use of hard usage and extra-hard usage cables on the floor or ground in temporary installations.

Related Item
Public Input No. 1981-NFPA 70-2014 [Section No. 590.4(J)]

Submitter Information Verification

Submitter Full Name: LORI WEIDNER
Organization: Kurion, Inc.
Affiliation: Hanford Electrical Codes Board
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 22:22:06 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-607-NFPA 70-2015
Statement: Multiconductor cords or cables that are identified in Table 400.4 for hard usage or extra hard usage shall not be required to comply with 590.4(J) as far as support is concerned. The extra text helps clarify what types of cords are acceptable for this temporary application.
Public Comment No. 615-NFPA 70-2015 [Section No. 590.6(B)]

(B) Use of Other Outlets.

For temporary wiring installations, receptacles, other than those covered by 590.6(A)(1) through (A)(3) used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, or equipment, or similar activities, shall have protection in accordance with (B)(1) or (B)(2). When using (B)(1) or (B)(2) is not practical, the assured equipment grounding conductor program in accordance with (B)(3), or (B)(4) should be allowed.

(1) GFCI Protection.

Ground-fault circuit-interrupter protection for personnel.

(2) SP GFCI Protection.

Special purpose ground-fault circuit-interrupter protection for personnel.

(3) Assured Equipment Grounding Conductor Program.

A written assured equipment grounding conductor program continuously enforced at the site by one or more designated persons to ensure that equipment grounding conductors for all cord sets, receptacles that are not a part of the permanent wiring of the building or structure, and equipment connected by cord and plug are installed and maintained in accordance with the applicable requirements of 250.114, 250.138, 406.4(C), and 590.4(D).

(a) The following tests shall be performed on all cord sets, receptacles that are not part of the permanent wiring of the building or structure, and cord-and-plug-connected equipment required to be connected to an equipment grounding conductor:

(2) All equipment grounding conductors shall be tested for continuity and shall be electrically continuous.

(3) Each receptacle and attachment plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.

(4) All required tests shall be performed as follows:

(5) Before first use on site

(6) When there is evidence of damage

(7) Before equipment is returned to service following any repairs

(8) At intervals not exceeding 3 months

(i) The tests required in item (2)(a) shall be recorded and made available to the authority having jurisdiction.

(4) EGFPD Protection.

Equipment ground-fault protective device.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

Substantiation for including SPGFCI devices in the standard:

Fatality Statistics continue to show electrocutions as a significant cause of death at the work place. The 2015 NFPA 70E Standard, Annex K states that electrocutions are the fourth leading cause of industrial fatalities. It also stated that the National Safety Council estimates that about 1000 fatalities every year are due to electrocution, where more that 50% of them take place on system voltage less than 600 V. Moreover, approximately 30,000 non-fatal electrical shock accidents occur every year.

UL 943C identifies protective devices designated as special purpose GFCI (SPGFCI) and thus designed to meet the both NEC and NFPA 70E definition of devices intended for personnel protection. Updating the NEC to include SPGFCIs designed and approved for industrial applications per UL 943C holds the promise of significantly reducing loss of life at the work place.

During the first draft meeting, CMP 2 recognized SPGFCIs as a potential improvement to safety and created FR-339 and FR-347 to include a new definition for SPGFCIs and an installation requirement in Article 210.8(B) respectively.
Substantiation for including EGFPD devices in the standard:

Although EGFPDs are rated as equipment protection by UL, they are tested to both UL943 GFCI standard and UL 1053 Ground-Fault Sensing and Relaying Equipment. Therefore, EGFPD offer protection similar to GFCIs. EGFPDs should not be confused with ground-fault protection of equipment (GFPE). EGFPDs are equipped with a tripping mechanism similar to GFCIs and therefore are capable of interrupting power when a ground-fault is detected.

EGFPDs use the same GFCIs tripping characteristic and therefore an EGFPD will clear a ground-fault within the same clearing time of a GFCI provided that the fault-current magnitude is higher than the device set trip level. EGFPDs differ from GFCIs in:

1. Tripping level is adjustable in the range of 6 to 100 mA (GFCIs have a fixed trip level; 6 mA for Class A and 20 mA for Classes C, D, and E)
2. Monitoring equipment grounding conductor continuity is not required (a mandate for Classes C, D, and E GFCIs).

Unfortunately, some industrial systems have natural leakage current of more than 20 mA during normal operation. The submitter of this PI has experienced a leakage of more than 50 mA while testing an arc welder and a plasma cutter. A similar situation was encountered at a brick manufacture running 6 wet saws (concrete cutters) feed from one source. For those systems, the use of Classes C, D, or E GFCIs defined by UL 943C is impractical. Therefore, EGFPDs could be used to provide some protection to personnel when GFCIs cannot be used.

Although, some commercial EGFPDs are equipped with internal means to monitor equipment grounding conductor continuity, this feature is not available in all devices because it is not a required feature by UL for these devices. Therefore, in order to insure the grounding conductor continuity, a ground continuity monitor relay can be used in conjunction with EGFPDs.

References:

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<td><strong>Resolution:</strong></td>
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<td><strong>Statement:</strong></td>
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600.1 Scope.

This article covers the installation of conductors, equipment, and field wiring for electric signs, outline lighting, and retrofit kits regardless of voltage. All installations, retrofit kits, and equipment using neon tubing, such as signs, decorative elements, skeleton tubing, or art forms, are covered by this article.

Informational Note: Sign and outline lighting illumination systems include, but are not limited to, cold cathode neon tubing, high-intensity discharge lamps (HID), fluorescent or incandescent lamps, light-emitting diodes (LEDs), and electroluminescent and inductance lighting.

Statement of Problem and Substantiation for Public Comment

The addition of Retrofit Kits is misplaced and out of context with the declaration that is intended to cover neon usage and installations. Re-positioned in the Scope Statement to harmonize with the statement that applies to field wiring.

Related Item
First Revision No. 5132-NFPA 70-2015 [Section No. 600.1]

Submitter Information Verification

Submitter Full Name: DAVID SERVINE
Organization: Servine Sign Services LLC
Affiliation: International Sign Association
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 13:50:14 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5119-NFPA 70-2015
Statement: The location of “and Retrofit Kits” in the first sentence is a better location. The second sentence relates to all neon type products and does not refer to field wiring.
600.1 Scope.
This article covers the installation of conductors, equipment, and field wiring for electric signs and retrofit kits, and outline lighting, regardless of voltage. All installations, retrofit kits, and equipment using neon tubing, such as signs, decorative elements, skeleton tubing, or art forms, are covered by this article.

Informational Note: Sign and outline lighting illumination systems include, but are not limited to, cold cathode neon tubing, high-intensity discharge lamps (HID), fluorescent or incandescent lamps, light-emitting diodes (LEDs), and electroluminescent and inductance lighting.

Statement of Problem and Substantiation for Public Comment
Moving the added "retrofit kits" to the first sentence is clearer and better grammar. The change should have no other effect on the intention of the addition.

Related Item
First Revision No. 5132-NFPA 70-2015 [Section No. 600.1]

Submitter Information Verification
Submitter Full Name: Randall Wright
Organization: RKW Consulting
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 15:12:47 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-5119-NFPA 70-2015
Statement: The location of “and Retrofit Kits” in the first sentence is a better location. The second sentence relates to all neon type products and does not refer to field wiring.
Public Comment No. 1333-NFPA 70-2015 [ Section No. 600.3 ]

600.3 Listed.

Fixed, mobile, or portable electric signs, section signs, outline lighting, photovoltaic (PV) powered signs, and retrofit kits, regardless of voltage, shall be listed, labeled, provided with installation instructions, and installed in conformance with that listing, unless otherwise approved by special permission.

(A) Field-Installed Skeleton Tubing.

Field-installed skeleton tubing shall not be required to be listed where installed in conformance with this Code.

(B) Outline Lighting.

Outline lighting shall not be required to be listed as a system when it consists of listed and labeled luminaires wired in accordance with Chapter 3.

Additional Proposed Changes

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<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Public Comments for This Document

<table>
<thead>
<tr>
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<tr>
<td>National Fire Protection Association Report</td>
<td></td>
</tr>
<tr>
<td>Public Comment No. 532-NFPA 70-2015 [Definition: Labeled]</td>
<td>Addresses committee concern of parts that are too small to be labeled.</td>
</tr>
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<td>---</td>
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<td></td>
</tr>
<tr>
<td>First Revision No. 5134-NFPA 70-2015 [Section No. 600.3]</td>
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</tbody>
</table>

**Submitter Information Verification**

| Submitter Full Name: JEFFREY FECTEAU |  |
| Organization: UNDERWRITERS LABORATORIES LLC |  |
| Affiliation: UL |  |
| Street Address: |  |
| City: |  |
| State: |  |
| Zip: |  |
| Submittal Date: Thu Sep 24 20:44:31 EDT 2015 |  |

**Committee Statement**

| Committee Action: | Rejected but see related SR |
| Resolution: | SR-5114-NFPA 70-2015 Removing the comma and adding and labeled with listing better clarifies the label is part of the listing and not some other label. |
| Statement: | The Panel agrees with public comment clarifying certain equipment be “listed and labeled” instead of just “listed.” Qualified Electrical Testing Laboratories do not consider a product to be listed unless the label has actually been applied. Additionally, the Article 100 definition for “labeled” includes the provision for labeling the smallest unit carton for parts which are too small to include the listing mark on the parts themselves. Labeling includes listing marks that are stamped or molded on or into the product. |
Public Comment No. 1465-NFPA 70-2015 [Section No. 600.4(B)]

(B) Retrofitted Signs and Outline Lighting Systems. Signs and outline lighting systems with a Retrofitted Illumination System.

- The retrofitted sign shall be marked that the illumination system has been replaced.
- The marking shall include the kit provider’s and installer’s name, logo, or unique identifier.

Signs equipped with tubular light-emitting diode lamps powered by the existing sign sockets shall require an additional warning label.

Retrofit illumination conversions shall be marked in a location visible during servicing in accordance with (1), (2), (3)

1. A permanent warning label that complies with 110.21(B) shall be applied to a retrofitted sign or outline lighting system:
   WARNING. RETROFIT KIT INSTALLED. REPLACE LAMPS AND POWER SOURCES WITH SAME TYPE AND RATING.

2. A permanent mark shall identify the retrofit kit installation company.

3. Other marks as required by the listed retrofit kit installation instructions or the authority having jurisdiction.

Statement of Problem and Substantiation for Public Comment

Revise for clarity and Code style for multiple requirements in a section. The marking instructions are vague and indeterminate.

1. A field applied hazard marking is required to be a label for compliance with 110.21(B). In the Code, text on cautionary labels is not unplanned or unspecific but rather it is uniform and specific to the hazard. e.g. 110.22(B)(C), 551.47, 700.7(B) This is for ease of recognition by different service personnel.

2. Omit “provider.” It is subjective and vague. Retrofit kits are required to be listed. (600.3) Qualified electrical testing laboratories that certify and list retrofit kits utilize a traceable marking that identifies the kit manufacturer making it an unnecessary duplication to require separate marking identifying the kit manufacturer for the AHJ. The installer of the kit needs to be identified since the installation company may not be the manufacturer of the retrofit kit or the listed host sign. This marking provides the AHJ with a means or identifying the installer of the field conversion. Secondly the marking identifying the installer provides the sign owner and future qualified service technicians access to a source for information about any special replacement parts and devices covered in the installation instructions for the original field conversion.

3. The additional requirement for marking T-LEDS is unnecessary because the warning label required in the revisions to (1) is sufficient in its scope to cover this safety issue. Revision for (3) apply to other markings that may be required in the installations for the listed kit conversion and additional marking required by the AHJ. For example, Washington's WAC 296-46B-600 requires a label with specific marking. "This label is in addition to any labeling required by the manufacturers installation instructions or the UL Standard used to manufacture the retrofit kit."

Related Item
First Revision No. 5135-NFPA 70-2015 [New Section after 600.4(A)]

Submitter Information Verification

Submitter Full Name: DAVID SERVINE
Organization: Servine Sign Services LLC
Affiliation: International Sign Association
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 12:41:14 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5120-NFPA 70-2015
Statement: This revision provides necessary clarity to address replacement of fluorescent lamps after a retrofit kit with tubular LEDs has been installed. The reference to 110.21(B) will require the label to address the hazard with words and/or symbols as required. Additionally, the location of the required label is clarified.

Need to define what message warning label needs to convey, as well as where this label needs to be placed.
Public Comment No. 399-NFPA 70-2015 [Section No. 600.4(B)]

(B) Signs with a Retrofitted Illumination System.

(1) The retrofitted sign shall be marked that the illumination system has been replaced.

(2) The marking shall include the kit providers and installer’s name, logo, or unique identifier.

(3) Signs equipped with tubular light-emitting diode lamps powered by the existing sign sockets shall require an additional warning label to alert end user that luminaire has been modified and no attempt shall be made to install or operate original type lamps. This label shall be placed where visible during relamping.

Statement of Problem and Substantiation for Public Comment

Need to define what message warning label needs to convey, as well as where this label needs to be placed.

Related Item

First Revision No. 5135-NFPA 70-2015 [New Section after 600.4(A)]

Submitter Information Verification

Submitter Full Name: DON MILETICH
Organization: CREE INC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 12 09:56:31 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5120-NFPA 70-2015
Statement: This revision provides necessary clarity to address replacement of fluorescent lamps after a retrofit kit with tubular LEDs has been installed. The reference to 110.21(B) will require the label to address the hazard with words and/or symbols as required. Additionally, the location of the required label is clarified.

Need to define what message warning label needs to convey, as well as where this label needs to be placed.
Public Comment No. 472-NFPA 70-2015 [Section No. 600.4(B)]

(B) Signs with a Retrofitted Illumination System.
(1) The retrofitted sign shall be marked that the illumination system has been replaced.
(2) The marking shall include the kit providers and installer’s name, logo, or unique identifier.
   - Signs equipped with tubular light-emitting diode lamps powered by the existing sign sockets shall require an additional warning label.

Statement of Problem and Substantiation for Public Comment

Delete (3) or tell us what the warning sign is supposed to say.

Related Item
First Revision No. 5135-NFPA 70-2015 [New Section after 600.4(A)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Aug 30 16:16:11 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5120-NFPA 70-2015
Statement: This revision provides necessary clarity to address replacement of fluorescent lamps after a retrofit kit with tubular LEDs has been installed. The reference to 110.21(B) will require the label to address the hazard with words and/or symbols as required. Additionally, the location of the required label is clarified.

Need to define what message warning label needs to convey, as well as where this label needs to be placed.
(3) Metal or Nonmetallic Sign Poles.

Metal or nonmetallic poles used to support signs shall be permitted to enclose supply conductors, provided the poles and conductors are installed in accordance with 410.30(B).

Statement of Problem and Substantiation for Public Comment

I agree with PI 2139... the panel state "The submitter has not provided a statement of problem to support a change in language" the reason for the change is to simplify the language for clarity.

Related Item

Public Input No. 2139-NFPA 70-2014 [Section No. 600.5(C)(3)]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 18 21:02:53 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Removing "metal or nonmetallic" does not provide clarity. Having "Metal and Nonmetallic" included in the section removes ambiguity regarding the application of the section and coordinates with 410.30(B).
(1) At Point of Entry to a Sign.

The disconnect shall be located at the point the feeder circuit or branch circuit(s) supplying a sign or outline lighting system enters a sign enclosure, a sign body, or a pole in accordance with 600.5(C)(3) and shall disconnect all ungrounded conductors where it enters the enclosure of the sign or pole.

Exception No. 1: A disconnect shall not be required for branch or feeder circuits passing through the sign where enclosed in a Chapter 3 listed raceway or metal-jacketed cable armored cable type AC or MC listed for the use.

Exception No. 2: A disconnect shall not be required at the point of entry to a sign enclosure or sign body for feeders or branch circuits that supply an internal panelboard(s) in a sign enclosure or sign body. The conductors shall be enclosed in a Chapter 3 listed raceway or metal-jacketed cable armored cable type AC or MC listed for the use. A field-applied permanent warning label that is visible during servicing shall be applied to the raceway at or near the point of entry into the sign enclosure or sign body. The warning label shall comply with 110.21(B) and state the following: "Danger. This raceway contains energized conductors. Do not open." The marking shall include the location of the disconnecting means for the energized feeders or branch circuit(s). The disconnecting means shall be capable of being locked in the open position in compliance with 110.25.

Statement of Problem and Substantiation for Public Comment

"Metal jacketed cable" is an ambiguous and inconsistent with Code terminology. In Code terms, cable with this physical characteristic is correctly identified in 320 and 330 as AC or MC armored cable. It is listed with specific conditions of use that comply with 320.10 and 330.10 and a robust alternative to Chapter 3 raceways. The proposed revision is for clarity, and consistency with Code terminology.

Related Item

First Revision No. 5137-NFPA 70-2015 [New Section after 600.6(A)(1)]

Submitter Information Verification

Submitter Full Name: DAVID SERVINE
Organization: Servine Sign Services LLC
Affiliation: International Sign Association
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 14:36:13 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5127-NFPA 70-2015
Statement: The word circuit was replaced with conductor(s) after feeder for clarity in the first sentence and in the exceptions. The words "Do Not Open" were removed from the label for clarity.

The reference to specific cable types was changed to "metal-jacketed identified for the location" to accommodate the different environmental locations where a sign may be installed.
Public Comment No. 473-NFPA 70-2015 [Section No. 600.6(A)(1)]

(1) At Point of Entry to a Sign.

The disconnect shall be located at the point the feeder circuit or branch circuit(s) supplying a sign or outline lighting system enters a sign enclosure, a sign body, or a pole in accordance with 600.5(C)(3) and shall disconnect all ungrounded conductors where it enters the enclosure of the sign or pole.

Exception No. 1: A disconnect shall not be required for branch or feeder circuits passing through the sign where enclosed in a Chapter 3 listed raceway or metal-jacketed cable.

Exception No. 2: A disconnect shall not be required at the point of entry to a sign enclosure or sign body for feeders or branch circuits that supply an internal panelboard(s) in a sign enclosure or sign body. The conductors shall be enclosed in a Chapter 3 listed raceway or metal-jacketed cable. A field-applied permanent warning label that is visible during servicing shall be applied to the raceway or cable at or near the point of entry into the sign enclosure or sign body. The warning label shall comply with 110.21(B) and state the following: “Danger. This raceway or cable contains energized conductors. Do not open.” The marking shall include the location of the disconnecting means for the energized feeders or branch circuit(s). The disconnecting means shall be capable of being locked in the open position in compliance with 110.25.

Statement of Problem and Substantiation for Public Comment

Since a cable could be use, then the warning label needs to be on the cable as well. What does it mean ‘Do not open’ on the label? What is it that you can open in the raceway or cable. Maybe this exception needs to be revised to achieve the panels intent.

Related Item
First Revision No. 5135-NFPA 70-2015 [New Section after 600.4(A)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Aug 30 16:19:18 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5127-NFPA 70-2015
Statement: The word circuit was replaced with conductor(s) after feeder for clarity in the first sentence and in the exceptions. The words “Do Not Open” were removed from the label for clarity.

The reference to specific cable types was changed to “metal-jacketed identified for the location” to accommodate the different environmental locations where a sign may be installed.
(1) At Point of Entry to a Sign.

The disconnect shall be located at the point the feeder circuit, or branch circuit(s) supplying a sign or outline lighting system enters a sign enclosure, a sign body, or a pole in accordance with 600.5(C)(3) and shall disconnect all ungrounded conductors where it enters the enclosure of the sign or pole.

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Statement of Problem and Substantiation for Public Comment

eliminating the first "circuit" is consistent with the rest of the sections and there could be more than one. Jacketed should be changed to either armored or sheathed to be consistent with the NEC language.

Related Item
First Revision No. 5137-NFPA 70-2015 [New Section after 600.6(A)(1)]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: master
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 18 21:35:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5127-NFPA 70-2015
Statement: The word circuit was replaced with conductor(s) after feeder for clarity in the first sentence and in the exceptions. The words “Do Not Open” were removed from the label for clarity.

The reference to specific cable types was changed to “metal-jacketed identified for the location” to accommodate the different environmental locations where a sign may be installed.
Public Comment No. 1669-NFPA 70-2015 [Section No. 600.6(A)(3)]

(3) Within Sight of the Controller.

The following shall apply for signs or outline lighting systems operated by electronic or electromechanical controllers located external to the sign or outline lighting system:

1. The disconnecting means shall be located within sight of the controller or in the same enclosure with the controller.
2. The disconnecting means shall disconnect the sign or outline lighting system and the controller from all ungrounded supply conductors.
3. The disconnecting means shall be designed such that no pole can be operated independently and shall be lockable in accordance with 110.25.

Exception: Where the disconnecting means is not located within sight of the controller, a permanent field-applied marking identifying the location of the disconnecting means shall be applied to the controller in a location visible during servicing. The warning label shall comply with 110.21(B).

Informational Note: The intention of the point of entry into a sign enclosure, sign body or pole is intended to allow the service or maintenance personnel complete and local control of the disconnecting means. This also allows local "Lock/Out Tag/Out" without a search of a electrical system, whether remote or local.

Statement of Problem and Substantiation for Public Comment

The informational note may clarify the intent of the safety of the location and rational for the means to be local and available.

Related Item
First Revision No. 5137-NFPA 70-2015 [New Section after 600.6(A)(1)]

Submitter Information Verification

Submitter Full Name: Randall Wright
Organization: RKW Consulting
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:07:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5126-NFPA 70-2015
Statement: The new informational note and existing text is properly located in the parent text of 600.6 to provide the code user with information related to revisions in First Revision No. 5137.

Editorially, "circuit" is revised to "conductor" for clarity.
(C) Class 2.

Where the installation complies with 600.33 and the power source provides a Class 2 output that complies with 600.24, either of the following wiring methods shall be permitted as determined by the installation instructions and conditions.

(1) Wiring methods identified in Chapter 3
(2) Class 2 cables complying with Part III of Article 725, Table 600.33(A)(1) and Table 600.33(A)(2).

Statement of Problem and Substantiation for Public Comment

CMP 18 has accepted the premise that references to 725 be deleted from 600. Power limited cable requirements have been moved to 600.33 and incorporated into Table 600.33(A)(1) and (A)(2). The text revision is required in 600.12(C)(2) as part of this realignment.

Related Item
Public Input No. 3556-NFPA 70-2014 [Section No. 600.12(C)]

Submitter Information Verification

Submitter Full Name: DAVID SERVINE
Organization: Servine Sign Services LLC
Affiliation: International Sign Association
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 18:19:48 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5125-NFPA 70-2015
Statement: Inadvertently left reference to Article 725 in First Draft, this action removes the references.
This action should satisfy the Correlating Committee recommendation in PC# 1827
Public Comment No. 1443-NFPA 70-2015 [Section No. 600.12(C)]

(C) Class 2.

Where the installation complies with 600.33 and the power source provides a Class 2 output that complies with 600.24, either of the following wiring methods shall be permitted as determined by the installation instructions and conditions.

1. Wiring methods identified in Chapter 3
2. Class 2 cables complying with Part III of Article 725. Wiring methods complying with 600.33

Statement of Problem and Substantiation for Public Comment

The task group in preparation of FR 5139 included the removal of 725 from all sections of 600 since we added all the wiring methods and wire to 600.33. During the process we resolved the two proposals (3556 and 4595) which counteracted our intent. This should clarify that all the Class 2 wiring methods and requirements for electric signs are included in Article 600.

Related Item

Public Input No. 3556-NFPA 70-2014 [Section No. 600.12(C)]
Public Input No. 4595-NFPA 70-2014 [Section No. 600.12(C)]
First Revision No. 5139-NFPA 70-2015 [Section No. 600.33]

Submitter Information Verification

Submitter Full Name: Randall Wright
Organization: RKW Consulting
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 11:35:05 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5125-NFPA 70-2015
Statement: Inadvertently left reference to Article 725 in First Draft, this action removes the references.

This action should satisfy the Correlating Committee recommendation in PC# 1827
Public Comment No. 1287-NFPA 70-2015 [Section No. 600.22(A)]

(A) Type.
Ballasts shall be identified for the use and shall be listed and labeled.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing and labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

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<td>Public Input No. 922-NFPA 70-2014 [Section No. 600.22(A)]</td>
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<tr>
<td>First Revision No. 5140-NFPA 70-2015 [Section No. 600.22(A)]</td>
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Submitter Information Verification
Committee Statement

Committee Action: Accepted
Resolution: SR-5115-NFPA 70-2015
Statement: The Panel agrees with public comment clarifying certain equipment be “listed and labeled” instead of just “listed.” Qualified Electrical Testing Laboratories do not consider a product to be listed unless the label has actually been applied.

Additionally, the Article 100 definition for “labeled” includes the provision for labeling the smallest unit carton for parts which are too small to include the listing mark on the parts themselves. Labeling includes listing marks that are stamped or molded on or into the product.
### Public Comment No. 1289-NFPA 70-2015 [Section No. 600.23(A)]

(A) Type.
Transformers and electronic power supplies shall be identified for the use and shall be listed and labeled.

### Additional Proposed Changes

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### Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term "and labeled" was added after "listed" during the First Revision Stage, the words "and labeled" after "listed" be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms "listed" and "labeled," most importantly, to clarify and establish a distinction between the terms "listed" and "labeled" which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the task group to address the 2017 NEC regarding the issue of "listed and labeled." As such, UL is submitting comments to request that the terms "and labeled" be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer's attestation that the product is in compliance with the appropriate standard. NRTL's conduct factory surveillance of products, surveillance is one method to validate the manufacturer's attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the "listing" is not impacted, as the "listing" is created at the completion of the "original" certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a "listing" has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL's do not consider a product as being listed unless it is also labeled. The UL White Book states that "Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards." Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL's have similar requirements.

### Related Public Comments for This Document

<table>
<thead>
<tr>
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<tbody>
<tr>
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<td>This addresses the committee concern of parts that are too small to be labeled.</td>
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<tr>
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<tr>
<td>Public Input No. 923-NFPA 70-2014 [Section No. 600.23(A)]</td>
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<tr>
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Committee Statement

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<thead>
<tr>
<th>Committee Action</th>
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<tr>
<td>Resolution</td>
<td>SR-5116-NFPA 70-2015</td>
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<tr>
<td>Statement</td>
<td>The Panel agrees with public comment clarifying certain equipment be “listed and labeled” instead of just “listed.” Qualified Electrical Testing Laboratories do not consider a product to be listed unless the label has actually been applied. Additionally, the Article 100 definition for “labeled” includes the provision for labeling the smallest unit carton for parts which are too small to include the listing mark on the parts themselves. Labeling includes listing marks that are stamped or molded on or into the product.</td>
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</table>
Public Comment No. 1291-NFPA 70-2015 [Section No. 600.24(A)]

(A) Listing.
Class 2 power supplies and power sources shall be listed and labeled for use with electric signs and outline lighting systems or shall be a component in a listed and labeled electric sign.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
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Statement of Problem and Substantiation for Public Comment

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Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

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## Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name:</th>
<th>JEFFREY FECTEAU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization:</td>
<td>UNDERWRITERS LABORATORIES LLC</td>
</tr>
<tr>
<td>Affiliation:</td>
<td>UL</td>
</tr>
<tr>
<td>Street Address:</td>
<td></td>
</tr>
<tr>
<td>City:</td>
<td></td>
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<tr>
<td>State:</td>
<td></td>
</tr>
<tr>
<td>Zip:</td>
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<td>Submittal Date:</td>
<td>Thu Sep 24 17:57:56 EDT 2015</td>
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## Committee Statement

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<td>Resolution:</td>
<td>SR-5117-NFPA 70-2015</td>
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</table>
The wiring methods and materials used shall be in accordance with the sign manufacturer's installation instructions using any applicable wiring methods from Chapter 3, Wiring Methods, and the requirements for Class 2 circuits contained in 600.12(C), 600.24, and 600.33(A), (B), (C), and (D).

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 5139.

Related Item
First Revision No. 5139-NFPA 70-2015 [Section No. 600.33]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 10:25:52 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5125-NFPA 70-2015
Statement: Inadvertently left reference to Article 725 in First Draft, this action removes the references.

This action should satisfy the Correlating Committee recommendation in PC# 1827
Public Comment No. 1325-NFPA 70-2015 [Section No. 600.33(A) [Excluding any Sub-Sections]]

Listed. Class 2 cable listed for the application that complies with Table 600.33(A)(1), and or Substitution Table (A)(2) shall be installed on the load side of the Class 2 power source. The conductors shall have an ampacity not less than the load to be supplied and shall not be sized smaller than 18 AWG.

Table 600.33(A)(1) Applications of Power Limited Cable in Signs and Outline Lighting

<table>
<thead>
<tr>
<th>Location</th>
<th>CL2</th>
<th>CL3</th>
<th>CL2R</th>
<th>CL3R</th>
<th>CL2P</th>
<th>CL3P</th>
<th>PLTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non General use inside buildings, non-concealed spaces inside buildings</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Concealed, Risers, vertical runs concealed spaces inside buildings</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Environmental air spaces plenums-risers ducts</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Wet locations</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

Y = Permitted. N = Not Permitted.

Table 600.33(A)(2) Class 2 Cable Substitutions

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Permitted Substitutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL3P</td>
<td>CMP</td>
</tr>
<tr>
<td>CL2P</td>
<td>CMP, CL3P</td>
</tr>
<tr>
<td>CL3R</td>
<td>CMP, CL3P, CMR</td>
</tr>
<tr>
<td>CL2R</td>
<td>CMP, CL3P, CL2P, CMR, CL3R</td>
</tr>
<tr>
<td>PLTC</td>
<td>CL2, CL3X, CL2X</td>
</tr>
<tr>
<td>CL3</td>
<td>CMP, CL3P, CMR, CL3R, CMG, CM, PLTC</td>
</tr>
<tr>
<td>CL3X</td>
<td>CMP, CL3P, CMR, CL3R, CMG, CM, PLTC, CL3, CMX</td>
</tr>
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</table>

Statement of Problem and Substantiation for Public Comment

600.33(A) Revisions.
The wide range of Class 2 cable types are each certified and listed for specific applications as identified by markings on the cable, PLTC as an example, is described in UL's "General Information For Electrical Equipment the White Book", under Power Limited Cable (QPTZ) as being suitable for direct burial in the earth WHEN MARKED DIRECT BURIAL. Similarly it is sunlight resistant WHEN MARKED SUNLIGHT RESISTANT. The change in the syntax in 600.33(A) clearly informs the Code user that the cable must not only be listed, but listed for the application as described on Table 600.33(A)(1) which is positioned directly below under the caption "Applications of Power Limited Cable in Signs and Outline Lighting".

Table 600.33(A)(1) Revisions.
Amend subtitle in Column 1, Row 1 to identify the group of Class 2 cables that are acceptable for common use in secondary Class 2 sign circuits inside buildings. (Reference Table 725.154, 725.136(K))
Amend subtitle in Column 1, Row 2 to identify group of Class 2 cables that are acceptable for use in secondary Class 2 sign circuits in risers and vertical runs. (Reference Table 725.154, 725.135(D)(1))
Amend subtitle in Column 1, Row 3 to identify the group of Class 2 cables that are suitable for secondary Class 2 sign circuits in environmental air spaces and ducts. (Reference Table 725.154, &25 135(B)(1),(C)(1))

The changes improve the usability of the table, readily matching the installation application with suitable Class 2 Cable types.

Related Item
First Revision No. 5139-NFPA 70-2015 [Section No. 600.33]

Submitter Information Verification

Submitter Full Name: DAVID SERVINE
Organization: Servine Sign Services LLC
Affiliation: International Sign Association
<table>
<thead>
<tr>
<th><strong>Committee Statement</strong></th>
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<tr>
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<td><strong>Resolution:</strong></td>
</tr>
<tr>
<td><strong>Statement:</strong></td>
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</tbody>
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Public Comment No. 400-NFPA 70-2015 [Section No. 600.33(A) [Excluding any Sub-Sections]]

Listed Class 2 cable that complies with Table 600.33(A)(1) and (A)(2) shall be installed on the load side of the Class 2 power source. The conductors shall have an ampacity not less than the load to be supplied and shall not be sized smaller than 18 AWG.

Table 600.33(A)(1) Applications of Power Limited Cable in Signs and Outline Lighting

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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Concealed spaces inside buildings</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>N</td>
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<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
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<td>N</td>
<td>N</td>
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</tr>
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<td>PLTC</td>
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<td>CMP, CL3P, CMR, CL3R, CMG, CM, PLTC</td>
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<tr>
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<td>CMP, CL3P, CMR, CL3R, CMG, CM, PLTC, CL3, CMX</td>
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Statement of Problem and Substantiation for Public Comment

There is no justification to require higher gauge wire for the signs while 22 AWG wire is permitted elsewhere in the standard to power other products. As long as wire gauge is sufficient to handle the load it should be permissible. With the growing demand for PoE it makes no sense to place these restrictions. To my knowledge there are no 18AWG Ethernet cables, and in fact some go down as small as 26AWG. Why should the sign lighting be different? 840.160 Powering Circuits goes all the way down to 26AWG and provides new Table 840.160 (A) with ampacity ratings.

Related Item
First Revision No. 5139-NFPA 70-2015 [Section No. 600.33]

Submitter Information Verification

Submitter Full Name: DON MILETICH
Organization: CREE INC

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-5124-NFPA 70-2015 Retain the 18 AWG because 26 AWG conductor size is not suitable for the ampacity used in signs and due to the voltage drop in the application or the LED and drivers the 18 gauge is specified from the wire manufactures. It also exists in field wiring in UL 48 as the minimum conductor size. Changing the language of "location" would not improve the clarity for the AHJ.
Statement: Made multiple editorial revisions to improve clarity and usability.

(1) - General Use.
CL2 or CL3, PLTC, or any listed applicable cable for general use shall be installed within and on buildings or structures.

(2) - Other Building Locations.
In other locations, any listed applicable cable permitted in 600.33(A)(1), (A)(2), (A)(3), and (A)(4) and Table 600.33(A)(1) and (A)(2) shall be permitted to be used as follows:
   (1) CL2P or CL3P — Ducts, plenums, or other spaces used for environmental air
   (2) CL2R or CL3R — Vertical shafts and risers
   (3) Substitutions from Table 600.33(A)(1)

Statement of Problem and Substantiation for Public Comment

Delete subsections 600.33(A)(1),(2),(3),(4)
The purpose of the revision to 600.33 was ostensibly to simplify the identity of permitted types of Class 2 power limited cable in secondary Class 2 sign circuits. The creation of Table 600.33(A)(1) and Substitution Table (A)(2) is intended to provide the Code user and the AHJ with easily recognizable Class 2 cable for environments common to sign installations. The repetition in (A)(1-4) does not contribute to that goal but adds confusion selecting the permitted cable for the installation application. For example, the subtitles on Table 600.33(A)(1) do not harmonize with the subsection titles GENERAL USE (A)(1) or OTHER BUILDING LOCATIONS (A)(2). The tables by themselves achieve the objective of bringing into Article 600 the identity of permitted Class 2 cable types from 725 for easy selection by the installer and AHJ approval.

Related Item
First Revision No. 5139-NFPA 70-2015 [Section No. 600.33]

Submitter Information Verification

Submitter Full Name: DAVID SERVINE
Organization: Servine Sign Services LLC
Affiliation: International Sign Association
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 23:24:59 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There is no confusion in selecting wire size. Submitter did not provide adequate substantiation for revision.
Public Comment No. 1364-NFPA 70-2015 [Section No. 600.33(B)]

(B) Installation.
Secondary wiring shall be installed in accordance with (B)(1) and (B)(2).

(1) Support wiring. Wiring shall be installed and supported in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable is not damaged by normal building use. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft). Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D).

(2) Connections in cable and conductors shall be made with listed insulating devices and be accessible after installation. Where made in a wall, connections shall be enclosed in a listed box.

Statement of Problem and Substantiation for Public Comment

Syntax correction required to clearly convey intended intent of this subsection which is describing the manner in which secondary wiring is to be supported on the building.

Related Item
First Revision No. 5139-NFPA 70-2015 [Section No. 600.33]

Submitter Information Verification

Submitter Full Name: DAVID SERVINE
Organization: Servine Sign Services LLC
Affiliation: International Sign Association
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 23:56:57 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-5123-NFPA 70-2015
Statement: Language revised for clarity.
Public Comment No. 474-NFPA 70-2015 [Section No. 600.34 [Excluding any Sub-Sections]]

All field wiring of components and subassemblies for an off-grid stand-alone, on-grid interactive, or non-grid interactive PV installation shall be installed in accordance with Article 690, as applicable, Article 600.34, and the PV powered sign installation instructions.

Statement of Problem and Substantiation for Public Comment

There is no Article 600.34.

Related Item

First Revision No. 5145-NFPA 70-2015 [New Section after 600.33]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 16:23:39 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-5122-NFPA 70-2015
Statement: The section was corrected editorially by removing the word “Article” before 600.34
Public Comment No. 475-NFPA 70-2015 [Section No. 600.34(D)]

(D) Grounding.
Grounding a PV powered sign shall comply with Article 690, Part V and Article 600.7.

Statement of Problem and Substantiation for Public Comment
There is no Article 600.7.

Related Item
First Revision No. 5145-NFPA 70-2015 [New Section after 600.33]

Submitter Information Verification
Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Aug 30 16:25:47 EDT 2015

Committee Statement
Committee Action: Accepted
Resolution: SR-5121-NFPA 70-2015
Statement: The section was corrected editorially by removing the word “Article” before 600.7.
Public Comment No. 1294-NFPA 70-2015 [ Section No. 600.42(H) ]

(H) Electrode Enclosures.
Electrode enclosures shall be listed and labeled.

(1) Dry Locations.
Electrode enclosures that are listed, labeled and identified for use in dry, damp, or wet locations shall be permitted to be installed and used in such locations.

(2) Damp and Wet Locations.
Electrode enclosures installed in damp and wet locations shall be specifically listed, labeled and identified for use in such locations.

Informational Note: See 110.3(B) covering installation and use of electrical equipment.

Additional Proposed Changes

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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Comment No. 532-NFPA 70-2015 [Definition: Labeled.]</td>
<td>This addresses the committee concern of parts that are too small to be labeled.</td>
</tr>
<tr>
<td>---</td>
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<tr>
<td>Related Item</td>
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<tr>
<td>Public Input No. 1072-NFPA 70-2014 [Definition: Labeled.]</td>
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<tr>
<td>Public Input No. 925-NFPA 70-2014 [Section No. 600.42(H)]</td>
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<tr>
<td>First Revision No. 5143-NFPA 70-2015 [Section No. 600.42(H)]</td>
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**Submitter Information Verification**

<table>
<thead>
<tr>
<th>Submitter Full Name: JEFFREY FECTEAU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization: UNDERWRITERS LABORATORIES LLC</td>
</tr>
<tr>
<td>Affiliation: UL</td>
</tr>
<tr>
<td>Street Address:</td>
</tr>
<tr>
<td>City:</td>
</tr>
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<td>State:</td>
</tr>
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<td>Zip:</td>
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<td>Submittal Date: Thu Sep 24 18:04:05 EDT 2015</td>
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**Committee Statement**

<table>
<thead>
<tr>
<th>Committee Action: Rejected but see related SR</th>
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</thead>
<tbody>
<tr>
<td>Resolution: SR-5118-NFPA 70-2015 Removed the comma and adding and labeled with listing better clarifies the label is part of the listing and not some other label.</td>
</tr>
</tbody>
</table>
| Statement: The Panel agrees with public comment clarifying certain equipment be “listed and labeled” instead of just “listed.” Qualified Electrical Testing Laboratories do not consider a product to be listed unless the label has actually been applied. 

Additionally, the Article 100 definition for “labeled” includes the provision for labeling the smallest unit carton for parts which are too small to include the listing mark on the parts themselves. Labeling includes listing marks that are stamped or molded on or into the product.
604.6 Listing Requirements.
Manufactured wiring systems and associated components shall be listed and labeled.

Informational Note: ANSI/UL 183, Standard for Manufacturing Wiring Systems, is a safety standard for manufactured wiring systems.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

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Related Item
Public Input No. 817-NFPA 70-2014 [Section No. 604.6]
Public Input No. 1072-NFPA 70-2014 [Definition: Labeled]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
<table>
<thead>
<tr>
<th>Committee Statement</th>
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</thead>
<tbody>
<tr>
<td><strong>Committee Action:</strong></td>
</tr>
<tr>
<td><strong>Resolution:</strong></td>
</tr>
<tr>
<td><strong>Statement:</strong></td>
</tr>
</tbody>
</table>
610.1 Scope.
This article covers the installation of electrical equipment and wiring used in connection with cranes, monorail hoists, hoists, and all runways.

Informational Note: For further information, see ANSI ASME B30.21, Lever Hoists, Safety Code, Standard for Cableways, Cranes, Derrick, Hoists, Hooks, Jacks, and Slings.

Statement of Problem and Substantiation for Public Comment

Referenced correct SDO name, standard name, and number.

Related Item
First Revision No. 3307-NFPA 70-2015 [Definition: Audio Signal Processing Equipment]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jun 25 23:39:03 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3301-NFPA 70-2015
Statement: The reference to ASME is correct. ASME develops the standards whereas ANSI accredits the standards. Correction to the B30 title is necessary to agree properly with ASME and the fact that it is a set of safety standards. Panel 12 does not accept that it is referring only to one specific standard (B30.21) as the PC suggests.
(F) Other Loads.

Additional loads, such as heating, lighting, and air conditioning, shall be multiplied by 2.25 times the full-load ampere rating in order to permit application of Table 610.14(A). Otherwise, these loads shall be provided for by application of the appropriate sections of this Code.

Additional Proposed Changes

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<th>Description</th>
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<tr>
<td>CMAA_substitution_of_NEC_310_16_vs_610_14-R2.xlsx</td>
<td>CMAA substantiation of 2.25 multiplier allowance in 610.14F.</td>
<td></td>
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</table>

Statement of Problem and Substantiation for Public Comment

Multiplying continuous loads by the 2.25 factor allows for ease of utilizing Table 610.14(A) which is for use with short-time rated crane and hoist motors to also be used for continuous loads on cranes. This is also in alignment with what the industry is doing based on CMAA (Crane Manufacturer’s Association of America) interpretation of this section of the Code.

The resubmitted public comment includes CMAA submitted substantiation showing that this 2.25 multiplier is a reliable substitution in order to use Table 610.14(A) for continuous use conductors instead of NEC 310.16.

Related Item

Public Input No. 3848-NFPA 70-2014 [Section No. 610.14(F)]

Submitter Information Verification

Submitter Full Name: Jody Greenwood
Organization: Navy Crane Center
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 14:39:08 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The suggested revision does not add any clarity to the code. It still refers the reader to the appropriate sections of the code. The CMAA's use of a single multiplier of 2.25 as a simplified approach to utilize the short time rated ampacity table for the continuous duty loads should not negate the use of the appropriate sections of the code for continuous duty loads.
620.1 Scope.
This article covers the installation of electrical equipment and wiring used in connection with elevators, dumbwaiters, escalators, moving walks, platform lifts, and stairway chairlifts.

Informational Note No. 1: For further information, see ASME A17.1-2013 /CSA B44-13, Safety Code for Elevators and Escalators.

Informational Note No. 2: For further information, see CSA B44.1-14 /ASME-A17.5-2014, Elevator and Escalator Electrical Equipment Certification Standard.

Informational Note No. 3: The term wheelchair lift has been changed to platform lift. For further information, see ASME A18.1-2008 2014, Safety Standard for Platform Lifts and Stairway Lifts, Chairlifts.

Statement of Problem and Substantiation for Public Comment

Referenced current standard names and editions.

Related Public Comments for This Document

<table>
<thead>
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<td>Public Comment No. 39-NFPA 70-2015 [Section No. 110.31]</td>
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<td>Public Comment No. 40-NFPA 70-2015 [Section No. 225.61]</td>
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<td>Public Comment No. 41-NFPA 70-2015 [Section No. 399.10]</td>
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<td>Public Comment No. 42-NFPA 70-2015 [Section No. Table]</td>
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<td>Public Comment No. 43-NFPA 70-2015 [Section No. B.310.15(B)(2)]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
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<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]</td>
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<td>Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]</td>
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<td>Public Comment No. 53-NFPA 70-2015 [Section No. 840.44(C)]</td>
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<td>Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]</td>
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<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<tr>
<td>Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]</td>
<td>Referenced correct SDO name, standard name, number, and edition.</td>
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Public Comment No. 92-NFPA 70-2015 [Section No. 110.28] Referenced correct SDO name, standard name, number, and edition.


Public Comment No. 101-NFPA 70-2015 [Section No. 690.7] Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)] Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)] Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 111-NFPA 70-2015 [Section No. 505.2] Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 112-NFPA 70-2015 [Section No. 505.5] Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]] Referenced correct SDO name, standard name, number, and edition.

Related Item

Public Input No. 3908-NFPA 70-2014 [Section No. 620.1] Referenced correct SDO name, standard name, number, and edition.

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 01 01:31:37 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3327-NFPA 70-2015
Statement: This change updates the referenced standards to the latest editions.
(B) Guards.

Live parts of the electrical equipment are suitably guarded to the requirements of 110.27(A), isolated, or insulated, so as to remove the likelihood of inadvertent contact between a qualified person in the working space and live voltage greater than 30 volts rms, 42 volts peak, or 60 volts dc and the equipment can be examined, adjusted, serviced, or maintained while energized without removal of this protection.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that this First Revision be rewritten to provide additional clarity and usability.

Related Item

First Revision No. 3328-NFPA 70-2015 [Section No. 620.5(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 10:26:43 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3328-NFPA 70-2015
Statement: The submitter of the Public Input No. 2885 wanted to reference 110.27(A) to help clarify the term “suitable guarded”. Referencing 110.27(A) does not accomplish that intent.

Section 110.27(A) addresses Live Parts Guarded Against Accidental Contact and providing isolation by location, partitions or screens, and elevation NOT isolated, or insulated for working clearances as addressed in 620.5(B). The removal of “to the requirements of 110.27(A)” eliminates the conflict.

Also, the removal of “so as”, “between a qualified person in the working space and” and the addition of “with”, “parts operating at” and the “s” after voltage provide additional clarity and usability per the request of the Correlating Committee.
The insulation of conductors shall comply with 620.11(A) through (D).

Informational Note: One method of determining that the insulation of conductors is flame retardant is by testing the conductors or cables to the VW-1 (Vertical-Wire) Flame Test in ANSI/UL 1581-2011, Reference Standard for Electrical Wires, Cables, and Flexible Cords.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 3330. The Correlating Committee directs Panel 12 clarify the use of the phrase "for that purpose."

Related Item
First Revision No. 3330-NFPA 70-2015 [Section No. 620.11(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 10:41:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3329-NFPA 70-2015
Statement: Replaces the phrase "for that purpose" with language to provide better clarity. The first sentence is retained as its deletion would increase the scope of the requirement
Statement of Problem and Substantiation for Public Comment

The public deserves to have equipment that will provide reasonable operation for both safety and comfort. Where manufacturers are now worldwide it is important for safe and proper operation that conductors be sized properly to provide voltage within a standard operating range. When determined by the manufacturer, many offshore manufacturers have very low standards and would not require consideration for voltage minimums. The time has come to elevate this issue parallel to it’s real importance.

Related Item

Public Input No. 4328-NFPA 70-2014 [New Section after 620.13(A)]

Submitter Information Verification

Submitter Full Name: TRAVIS LINDSEY
Organization: TLC SERVICES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 11:05:45 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: NEC section 110.3 addresses installation and use of equipment and 110.4 states that the voltage considered shall be that at which the circuit operates. The NEC is not a design document.
(A) Conductors Supplying Single Motor.

Conductors supplying a single motor shall have an ampacity not less than the percentage of motor nameplate current determined from 430.22(A) and (E).

Informational Note: Some elevator motor currents, or those motor currents of similar function, exceed the motor nameplate value. Heating of the motor and conductors is dependent on the root-mean-square (rms) current value and the length of operation time. Because this motor application is inherently intermittent duty, conductors are sized for duty cycle service as shown in Table 430.22(E).

(B) Voltage Regulation.

If a voltage range is provided by the equipment manufacturer, feeder and branch circuit conductors shall be sized to provide voltage at the equipment within the range that is required by the manufacturer. In addition, feeder and branch-circuit conductors shall be sized so the voltage at the end of the feeder conductor is not lower than 97% of that at the service or source and for branch circuits, not lower than 95% of the voltage at the service or source at the furthest outlet. Calculations shall be based on circuit loading at 80 percent of the rating of the overcurrent device.

Statement of Problem and Substantiation for Public Comment

It is important for safe and proper operation that conductors be sized properly to provide voltage within the operating range as determined by the manufacturer. It is very common for feeder conductors for elevators, escalators, and similar equipment to be lengthy so it is important that the conductors be sized properly so the electrical systems will perform safely.

Related Item

Public Input No. 4328-NFPA 70-2014 [New Section after 620.13(A)]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 17:52:05 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: NEC section 110.3 addresses installation and use of equipment and 110.4 states that the voltage considered shall be that at which the circuit operates (under load). The addition of this new section is redundant.
(A) Marking.

Where an elevator control panel is utilized, it shall be marked with its short-circuit current rating, based on one of the following:

(1) Short-circuit current rating of a listed assembly
(2) Short-circuit current rating established utilizing an approved method

Informational Note: UL 508A-2013, Supplement SB, is an example of an approved method.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to reconsider the use of the word "utilized.

Related Item

Public Input No. 1-NFPA 70-2013 [Section No. 310.15(B)(3)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 11:11:22 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3330-NFPA 70-2015
Statement: The revised text in (A) replaces "utilized" with "installed" which is the correct term. The revised text in (B) rearranges the sentence for clarity and consistency with a similar requirement in 409.22.
<table>
<thead>
<tr>
<th>Sections 620.16(A), 620.16(B)</th>
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<tbody>
<tr>
<td>(A) Marking.</td>
</tr>
<tr>
<td>(1) Short-circuit current rating of a listed assembly</td>
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<tr>
<td>Informational Note: UL 508A-2013, Supplement SB, is an example of an approved method.</td>
</tr>
<tr>
<td>(B) Installation.</td>
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**Statement of Problem and Substantiation for Public Comment**

The revised text in (A) replaces "utilized" with "installed" which is the correct term. The revised text in (B) rearranges the sentence for clarity and consistency with a similar requirement in 409.22.

**Related Item**

First Revision No. 3331-NFPA 70-2015 [New Section after 620.15]

**Submitter Information Verification**

<table>
<thead>
<tr>
<th>Submitter Full Name:</th>
<th>John Kovacik</th>
</tr>
</thead>
<tbody>
<tr>
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<td>UL LLC</td>
</tr>
<tr>
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<th>Rejected but see related SR</th>
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<tr>
<td>Resolution:</td>
<td>SR-3330-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement:</td>
<td>The revised text in (A) replaces &quot;utilized&quot; with &quot;installed&quot; which is the correct term. The revised text in (B) rearranges the sentence for clarity and consistency with a similar requirement in 409.22.</td>
</tr>
</tbody>
</table>
620.22 Branch Circuits for Car Lighting, Receptacle(s), Ventilation, Heating, and Air-Conditioning.

(A) Car Light Source.
An individual branch circuit shall supply the car lights, receptacle(s), auxiliary lighting power source, and ventilation on each elevator car. The overcurrent device protecting the branch circuit shall be located in the elevator machine room or control room/machinery space or control space.
Required lighting shall not be connected to the load side of a ground-fault circuit interrupter.

(B) Air-Conditioning and Heating Source.
An individual branch circuit shall supply the air-conditioning and heating units on each elevator car. The overcurrent device protecting the branch circuit shall be located in the elevator machine room or control room/machinery space or control space.

Statement of Problem and Substantiation for Public Comment

The point is, these two sections use a term "A separate branch circuit" is not defined in Article 100, or in Article 620 for that matter. So, this phrase is subject to varying interpretations.
The term "individual" is defined in Article 100 and should be used.

Related Item
Public Input No. 3707-NFPA 70-2014 [Sections 620.22(A), 620.22(B)]

Submitter Information Verification
Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 18:00:05 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: "Individual branch circuit" is defined in the NEC in Article 100: Branch Circuit, Individual. A branch circuit that supplies only one utilization equipment. The term "separate" is common language and does not require an NEC definition.
620.23 Branch Circuits for Machine Room or Control Room/Machinery Space or Control Space Lighting and Receptacle(s).

(A) Separate Branch Circuit.
Separate branch circuit(s) shall supply the machine room or control room/machinery space or control space lighting and receptacle(s).
Required lighting shall not be connected to the load side of a ground-fault circuit interrupter.

(B) Lighting Switch.
The machine room or control room/machinery space or control space lighting switch shall be located at the point of entry.

(C) Duplex Receptacle.
At least one 125-volt, single-phase, 15- or 20-ampere duplex receptacle shall be provided in each machine room or control room and machinery space or control space.

Informational Note: See ASME A17.1-2010/CSA B44-10, Safety Code for Elevators and Escalators, for illumination levels.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 3386.

Related Item
First Revision No. 3386-NFPA 70-2015 [Section No. 620.23(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 10:45:29 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3331-NFPA 70-2015
Statement: Panel 12 has changed the title of section 620.23(A) plural and relocated "the lighting and receptacle(s)" to add clarity to the rule and to clarify the intent of FR 3386 per the request of the Correlating Committee. The Panel action also updates the referenced standards to the most recent edition.
Public Comment No. 1260-NFPA 70-2015 [Section No. 620.23(A)]

(A)  

Separate Branch Circuit Circuits.  

Separate  

The branch circuit(s) shall supply  
supplying the  

machine room or control room/machinery space or control space lighting and  

lighting of any machine rooms, control rooms, machinery spaces, or control spaces shall be separate  

from the branch circuit(s) supplying the receptacle(s)  

Required lighting shall not be connected to the load side of a ground-fault circuit interrupter  
in those places. All these circuits shall supply no other loads.  

Statement of Problem and Substantiation for Public Comment

Revise the text as recommended by Scott Cline in his affirmative ballot comment as follows:
The FR wording is an improvement, but the Title needs to have “Circuit” made plural, AND I think it still does not solve the problem of ambiguity. It could  

still be interpreted correctly but unintentionally that one circuit could supply both lighting and receptacles, just as long as it was a circuit  

separate from all  

lighting and receptacles outside the listed places.  

Related Item  

First Revision No. 3386-NFPA 70-2015 [Section No. 620.23(A)]

Submitter Information Verification

Submitter Full Name: John Kovacik  
Organization: UL LLC  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu Sep 24 17:01:04 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR  
Resolution: SR-3331-NFPA 70-2015  
Statement: Panel 12 has changed the title of section 620.23(A) plural and relocated “the lighting and receptacle(s)” to add clarity to the rule and to clarify the intent of FR 3386 per the request of the Correlating Committee. The Panel action also updates the referenced standards to the most recent edition.
Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]

(C) Duplex Receptacle.
At least one 125-volt, single-phase, 15- or 20-ampere duplex receptacle shall be provided in each machine room or control room and machinery space or control space.

Informational Note: See ASME A17.1-2013/CSA B44-10, Safety Code for Elevators and Escalators, for illumination levels.

Statement of Problem and Substantiation for Public Comment


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Related Item
First Revision No. 3388-NFPA 70-2015 [Section No. 620.24(C)]

Submitter Information Verification
Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jun 25 19:18:32 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3331-NFPA 70-2015
Statement: Panel 12 has changed the title of section 620.23(A) plural and relocated “the lighting and receptacle(s)” to add clarity to the rule and to clarify the intent of FR 3386 per the request of the Correlating Committee. The Panel action also updates the referenced standards to the most recent edition.
620.24 Branch Circuit for Hoistway Pit Lighting and Receptacle(s).

(A) Separate Branch Circuit.
Separate branch circuit(s) shall supply the hoistway pit lighting and receptacle(s).
Required lighting shall not be connected to the load side of a ground-fault circuit interrupter.

(B) Lighting Switch.
The lighting switch shall be so located as to be readily accessible from the pit access door.

(C) Duplex Receptacle.
At least one 125-volt, single-phase, 15- or 20-ampere duplex receptacle shall be provided in the hoistway pit.

Informational Note No. 1: See ASME A17.1-2010/CSA B44-10, Safety Code for Elevators and Escalators, for illumination levels.

Informational Note No. 2: See 620.85 for ground-fault circuit-interrupter requirements.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 3387.

Related Item
First Revision No. 3387-NFPA 70-2015 [Section No. 620.24(A)]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 10:46:34 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3332-NFPA 70-2015
Statement: This change complies with the request of the Correlating Committee to clarify the intent of First Revision No. 3387. This rule requires at least two circuits, and so the parenthetic (s) in "circuit(s)" is incorrect. This change also updates the referenced standards to the most recent edition.
Public Comment No. 1264-NFPA 70-2015 [Section No. 620.24(A)]

(A) Separate Branch Circuit

Circuit(s) shall supply the hoistway pit lighting and receptacle(s).

Required lighting shall not be connected to the load side of a ground-fault circuit interrupter.

Statement of Problem and Substantiation for Public Comment

Revise text as recommended by Scott Cline in his affirmative ballot comment as follows:
This rule requires at least two circuits, and so the parenthetic (s) in circuit(s) is incorrect.

Related Item
First Revision No. 3387-NFPA 70-2015 [Section No. 620.24(A)]

Submitter Information Verification

Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 17:17:45 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3332-NFPA 70-2015
Statement: This change complies with the request of the Correlating Committee to clarify the intent of First Revision No. 3387. This rule requires at least two circuits, and so the parenthetic (s) in "circuit(s)" is incorrect. This change also updates the referenced standards to the most recent edition.
Duplex Receptacle.
At least one 125-volt, single-phase, 15- or 20-ampere duplex receptacle shall be provided in the hoistway pit.

Informational Note No. 1: See ASME A17.1-2010 and CSA B44-13, Safety Code for Elevators and Escalators, for illumination levels.

Informational Note No. 2: See 620.85 for ground-fault circuit-interrupter requirements.

Statement of Problem and Substantiation for Public Comment
Referenced current edition of ASME A17.1 in informational note #1.

Related Public Comments for This Document

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Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]

Related Item
First Revision No. 3388-NFPA 70-2015 [Section No. 620.24(C)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 19:26:58 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3332-NFPA 70-2015
Statement: This change complies with the request of the Correlating Committee to clarify the intent of First Revision No. 3387. This rule requires at least two circuits, and so the parenthetic (s) in "circuit(s)" is incorrect. This change also updates the referenced standards to the most recent edition.
(A) Type.

The disconnecting means shall be an enclosed externally operable fused motor circuit switch or circuit breaker that is lockable open in accordance with 110.25.

The disconnecting means shall be a listed device.

Informational Note: For additional information, see ASME A17.1-2013/CSA B44-13, Safety Code for Elevators and Escalators.

Exception No. 1: Where an individual branch circuit supplies a platform lift, the disconnecting means required by 620.51(C)(4) shall be permitted to comply with 430.109(C). This disconnecting means shall be listed and shall be lockable open in accordance with 110.25.

Exception No. 2: Where an individual branch circuit supplies a stairway chairlift, the stairway chairlift shall be permitted to be cord-and-plug-connected, provided it complies with 422.16(A) and the cord does not exceed 1.8 m (6 ft) in length.

Statement of Problem and Substantiation for Public Comment

In the information note referenced current edition of ASME A17.1/CSA B44.

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Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]
Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]
Public Comment No. 111-NFPA 70-2015 [Section No. 505.2]
Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]
Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]

Related Item
First Revision No. 3388-NFPA 70-2015 [Section No. 620.24(C)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 19:51:27 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3333-NFPA 70-2015
Statement: Updated to latest reference standard names and editions.
(2) Available Short-Circuit Current Field Marking.
Where an elevator control panel is used, it shall be legibly marked in the field with the maximum available short-circuit current. The field marking(s) shall include the date the short-circuit current calculation was performed and be of sufficient durability to withstand the environment involved.

When modifications to the electrical installation occur that affect the maximum available short-circuit current at the elevator control panel, the maximum available short-circuit current shall be verified or recalculated as necessary to ensure the elevator control panel’s short-circuit current rating is sufficient for the maximum available short-circuit current at the line terminals of the equipment. The required field marking(s) shall be adjusted to reflect the new level of maximum available short-circuit current.

Statement of Problem and Substantiation for Public Comment

IEC’s position is to delete 620.51(D)(2) - (FR 3393)

The code already requires that equipment be installed according to available fault current, so adding this requirement is redundant. The installer/supplier already has the responsibility/liability to install the proper equipment based on the characteristics of the system. This proposal puts too much liability on the contractor/supplier because after installation various factors can change which will affect the available fault current. Feeders can be reworked, transformers can be changed with different impedance values, motor loads can be added to the existing system and similar factors that can change the available fault current. In the case of a lawsuit, the installer will have the burden of proof that the installation was done according to code and would result in unnecessary costs for defending an installation that was installed correctly, but that had variables change that are out of their control. A better proposal would be to require the owner to relabel the equipment after any alteration to the system.

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<td>Public Comment No. 754-NFPA 70-2015 [Section No. 440.10(B)]</td>
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Related Item
First Revision No. 3393-NFPA 70-2015 [Section No. 620.51(D)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 18 20:29:55 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The committee reaffirms that marking of the available short-circuit current and its date of calculation will increase safety. It will create safer installations by adding language to assist the installer and the Authority Having Jurisdiction (AHJ).
Surge Protection.

Where any of the disconnecting means in 620.51 has been designated as supplying an emergency or a standby system load, surge protection shall be provided.

Informational note: See 700.8 for surge protection required for emergency systems.

Statement of Problem and Substantiation for Public Comment

In accordance with section 620.91 elevators can be powered by an emergency or standby system. Section 700.8 has the requirement for surge protection for emergency systems; however, there is no requirement for surge protection in Article 701 for legally required standby systems nor is the requirement in Article 702 for optional standby systems. The proposed reworded text provides clarity.

Related Item

First Revision No. 3395-NFPA 70-2015 [New Section after 620.51(D)]

Submitter Information Verification

Submitter Full Name: ROBERT JONES
Organization: IEC Texas Gulf Coast
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 18:31:20 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The intent of First Revision No. 3395 was to provide a requirement for surge protection on elevator disconnects for systems that are designated as emergency loads. This aligns with 700.8, requiring surge suppression on emergency system switchboards and panelboards, but not on legally required standby system and optional standby system switchboards and panelboards.
An elevator(s) shall be permitted to be powered by an emergency or standby power system.

Informational Note: See ASME A17.1-2010 /CSA B44-10, Safety Code for Elevators and Escalators, 2.27.2, for additional information.

Statement of Problem and Substantiation for Public Comment

Referenced current edition of ASME A17.1/CSA B44 in the informational note.

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<td>Public Comment No. 42-NFPA 70-2015 [Section No. Table]</td>
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<td>Public Comment No. 43-NFPA 70-2015 [Section No. B.310.15(B)(2)]</td>
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<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
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<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
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<td>Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 53-NFPA 70-2015 [Section No. 840.44(B)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
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<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
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<td>Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]</td>
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<td>Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]</td>
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<td>Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]</td>
<td>Referenced current SDO standard name, and edition.</td>
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First Revision No. 3388-NFPA 70-2015 [Section No. 620.24(C)]

<table>
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<tr>
<td><strong>Submitter Full Name:</strong> Aaron Adamczyk</td>
</tr>
<tr>
<td><strong>Organization:</strong> [ Not Specified ]</td>
</tr>
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<td><strong>City:</strong></td>
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<td><strong>State:</strong></td>
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<th>Committee Statement</th>
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<tr>
<td><strong>Committee Action:</strong> Accepted</td>
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<tr>
<td><strong>Resolution:</strong> SR-3335-NFPA 70-2015</td>
</tr>
<tr>
<td><strong>Statement:</strong> This Panel action updates the informational note to reference the latest standard names and editions.</td>
</tr>
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</table>
625.1 Scope.

This article covers the electrical conductors and equipment external to an electric vehicle that connect an electric vehicle to a supply of electricity by conductive, inductive, or wireless power transfer (contactless inductive charging) means, and the installation of equipment and devices related to electric vehicle charging.

Informational Note No. 1: For industrial trucks, see NFPA 505-2013, Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation.

Informational Note No. 2: UL 2594-2013, Standard for Electric Vehicle Supply Equipment, is a safety standard for conductive electric vehicle supply equipment. UL 2202-2009, Standard for Electric Vehicle Charging System Equipment, is a safety standard for conductive electric vehicle charging equipment.

Informational Note No. 3: UL 2750, Wireless Charging Equipment for Electric Vehicles.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to provide further explanatory text in Informational Note 3.

Related Item

First Revision No. 3359-NFPA 70-2015 [Section No. 625.1]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 10:47:58 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3338-NFPA 70-2015
Statement: The Panel made revisions to clarify the informational note as directed by the Correlating Committee. Informational Note No. 3 should be excluded from final draft if document has not been published at that time.
Portable (as applied to EVSE):

An EVSE intended for indoor or outdoor use that can be carried from charging location to location and is transported in the vehicle when not in use. This type of cord set will be subject to changing environmental conditions.

Statement of Problem and Substantiation for Public Comment

The revisions qualify this definition of portable as applying only to EVSE as there are other definitions for portable in the Code. The last sentence is deleted as it is unclear what is meant by “This type of cord set.....”

Related Item

First Revision No. 3410-NFPA 70-2015 [New Definition after Definition: Plug-In Hybrid Electric Ve...]

Submitter Information Verification

Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 18:01:15 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3339-NFPA 70-2015
Statement: This revision clarifies this definition of portable as applying only to EVSE as there are other definitions for portable in the Code. The last sentence was deleted as it does not relate to portability.
**Public Comment No. 1462-NFPA 70-2015 [ Definition: Portable. ]**

<table>
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<td>An EVSE intended for indoor or outdoor use that can be carried from charging location to location and is transported in the vehicle when not in use. This type of cord set will device may be subject to changing environmental conditions.</td>
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</table>

**Statement of Problem and Substantiation for Public Comment**

Not all portable EVSE are cord sets. Changing "will" to "may" improves the clarity of the proposal as the environmental conditions for portable EVSE may not always change.

**Related Item**

First Revision No. 3410-NFPA 70-2015 [New Definition after Definition: Plug-In Hybrid Electric Ve...]

**Submitter Information Verification**

<table>
<thead>
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<th>Name: GREGORY C NIEMINSKI</th>
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<tbody>
<tr>
<td>Organization: EPRI</td>
</tr>
<tr>
<td>Affiliation: EPRI National Electric Transportation Infrastructure Working Council's NEC Task Force</td>
</tr>
<tr>
<td>Street Address:</td>
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<tr>
<td>City:</td>
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**Committee Statement**

| Committee Action: Rejected but see related SR |
|----------------|----------------|
| Resolution: SR-3339-NFPA 70-2015 |
| Statement: This revision clarifies this definition of portable as applying only to EVSE as there are other definitions for portable in the Code. The last sentence was deleted as it does not relate to portability. |
**Public Comment No. 1833-NFPA 70-2015 [Definition: Portable.]**

**625.2 Portable.**
An EVSE intended for indoor or outdoor use that can be carried from charging location to location and is transported in the vehicle when not in use. This type of cord set will be subject to changing environmental conditions.

**Statement of Problem and Substantiation for Public Comment**

The Correlating Committee notes that there are proposed definitions for "portable" in 625.2 and "portable equipment" in Article 100. The Correlating Committee directs Panel 12 to review both proposed definitions. The Correlating Committee also directs the panel to consider the context of the use of the word "portable" throughout Article 625.

**Related Item**

First Revision No. 3360-NFPA 70-2015 [New Definition after Definition: Electric Vehicle Supply Eq...]

**Submitter Information Verification**

Submitter Full Name: CC on NEC-AAC  
Organization: NFPA  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Tue Sep 29 10:49:12 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR  
Resolution: SR-3339-NFPA 70-2015  
Statement: This revision clarifies this definition of portable as applying only to EVSE as there are other definitions for portable in the Code. The last sentence was deleted as it does not relate to portability.
Wireless Power Transfer Equipment (WPTE).

Equipment consisting of a charger power converter and a primary pad. The two devices are either of the following:

- Interconnected by an output cable or suitable conduit system
- Contained within a single enclosure without an output cable or other suitable wiring means

Statement of Problem and Substantiation for Public Comment

The deleted text simplifies and clarifies the definition. The mention of a cable in wireless power transfer equipment seems confusing. Also, it is not clear what is meant by "suitable conduit system" and "suitable wiring means."

Related Item

First Revision No. 3413-NFPA 70-2015 [New Definition after Definition: Rechargeable Energy Storag...]

Submitter Information Verification

Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 18:20:08 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3340-NFPA 70-2015
Statement: The deleted text simplifies and clarifies the definition. The modified text completely defines the equipment.
Public Comment No. 1455-NFPA 70-2015 [Definitions (625.2): Fastened in... to Fixed in Pl...]

Definitions (625.2): Fastened in... to Fixed in Pl...

**Fastened in Place.**

Mounting means of an EVSE in which the fastening means are specifically designed to permit periodic removal for relocation, interchangeability, maintenance, or repair without the use of a tool.

**Fixed in Place.**

Mounting means of an EVSE permanently attached to a wall, surface or surface mounting means with fasteners that require a tool to be removed remove the EVSE.

Statement of Problem and Substantiation for Public Comment

In the original wording it is not clear if the “mounting means” or the “EVSE” is intended to be either “Fastened in Place” or “Fixed in Place”.

The wording could imply that if the mounting means was the part that was fixed in place using fasteners and a tool, the assembly would be considered “fixed in place”. Yet, the EVSE could be simply hung on the mounting means for ease of removal or relocation so it would not actually be fixed in place.

The suggested change clarifies that it is the EVSE, not the mounting means, which is either “fastened in place” to permit relocation, etc. or “fixed in place”.

Related Item

First Revision No. 3360-NFPA 70-2015 [New Definition after Definition: Electric Vehicle Supply Eq...]

Submitter Information Verification

Submitter Full Name: GREGORY C NIEMINSKI
Organization: EPRI
Affiliation: EPRI National Electric Transportation Infrastructure Working Council’s NEC Task Force

Committee Statement

Committee Action: Rejected
Resolution: The proposed changes do not add clarity to the definition.
Public Comment No. 984-NFPA 70-2015 [Section No. 625.5]

625.5.6 Listed and Labeled. EVSE or WPTE shall be listed and labeled.

Additional Proposed Changes

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<tr>
<th>File Name</th>
<th>Description</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL's have similar requirements.

The .6 section of this Article is not used, the committee statement that “The numbering was not changed due to the impact on manufacturer’s documentation” is not in conformance with 2.4.1 of the NEC style manual. This will make the NEC more user friendly by following an already established pattern that the .6 section of an article is typically associated with listing requirements such as 324.6, 334.6, 340.6, 342.6, 410.6 etc...

Related Item
Public Input No. 4627-NFPA 70-2014 [Section No. 625.5]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3341-NFPA 70-2015
Statement: The Panel reaffirms that First Revision No. 3365 intended to add "and labeled" in the body of the text. Additionally, "and Labeled" is added to the section title, and it is renumbered to 625.6 for consistency throughout the Code.
625.16 Means of Coupling

The means of coupling to the electric vehicle shall be conductive, inductive, or wireless power transfer. Attachment plugs, electric vehicle connectors, and electric vehicle inlets shall be listed or labeled for the purpose.

Additional Proposed Changes

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<td>FFVI2_Guide_Information.pdf</td>
<td>Guide Information for EV Connectors and Inlets</td>
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Statement of Problem and Substantiation for Public Comment

Based on the committee statement, "labeled would not be practically enforceable," this would also apply to the term listed since this section permits for the option of either listed or labeled. Therefore, the entire second sentence should be deleted. NEC Section 625.5 already requires that all electrical materials, devices, fittings, and associated equipment shall be listed. 625.2 defines an EV coupler as being the mating of the EV inlet and the EV connector. The definition of EV inlet and EV connector identifies both products as a device.

Therefore, the last sentence of Section 625.16 is redundant and actually creates a conflict as EV connectors and inlets are not listed, but only recognized components that are intended for use as components of listed equipment. Electric Vehicle Plugs, Receptacles, Couplers and Inlets are covered by UL Product Category FFVI2 which states that the devices covered under this category are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field.

Related Item

Public Input No. 927-NFPA 70-2014 [Section No. 625.16]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 04 18:12:53 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3342-NFPA 70-2015
Statement: Listing and labeling is covered by 625.5 (new 625.6 per Second Revision No. 3341) and does not need to be repeated here.
(A) Power-Supply Cord.

The cable for cord-connected equipment shall comply with all of the following:

1. Be any of the types specified in 625.17(B) or hard service cord, junior hard service cord, or portable power cable types in accordance with Table 400.4. Hard service cord, junior hard service cord, or portable power cable types shall be listed, as applicable, for exposure to oil and damp and wet locations.

2. Have an ampacity as specified in Table 400.5(A)(1) or, for 8 AWG and larger, in the 60°C columns of Table 400.5(A)(2).

3. Have an overall length as specified in 625.17(A)(3)a. or b as follows:

4. When the interrupting device of the personnel protection system specified in 625.22 is located within the enclosure of the supply equipment or charging system, the power-supply cord shall be not more than

   - 300 mm
   - 915 mm (36 in.)

5. When the interrupting device of the personnel protection system specified in 625.22 is located at the attachment plug, or within the first 300 mm (12 in.) of the power-supply cord, the overall cord length shall be a minimum of 1.8 m (6 ft) and shall be not greater than 4.6 m (15 ft).

Statement of Problem and Substantiation for Public Comment

300mm (12 in.) power cord is too short for most installations where the EVSE is wall mounted in a typical garage and studs are spaced at the standard 16 in. (and some are 24 in.) apart. Mounting an EVSE equipped with a power cord and plug to the wall and installing a power outlet at the next closest stud would require more than a 12 in. cord length for all practical purposes.

This proposal is for stationary (as opposed to portable) EVSEs. The concern with "protecting" a length of cord longer than 12 in. minimized as the EVSE enclosure is expected to be fastened in place at a height of not less than 18 in. off the floor (Article 625.50). We propose allowing a longer cord (36 in.) and yet not so long that it would touch the floor or be subjected to snagging thus increasing the risk of damage.

Related Item

Public Input No. 1038-NFPA 70-2014 [Section No. 625.17(A)]

Submitter Information Verification

Submitter Full Name: SEAN LUI
Organization: TESLA MOTORS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 14:51:50 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Relaxing protection requirements does not add to practicality of installation and could increase the risk to the end user.
Output Cable.

The output cable to the electric vehicle shall be one of the following:

(1) Output Cable to the Primary Pad.

If used, the output cable to the primary pad shall be Type EV, EVE, or EVT flexible cable as specified in Table 400.4. The output cable shall have an ampacity as specified in Table 400.5(A)(1) or, for 8 AWG and larger, in the 60°C columns of Table 400.5(A)(2).

(2) Output Cable to the Primary Pad.

Exception to (B)(1): Listed electric vehicle supply equipment may incorporate output cables having ampacities greater than those in Table 400.5(A)(2).

Exception to (B)(2): An approved wiring system may be permitted in place of the output cable to the primary pad. [See 625.102(E)].

based on the permissible temperature limits for the components and the cable.

Statement of Problem and Substantiation for Public Comment

Removal of reference to Table 400.5(A)(1) in the 2014 code was a correct step toward moving away from using the NEC as an end product safety standard which was never intended. The only types of cable allowed on the output of an EVSE are those mentioned in 625.17(B)(1) above, namely EV cables per UL 62, and none of those cables are called out by Table 400.5(A)(1) and in fact EV cables did not exist until recently. It is also interesting that 625.17(B)(1) does not specify which column of Table 400.5(A)(1). For some reason, the center column seem to be the default but there is nothing preventing the third column from being used which also allows higher currents to be used. Similarly, it is difficult to understand the technical reason for the reference to Table 400.5(A)(2) for cables 8 AWG and larger. EV cables are designed for their intended purpose and all EV types are available up to 105°C. It has been argued that without the reference to these tables there would be no guidance but Article 400.5(A) clearly states “These tables shall be used in conjunction with applicable end-use product standards to ensure selection of the proper size and type.” When Article 625 was written there were no end product standards for EVSE but now we have ANSI tri-national UL 2594 for guidance for the end products as well as UL 2202. There is no evidence to suggest that manufacturers and third party test labs are not competent to select and properly evaluate appropriate conductor sizes with proper temperature ratings for safe and reliable end product service. All products from our company were tested at 32 A using 10 AWG EV cables and all passed with sizeable margin. Using the NEC as an end product...
standard tends to slow development of affordable and safe EVSE products for this emerging market by applying requirements that
were not written to cover these EVSE products

**Related Item**

First Revision No. 3369-NFPA 70-2015 [Section No. 625.17(B)]

### Submitter Information Verification

<table>
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<tr>
<th>Submitter Full Name</th>
<th>CRAIG RODINE</th>
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<tbody>
<tr>
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<td>CHARGEPOINT INC</td>
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<tr>
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### Committee Statement

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<tr>
<td>Resolution</td>
<td>Panel 12 reaffirms that the ampacity tables are necessary to maintain requirements on the output cable of the EVSE and that the exceptions reduce the level of safety.</td>
</tr>
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</table>
(1) Output Cable to the Electric Vehicle.

The output cable to the electric vehicle shall be Type EV, EVJ, EVE, EVJE, EVT, or EVJT flexible cable as specified in Table 400.4. The output cable shall have an ampacity as specified in Table 400.5(A)(1) or, for 8 AWG and larger, in the 60°C columns of Table 400.5(A)(2).

Exception to (B)(1): Listed electric vehicle supply equipment may incorporate output cables having ampacities greater than the ampacities in the 60°C columns of Table 400.5(A)(2) based on the permissible temperature limits for the components and the cable.

Statement of Problem and Substantiation for Public Comment

The proposed change effectively restores the exception in 625.17(B) of the 2014 NEC that allows output cable Ampacity to, in some cases, be higher than the value designated in the referenced tables. The proposed new exception requires that products using the exception be Listed, which will insure that such products perform within the rated temperature ratings of the components and with allowable touch temperatures.

Forcing wire gauges to be selected from a table will stifle innovation and the growth of the market for plug-in electric vehicles. Products should be evaluated based on objective metrics of actual operation of the product, not limited by a value in a table. 32 Amp EVSEs with 10AWG output cables have been successfully used for a long time, and at least two listed 32A EVSEs with 10AWG output cables are on the market now. FR3369 as written would not allow these products.

There is also a push for higher and higher charging power. Innovation will be required in order to accommodate higher currents with manageable cable sizes. For example, one auto manufacturer has deployed liquid-cooled output cables.

Related Item

First Revision No. 3369-NFPA 70-2015 [Section No. 625.17(B)]

Submitter Information Verification

Submitter Full Name: Alec Brooks
Organization: AeroVironment
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 16:55:48 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Panel 12 reaffirms that the ampacity tables are necessary to maintain requirements on the output cable of the EVSE and that the exceptions reduce the level of safety.
(1) Output Cable to the Electric Vehicle.

The output cable to the electric vehicle shall be Type EV, EVJ, EVE, EVJE, EVT, or EVJT flexible cable as specified in Table 400.4. The output cable shall have an ampacity as specified in Table 400.5(A)(1) or, for 8 AWG and larger, in the 60°C columns of Table 400.5(A)(2).

Exception to (B)(1): Listed electric vehicle supply equipment may incorporate output cables having ampacities greater than the ampacities in the 60°C columns of Table 400.5(A)(2) based on the permissible temperature limits for the components and the cable.

Statement of Problem and Substantiation for Public Comment

This "Code is not intended as a design specification..." (NEC Article 90.1(A)).

Section 625.17(B)(1), as written, does not allow improvements nor innovation on cable technologies used for delivering power to EVs. The NEC referenced table(s) prescribes conductor sizes based on materials and geometry rather than the actual temperature of the conductors which is the primary driver for conductor sizing. Any new developments in insulation or conductor materials, cooling technology, etc. enabling a cable to be lighter, more flexible, and easier to use would not be allowed because such cable is not covered in the existing cited Table(s). This seriously hampers progress in this growing industry and goes directly against the original intent of the Code for not being a "design spec" used to dictate how products should be created.

This proposal basically restores the exception in 625.17(B) of the 2014 NEC which allows Listed EVSEs output cable ampacity to be higher (in some cases) than the value designated in the referenced tables. Listed EVSE products are required to go through extensive testing which includes, but not limited to verifying that the device actually performs within the rated temperature ratings of the components and within allowable safe surface touch temperatures. Product specific safety standards (e.g. UL 2594) provide comprehensive requirements aimed at addressing potential hazards to a specific class of products. This type of documents are much better suited at providing safety design requirements than the NEC which has a much broader scope ("the practical safeguarding of persons and property from hazards arising from the use of electricity. (Article 90.1(A)).

With the market demand for ever longer range EVs, the need to provide faster charging requires the development of higher power charging stations. Forcing the use of certain size and type of cables precludes the innovation required to develop cables that can accommodate higher currents within a manageable/useable size. One example is the use of liquid-cooled cables which minimizes the amount of copper necessary to carry the same amount of current as a conventional cable at the same temperature. Without the proposed exception to Article 625.17(B), such cable would never be allowed to be used with an EVSE because the cited Table dictates the conductor size based on current alone without regard to other critical performance parameters.

Related Item

First Revision No. 3369-NFPA 70-2015 [Section No. 625.17(B)]

Submitter Information Verification

Submitter Full Name: SEAN LUI
Organization: TESLA MOTORS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:22:04 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Panel 12 reaffirms that the ampacity tables are necessary to maintain requirements on the output cable of the EVSE and that the exceptions reduce the level of safety.
Public Comment No. 1719-NFPA 70-2015 [Section No. 625.17(B)(1)]

(1) Output Cable to the Electric Vehicle.

The output cable to the electric vehicle shall be Type EV, EVJ, EVE, EVJE, EVT, or EVJT flexible cable as specified in Table 400.4. The output cable shall have an ampacity as specified in Table 400.5(A)(1) or, for 8 AWG and larger, in the 60°C columns of Table 400.5(A)(2).

Exception to (B)(1): Listed electric vehicle supply equipment may incorporate output cables having ampacities greater than the ampacities in the 60°C columns of Table 400.5(A)(2) based on the permissible temperature limits for the components and the cable.

Statement of Problem and Substantiation for Public Comment

The proposed change effectively restores the exception in 625.17(B) of the 2014 NEC that allows output cable Ampacity to, in some cases, be higher than the value designated in the referenced tables. The proposed new exception requires that products using the exception be Listed, which will insure that such products perform within the rated temperature ratings of the components and with allowable touch temperatures.

Forcing wire gauges to be selected from a table will stifle innovation and the growth of the market for plug-in electric vehicles. Products should be evaluated based on objective metrics of actual operation of the product, not limited by a value in a table. 32 Amp EVSEs with 10AWG output cables have been successfully used for a long time, and at least two listed 32A EVSEs with 10AWG output cables are on the market now. FR3369 as written would not allow these products.

EV cables are designed for their intended purpose and all EV types are available up to 105˚C. It has been argued that without the reference to these tables there would be no guidance but Article 400.5 (A) clearly states “These tables shall be used in conjunction with applicable end-use product standards to ensure selection of the proper size and type.” When Article 625 was written there were no end product standards for EVSE but now we have ANSI tri-national UL 2594 for guidance for the end products as well as UL 2202. There is no evidence to suggest that manufacturers and third party test labs are not competent to select and properly evaluate appropriate conductor sizes with proper temperature ratings for safe and reliable end product service. All products from our company were tested at 32 A using 10 AWG EV cables and all passed with sizeable margin. Using the NEC as an end product standard tends to slow development of affordable and safe EVSE products for this emerging market by applying requirements that were not written to cover these EVSE products.

Related Item
First Revision No. 3369-NFPA 70-2015 [Section No. 625.17(B)]

Submitter Information Verification

Submitter Full Name: Jason France
Organization: ClipperCreek Inc
Affiliation: President of ClipperCreek, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 17:50:57 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Panel 12 reaffirms that the ampacity tables are necessary to maintain requirements on the output cable of the EVSE and that the exceptions reduce the level of safety.
(1) Output Cable to the Electric Vehicle.

The output cable to the electric vehicle shall be Type EV, EVJ, EVE, EVJE, EVT, or EVJT flexible cable as specified in Table 400.4. The output cable shall have an ampacity as specified in Table 400.5(A)(1) or, for 8 AWG and larger, in the 60°C columns of Table 400.5(A)(2).

Exception to (B)(1): Where 10 AWG and smaller circuit conductors are used in listed output charging assemblies having EV or EVJ cords rated 90°C or higher and only two conductors are carrying current, their ampacity shall be determined using the last column of Table 400.5(A)(1).

Statement of Problem and Substantiation for Public Comment

FR 3369 has been developed to permit ampacities for 10 AWG conductors to be in accordance with Table 400.5(A)(1). However, this table has ampacities listed in two different columns. One is for standard cord products with minimum temperature rating of 60°C and the other is for heater cords. The main difference between standard cord products and heater cords is that the minimum temperature rating for heater cords is 90°C and must use a thermosetting insulation and jacket. Since the ampacities in the last column of Table 400.5(A)(1) is permitted for heater cords that are also attached to appliances, these ampacities should be permitted for output charger cords that are constructed with the same materials and have the same temperature rating as heater cords.

Related Item

First Revision No. 3369-NFPA 70-2015 [Section No. 625.17(B)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 18:35:55 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Panel 12 reaffirms that the ampacity tables are necessary to maintain requirements on the output cable of the EVSE and that the exceptions reduce the level of safety.
Public Comment No. 1172-NFPA 70-2015 [Section No. 625.17(B)(2)]

(2) Output Cable to the Primary Pad.

If used, the output cable to the primary pad shall be Type EV, EVJ, EVE, EVJE, EVT, or EVTJ flexible cable as specified in Table 400.4. The output cable shall have an ampacity as specified in Table 400.5(A)(1) or, for 8 AWG and larger, in the 60°C columns of Table 400.5(A)(2).

Exception to (B)(2): An approved wiring system may be permitted in place of the output cable to the primary pad. [See 625.102(E)].

Statement of Problem and Substantiation for Public Comment

These cable types are suitable for use as the output cable to the primary pad, as well as the output cable to the electric vehicle.

Related Item

First Revision No. 3369-NFPA 70-2015 [Section No. 625.17(B)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 23:46:30 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The use of these cables includes situations where the cable will be lying on the floor or ground and the use of extra hard usage cables is required.
625.19 Automatic De-Energization of Cable

The electric vehicle supply equipment or the cable-connector combination of the equipment shall be provided with an automatic means to de-energize the cable conductors and electric vehicle connector upon exposure to strain that could result in either cable rupture or separation of the cable from the electric connector and exposure of live parts. Automatic means to de-energize the cable conductors and electric vehicle connector shall not be required for portable electric vehicle supply equipment constructed in accordance with 625.44(A).

Delete article.

Statement of Problem and Substantiation for Public Comment

The type of hazard being addressed here is evaluated as a part of the Listing certification program. The methods for compliance involve certain internal constructions, components and other features that the AHJ cannot inspect or examine in the field. This article should be deleted as the determination of the adequacy of the equipment is determined during the certification process. The presence of a Listing Mark would indicate compliance.

Related Item

First Revision No. 3380-NFPA 70-2015 [Section No. 625.19]

Submitter Information Verification

Submitter Full Name: GREGORY C NIEMINSKI
Organization: EPRI
Affiliation: EPRI National Electric Transportation Infrastructure Working Council's NEC Task Force
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 12:58:07 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter's substantiation does not justify the removal of this section. This requirement enhances safety and maintains a minimum level of safety requirements.
625.22 . Personnel Protection System.

The equipment shall have a listed system of protection against electric shock of personnel. Where cord-and-plug-connected equipment is used, the interrupting device of a listed personnel protection system shall be provided and shall be an integral part of the attachment plug or shall be located in the power-supply cord not more than 300 mm (12 in.) from the attachment plug. A personnel protection system shall not be required for supplies less than 50 volts dc.

Statement of Problem and Substantiation for Public Comment

Section 625.5 requires that EVSE shall be listed, the deleted text is not necessary as this safety system is covered by the product standards as detailed in PI 3982. The committee statement that this section contains the 12 inch limitation is also not necessary as UL 2594 (Electric Vehicle Supply Equipment) clause 9.2.3(a)(1) requires that the interrupting device provided as part of the personnel protection system is required to be located at the attachment plug or not more than 12 inches from the attachment plug for portable EV cord sets and movable EV charging stations. Additionally, UL 2202 (Electric Vehicle Charging System Equipment) clause 11.4.2.6 requires that cord and plug connected units shall have ground fault protection for personnel as an integral part of the attachment plug or located in the cable not more than 12 inches from the attachment plug. Therefore, if the product is listed, as required by NEC Section 625.5 and labeled as required by the certification body this personnel protection an the location of this personnel protection is already addressed.

Related Item

Public Input No. 3982-NFPA 70-2014 [Section No. 625.22]

Submitter Information Verification

Submitter Full Name: Teri Dwyer
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:30:23 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter's substantiation does not justify the removal of this section. This requirement enhances safety and maintains a minimum level of safety requirements.
Public Comment No. 1199-NFPA 70-2015 [ Section No. 625.44 ]

625.44  Equipment Connection.
Equipment shall be connected to the premises wiring system in accordance with one of the following:

(A)  Portable Equipment.
Portable equipment shall be connected to the premises wiring systems by one of the following methods:

(1) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated at 125 volt, single phase, 15 or 20 amperes
(2) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 50 volts dc maximum, 15 or 20 amperes
(3) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 250 volts, single phase, 15 or 20 amperes

The length of the power supply cord, if provided, between the receptacle outlet and the equipment shall be in accordance with 625.17(A)(3).

(B)  Stationary Equipment.
Stationary equipment intended to be fastened in place in such a way as to permit ready removal for interchange, facilitation of maintenance or repair, or repositioning, shall be connected to the premises wiring system by one of the following methods:

(1) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlets rated 250 volt, single phase, up to 50 amperes
(2) A nonlocking, 3-pole, 4-wire grounding-type receptacle outlet rated 250 volt, three phase, up to 50 amperes
(3) Any of the receptacle outlets in 625.44(A) (1) or (2).

The length of the power supply cord, if provided, between the receptacle outlet and the equipment shall be in accordance with 625.17(A)(3).

(C)  Fixed Equipment.
All other equipment shall be permanently wired and fastened in place to the supporting surface, a wall, a pole, or other structure.

Statement of Problem and Substantiation for Public Comment

The text of FR3379 is identical to the originally proposed FR as suggested in the first draft meetings in January, with one exception. This exception was to remove one line in 625.44(A) concerning the use of 250 V ac, single phase receptacles as suitable receptacles for portable devices. The text of this FR should have been identical to the originally proposed FR without the removal of this one line. The FR should be as shown below:

The 2014 NEC allowed the use of 240 V, cord-and-plug connected portable devices, but the wording used in the code indicated that these portable devices were to be fastened in place during use. The text actually states “fastened in place to facilitate repositioning of portable devices” which is not clear as pointed out in the substantiation for multiple PIs for this clause.

The use of 240 V portable devices was never prohibited by the 2014 edition of the code. With the change as shown in FR3379, the 2017 edition of the code will be prohibiting a piece of equipment that was allowed to be used for the last 3 years with a lack of any reported concerns in the field. On what basis is the panel disallowing the use of 240 V ac cord-and-plug connected portable devices? The FR should have included the reference to 240 V ac portable devices as shown.

Related Item
First Revision No. 3379-NFPA 70-2015 [Section No. 625.44]

Submitter Information Verification

Submitter Full Name: Joseph Bablo
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 12:05:42 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The committee reaffirms its position that portable EVSEs are limited to 125 volt 20 amperes maximum as stated during the 2014 revision cycle in the committee statement to comment 12-25 Log #1375 and First Revision No. 3379 committee statement. There is insufficient substantiation provided to revise the requirements.
Public Comment No. 1075-NFPA 70-2015 [Section No. 625.44(A)]

(A) Portable Equipment.

Portable equipment shall be connected to the premises wiring systems by one or more of the following methods:

1. A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated at 125 volt, single phase, 15 or 20 amperes
2. A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated at 250 volt, single phase, 15 or 20 amperes
3. A nonlocking, 2-pole, 3-wire or 3-pole, 4-wire grounding-type receptacle outlet rated at 250 volt, single phase, 30 or 50 amperes
4. A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 50 volts dc maximum, 15 or 20 amperes

The length of the power supply cord, if provided, between the receptacle outlet and the equipment shall be in accordance with 625.17(A) (3).

Statement of Problem and Substantiation for Public Comment

Section 625.44 and its predecessor 625.13 (before 2014) have always been unclear in wording and interpretation. Early on there was disagreement on whether the NEC allowed any form of plug-in 250V EVSE. More recently there has been disagreement on whether 250V portable EVSEs are allowed and the definition of “fastened in place”.

The change proposed here is to return to the version developed and approved in CMP12 Task Group 3 in January 2015 as the starting point, with changes as follows:

1) In line (A) add “or more” to include the possibility that a portable EVSE could be configured to plug in to more than one outlet type. AeroVironment’s Turbocord and Tesla’s Mobile Connector both can plug in to more than one outlet type.

2) Add a new line restoring 15- and 20-Amp receptacles at 250V as it was in the Task Group 3 draft.

3) Add a new line listing allowed 30- and 50-Amp receptacles, and adding 3-pole, 4-wire receptacles. 3-pole, 4-wire receptacles are not necessary for vehicle charging (as the neutral is not used), but there is no reason to exclude them. With their additional plug-blade, these receptacles provide even better plug security than 2-pole receptacles. Portable 250V cordsets with 4-wire plugs are standard equipment in one large EV manufacturer’s products.

Technically, there is no valid reason to exclude 250V portable products.

- All 250V portable products have no more than 125V to ground.
- 125V portable EVSEs are not required to be used with GFCI outlets. Ground fault charge current interruption protection (CCID) is included in all EVSEs.
- All types of 250V plug-in appliances and devices, including EVSEs, have a potential 250V line-to-line shock hazard from the plug blades when plugging or unplugging. This is deemed an acceptable risk in the current NEC and previous revisions of the NEC.

Millions of Outdoor receptacles rated 125 VAC are in homes in the United States, many without GFCI protection. GFCIs have been required in receptacles primarily to provide ground fault protection from failures or misuse of end products. Electric vehicle supply equipment always has built-in personal protection for ground faults called a “charge current interrupting device” (CCID). The only risk being mitigated by a GFCI outlet when used for powering an EVSE is protection from contacting a single plug blade and getting a shock to ground. We are not aware of any electric shock incidents in connection with charging vehicles through electric vehicle supply equipment, and specifically none from contact with plug blades while plugging in electric vehicle supply equipment.

Note also that the Voltage to ground of 250VAC is 125VAC -- the same as a 125VAC circuit.

Multiple models of 250V portable EVSEs are already in use in North America. Some are labelled and NRTL Listed as stationary fastened in place, but are physically very small and marketed as easy to take with you on the go (avoiding the word “portable”). Others are NRTL Listed as portable products. In addition, a large number of portable 250V EVSEs have been delivered with each Tesla Model S. Volvo will be including a portable 125/250V portable EVSE with every new 2016 XC90 plug-in hybrid vehicle. There are already tens of thousands of “portable” 250V EVSEs in use today in the United States alone. Due to charge times and increasing battery pack sizes on EVs/PHEVs, there is existing and growing market demand for 250V portable EVSEs. These products will not go away if 625.44(A) is adopted as-is – but NRTL Listings and independent safety evaluations of these products would no longer be possible.

Related Item
First Revision No. 3379-NFPA 70-2015 [Section No. 625.44]

Submitter Information Verification

Submitter Full Name: Alec Brooks
Committee Statement

Committee Action: Rejected

Resolution: The committee reaffirms its position that portable EVSEs are limited to 125 volt 20 amperes maximum as stated during the 2014 revision cycle in the committee statement to comment 12-25 Log #1375 and First Revision No. 3379 committee statement. There is insufficient substantiation provided to revise the requirements.
Portable equipment shall be connected to the premises wiring systems by one or more of the following methods:

1. A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated at 125 volt, single phase, 15 or 20 amperes
2. A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 250 volt, single phase, 15 or 20 amperes
3. A nonlocking, 2-pole, 3-wire or 3-pole, 4-wire grounding-type receptacle rated at 250 volt, single phase, 30 or 50 amperes
4. A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 50 volts dc maximum, 15 or 20 amperes

The length of the power supply cord, if provided, between the receptacle outlet and the equipment shall be in accordance with 625.17(A) (3).

Statement of Problem and Substantiation for Public Comment

Electric vehicles benefit from higher charging rates achievable with 250V rated portable equipment. There is no verifiable technical or safety related reason to prohibit 250V products. IEC, SAE, and GB standards all include portable products at over 200V.

Section 625.44 and its predecessor 625.13 (before 2014) have always been unclear in wording and interpretation. The change proposed here is to return to the version developed and approved in CMP12 Task Group 3 in January 2015 which enables improvements and innovations in EVSE products to come to the market without compromising safety.

We also propose two enhancements to that version in order to account for improved product designs for electric vehicle owners:

1) In line (A) add “or more” to include the possibility that a portable EVSE could be configured to plug in to more than one outlet type. This adds much needed flexibility for EV users to charge their vehicles when travelling as it allows the use of different outlet types.

2) Add a new line listing allowed 30- and 50-Amp receptacles, and adding 3-pole, 4-wire receptacles. 3-pole, 4-wire receptacles are not necessary for vehicle charging (as the neutral is not used), but there is no reason to exclude them. With their additional plug-blade, these receptacles provide even better plug security than 2-pole receptacles.

From a safety engineering point of view, there is no valid reason to exclude 250V portable products.

- 125V portable EVSEs are not required to be used with GFCI outlets. And even if it was required, it is clearly impractical to enforce such requirement given the fact that the devices are portable. Therefore, a ground fault current interruption device (CCID) is built in inside all EVSEs by design to afford the user such protection anywhere the EVSE is used.
- All types of 250V plug-in appliances and devices, including EVSEs, have a potential 250V line-to-line shock hazard from the plug blades when plugging or unplugging. However, the solution to this is for our industry to develop more "touch safe" plugs rather than banning the existing plugs that had been in use for decades and are the same ones used in EVSE products now to take advantage of existing infrastructure.
- The concern with 250V rated devices being heavier and putting stress on the outlet is mostly unfounded because most portable EVSEs have a wide input range and are physically the same unit (it is just rated 125V-250V). Furthermore, 250V plugs/receptacles are physically larger (e.g. NEMA 14-50 outlets) and provide much better blade retention than the 125V ones (e.g. NEMA 5-15), so if a 125V outlet can take the EVSE, a 250V outlet can certainly take it as well.

As stated in the very first paragraph of the Code (Article 90.1(A), the purpose of the NEC is the “practical safeguarding of persons and property”. Limiting consumer options and/or banning an entire class of EVSEs is certainly not practical from the public’s point of view.

Related Item
First Revision No. 3379-NFPA 70-2015 [Section No. 625.44]

Submitter Information Verification

Submitter Full Name: SEAN LUI
Organization: TESLA MOTORS
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:50:17 EDT 2015
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>The committee reaffirms its position that portable EVSEs are limited to 125 volt 20 amperes maximum as stated during the 2014 revision cycle in the committee statement to comment 12-25 Log #1375 and First Revision No. 3379 committee statement. There is insufficient substantiation provided to revise the requirements.</td>
</tr>
</tbody>
</table>
Portable equipment shall be connected to the premises wiring systems by one or more of the following methods:

1. A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated at 125 volt, single phase, 15 or 20 amperes

2. A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 250 volt, single phase, 15 or 20 amperes

3. A nonlocking, 2-pole, 3-wire or 3-pole, 4-wire grounding-type receptacle outlet rated at 250 volt, single phase, 30 or 50 amperes

4. A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 50 volts dc maximum, 15 or 20 amperes

The length of the power supply cord, if provided, between the receptacle outlet and the equipment shall be in accordance with 625.17(A)(3).

Statement of Problem and Substantiation for Public Comment

Section 625.44 and its predecessor 625.13 (before 2014) have always been unclear in wording and interpretation. Early on there was disagreement on whether the NEC allowed any form of plug-in 250V EVSE. More recently there has been disagreement on whether 250V portable EVSEs are allowed and the definition of “fastened in place”.

Multiple models of 250V portable EVSEs are already in use in North America. Some are labelled and NRTL Listed as stationary fastened in place, but are physically very small and marketed as easy to take with you on the go (avoiding the word “portable”). Others are NRTL Listed as portable products. In addition, a large number of portable 250V EVSEs have been delivered with each Tesla Model S. Volvo will be including a portable 125/250V portable EVSE with every new 2016 XC90 plug-in hybrid vehicle. There are already tens of thousands of “portable” 250V EVSEs in use today in the United States alone. Due to charge times and increasing battery pack sizes on EVs/PHEVs, there is existing and growing market demand for 250V portable EVSEs. These products will not go away if 625.44(a) is adopted as-is – but NRTL Listings and independent safety evaluations of these products would no longer be possible.

As the President of ClipperCreek, and as a major supplier of cord sets to the automotive industry, I can attest that the industry is moving to delivering 240V cord sets with the vehicle. If the NEC specifically disallows the products, the result will be that vehicles will be delivered with unlisted cord set products in the trunk developed to automakers standards instead of the harmonized Tri-national UL standards will become the norm.

Submitter Information Verification

Submitter Full Name: Jason France
Organization: ClipperCreek Inc
Affiliation: President of ClipperCreek
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 17:58:06 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The committee reaffirms its position that portable EVSEs are limited to 125 volt 20 amperes maximum as stated during the 2014 revision cycle in the committee statement to comment 12-25 Log #1375 and First Revision No. 3379 committee statement. There is insufficient substantiation provided to revise the requirements.
Public Comment No. 1481-NFPA 70-2015 [Sections 625.44(A), 625.44(B)]

Sections 625.44(A), 625.44(B)

(A) Portable Equipment.

Portable equipment shall be connected to the premises wiring systems by one of the following methods:

(1) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated at 125 volt or 250 volt, single phase, 15 or 20 amperes

(2) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 50 volts dc maximum, 15 or 20 amperes

The length of the power supply cord, if provided, between the receptacle outlet and the equipment shall be in accordance with 625.17(A)(3).

(B) Stationary Equipment.

Stationary equipment intended to be fastened in place in such a way as to permit ready removal for interchange, facilitation of maintenance or repair, or repositioning, shall be connected to the premises wiring system by one of the following methods:

(1) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlets rated 125 volt or 250 volt, single phase, up to 50 amperes

(2) A nonlocking, 3-pole, 4-wire grounding-type receptacle outlet rated 250 volt, three phase, up to 50 amperes

(3) Any of the receptacle outlets in 625.44(A) (1) or (2)

The length of the power supply cord, if provided, between the receptacle outlet and the equipment shall be in accordance with 625.17(A)(3).

Statement of Problem and Substantiation for Public Comment

Cord and plug connected EVSE intended for connection to either 125 volt or 250 volt receptacles has been Listed for years, as evidenced in the 2014 National Electrical code, Article 625.44(A) and (B). Requirements covering these products can be found in UL2594, Standard for Electric Vehicle Supply Equipment and in SAE J1772, Standard for SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler.

The proposal in the first report would eliminate a class of EVSE that has been installed successfully and used without incident for years.

Related Item
First Revision No. 3379-NFPA 70-2015 [Section No. 625.44]

Submitter Information Verification

Submitter Full Name: GREGORY C NIEMINSKI
Organization: EPRI
Affiliation: EPRI National Electric Transportation Infrastructure Working Council’s NEC Task Force
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:02:48 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3344-NFPA 70-2015
Statement: The addition allows for 125 volt or 250 volt stationary equipment.
Public Comment No. 758-NFPA 70-2015 [Section No. 625.44(C)]

(C) Fixed Equipment.
All other equipment shall be permanently wired and fastened in place to the supporting surface, a wall, a pole, or other structure.

Statement of Problem and Substantiation for Public Comment

eliminating the different types of support leave the door open for every type of support like a building.

Related Item
First Revision No. 3379-NFPA 70-2015 [Section No. 625.44]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 18 22:02:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3346-NFPA 70-2015
Statement: Eliminating the specific types of structures does not restrict the type of support. Panel 12 changed "fastened" to "fixed" to remain consistent with the definition.
Loss of Primary Source.

Means shall be provided such that, upon loss of voltage from the utility or other electrical system(s), energy cannot be back fed through the electric vehicle and the supply equipment to the premises wiring system unless permitted by 625.48.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 3375

Related Item
First Revision No. 3375-NFPA 70-2015 [New Section after 625.46]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 10:50:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3347-NFPA 70-2015
Statement: Panel 12 revised to eliminate syntax error and added a section title.
Public Comment No. 759-NFPA 70-2015 [Section No. 625.102(A)]

(A) Type.
The charger power converter, where integral to the primary pad, shall comply with 625.102(C). The charger power converter, if not integral to the primary pad, shall be provided with a suitable enclosure rating, minimum Type 3R and shall be mounted in one of the following forms:

1. Pedestal
2. Wall or pole mounted
3. Raised concrete pad

Statement of Problem and Substantiation for Public Comment

The section heading is "type" the way it is installed is not relevant. and should be place in section B

Related Item
First Revision No. 3378-NFPA 70-2015 [New Section after 625.52]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: master
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 18 22:15:04 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3348-NFPA 70-2015
Statement: Panel 12 moved text from the "Type" section (A) to the renamed "Installation" section (B). The text is an installation requirement and is better served in the installation section.
Public Comment No. 760-NFPA 70-2015 [Section No. 625.102(B)]

(B) Mounting Height, Installation.

If the charger power converter is not integral to the primary pad, it shall be mounted at a height of not less than 450 mm (18 in.) above the floor level for indoor locations or 600 mm (24 in) above grade level for outdoor locations. The charge power converter shall be mounted in one of the following forms.

1. Pedestal
2. Wall or Pole
3. Building or structure
4. Raised concrete pad

Statement of Problem and Substantiation for Public Comment

Installation is the requirement of this section, and the means to accomplish this should be in this section, including building and structures.

Related Item
First Revision No. 3378-NFPA 70-2015 [New Section after 625.52]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: master
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 18 22:25:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3348-NFPA 70-2015
Statement: Panel 12 moved text from the “Type” section (A) to the renamed “Installation” section (B). The text is an installation requirement and is better served in the installation section.
630.6 Listing.
All welding and cutting power equipment under the scope of this article shall be listed.

Statement of Problem and Substantiation for Public Comment

NEMA is concerned that the term "equipment" in the section heading can be misinterpreted to include ancillary equipment that is not directly connected to an electrical supply system but is connected to an arc welding power source.

Related Item
First Revision No. 3358-NFPA 70-2015 [New Section after 630.1]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 11:39:38 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3302-NFPA 70-2015
Statement: The term “equipment” in the section heading can be misinterpreted to include ancillary equipment that is not directly connected to an electrical supply system but is connected to an arc welding power source. The change will provide clarity for intended listing requirements.
Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack.]

**Equipment Rack.**
A framework for the support, enclosure, or both, of equipment; may be portable or stationary.

**Informational Note:** See ANSI/EIA/ECIA 310-D 2005, Cabinets, Racks, Panels and Associated Equipment.

Statement of Problem and Substantiation for Public Comment

Referenced current SDO name combination, revision, and edition.

Related Public Comments for This Document

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<tr>
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<td>Public Comment No. 41-NFPA 70-2015 [Section No. 399.10]</td>
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<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
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<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
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<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
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<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
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<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
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<td>Referenced correct SDO name, standard name, number, and edition.</td>
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<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
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<td>Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]</td>
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<td>Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]</td>
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<td>Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]</td>
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<td>Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]</td>
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<td>Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]</td>
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Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]
Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 111-NFPA 70-2015 [Section No. 505.2]
Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]
Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]
Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 95-NFPA 70-2015 [Section No. 620.1]
Referenced correct SDO name, standard name, number, and edition.

Related Item
First Revision No. 3309-NFPA 70-2015 [Section No. 640.3(B)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 01 01:52:42 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3303-NFPA 70-2015
Statement: Panel 12 is making these edits to keep the referenced standard current.
Public Comment No. 164-NFPA 70-2015 [Section No. 640.3(B)]

(B) Ducts, Plenums, and Other Air-Handling Spaces.
Section 300.22(B) shall apply to circuits and equipment installed in ducts specifically fabricated for environmental air. Section 300.22(C) shall apply to circuits and equipment installed in other spaces used for environmental air (plenums).

Exception No. 1: Class 2 and Class 3 cables installed in accordance with 725.135(B) and Table 725.154 shall be permitted to be installed in ducts specifically fabricated for environmental air.

Exception No. 2: Class 2 and Class 3 cables installed in accordance with 725.135(C) and Table 725.154 shall be permitted to be installed in other spaces used for environmental air (plenums).

Informational Note: NFPA 90A-2015, Standard for the Installation of Air Conditioning and Ventilating Systems, 4.3.10.2.6.5, permits loudspeakers, loudspeaker assemblies, and their accessories listed in accordance with UL 2043-2008, Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces, to be installed in other spaces used for environmental air (ceiling cavity plenums).

Statement of Problem and Substantiation for Public Comment

In the informational note, UL 2043 edition is updated.

Related Item
First Revision No. 645-NFPA 70-2015 [Section No. 300.22(C)(3)]
First Revision No. 3309-NFPA 70-2015 [Section No. 640.3(B)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jul 06 23:36:08 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3304-NFPA 70-2015
Statement: Panel 12 is making these edits to keep the referenced standard current. The Panel action complies with the CC directive to reconsider. The error noted in balloting was corrected by NFPA staff and does not require further action.
Public Comment No. 1835-NFPA 70-2015 [Section No. 640.3(B)]

**Section 300.22(B)**

Section 300.22(B) shall apply to circuits and equipment installed in ducts specifically fabricated for environmental air. Section 300.22(C) shall apply to circuits and equipment installed in other spaces used for environmental air (plenums).

**Exception No. 1:** Class 2 and Class 3 cables installed in accordance with 725.135(B) and Table 725.154 shall be permitted to be installed in ducts specifically fabricated for environmental air.

**Exception No. 2:** Class 2 and Class 3 cables installed in accordance with 725.135(C) and Table 725.154 shall be permitted to be installed in other spaces used for environmental air (plenums).


Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs Code-Making Panel 12 provide further consideration to the comments expressed in voting on FR 3309.

**Related Item**

First Revision No. 3309-NFPA 70-2015 [Section No. 640.3(B)]

Submitter Information Verification

**Submitter Full Name:** CC on NEC-AAC

**Organization:** NFPA

**Street Address:**

**City:**

**State:**

**Zip:**

**Submittal Date:** Tue Sep 29 10:52:05 EDT 2015

Committee Statement

**Committee Action:** Rejected but see related SR

**Resolution:** SR-3304-NFPA 70-2015

**Statement:** Panel 12 is making these edits to keep the referenced standard current. The Panel action complies with the CC directive to reconsider. The error noted in balloting was corrected by NFPA staff and does not require further action.
640.25 Loudspeaker Installation in Fire Resistance-Rated Partitions, Walls, and Ceilings.

Loudspeakers installed in a fire resistance–rated partition, wall, or ceiling shall be listed, labeled and identified for that purpose or installed in an enclosure or recess that maintains the fire resistance rating.

Informational Note: Fire-rated construction is the fire-resistive classification used in building codes. One method of determining fire rating is testing in accordance with NFPA 256-2003, Standard Methods of Fire Tests of Roof Coverings.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document pages 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item

Public Input No. 928-NFPA 70-2014 [Section No. 640.25]
First Revision No. 3314-NFPA 70-2015 [Section No. 640.25]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3305-NFPA 70-2015
Statement: Panel 12 revised the requirements by adding the words "and labeled, or identified" to ensure the integrity of the fire resistive rated wall, partition or ceiling. If a product is listed and labeled it would be identified for the purpose. The term is redundant and not needed. Added "as speaker assemblies for fire resistance" to characterize the types of speaker assemblies required from others that would not fulfill the requirements. Additionally, removed the portion of the Informational Note referencing NFPA 256, since that standard has been withdrawn.
640.25 Loudspeaker Installation in Fire Resistance-Rated Partitions, Walls, and Ceilings.

Loudspeakers installed in a fire resistance-rated partition, wall, or ceiling shall be listed for that purpose or installed in an enclosure or recess that maintains the fire resistance rating.

Informational Note: Fire-rated construction is the fire-resistant classification used in building codes. One method of determining fire rating is testing in accordance with NFPA 256-2003, Standard Methods of Fire Tests of Roof Coverings.

Statement of Problem and Substantiation for Public Comment

In the informational note, removed reference to NFPA 256 since has been withdrawn.

Related Item
First Revision No. 3314-NFPA 70-2015 [Section No. 640.25]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 06 23:45:53 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3305-NFPA 70-2015
Statement: Panel 12 revised the requirements by adding the words "and labeled, or identified" to ensure the integrity of the fire resistive rated wall, partition or ceiling. If a product is listed and labeled it would be identified for the purpose. The term is redundant and not needed. Added "as speaker assemblies for fire resistance" to characterize the types of speaker assemblies required from others that would not fulfill the requirements. Additionally, removed the portion of the Informational Note referencing NFPA 256, since that standard has been withdrawn.
## Public Comment No. 1836-NFPA 70-2015 [Section No. 640.42(A)]

### (A) Between Equipment and Branch-Circuit Power.

Power supply cords for audio equipment shall be listed and shall be permitted to be used where the interchange, maintenance, or repair of such equipment is facilitated through the use of a power-supply cord.

### Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that 640.42(A)(B) and (C) be rewritten to comply with the NEC Style Manual as noted in balloting comments.

**Related Item**

Public Input No. 1-NFPA 70-2013 [Section No. 310.15(B)(3)]

### Submitter Information Verification

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<td>Tue Sep 29 10:55:43 EDT 2015</td>
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### Committee Statement

| Committee Action: | Rejected but see related SR |
| Resolution:       | SR-3306-NFPA 70-2015 |
| Statement:        | Panel 12 revised 640.42 to meet the requirements of the Style Manual as per the CC direction. Added “Installation of” to provide clarity to the requirement. |
Public Comment No. 25-NFPA 70-2015 [Section No. 645.1]

645.1 Scope.
This article covers equipment, power-supply wiring, equipment interconnecting wiring, and grounding of information technology equipment and systems in an information technology equipment room.

Informational Note: For further information, see NFPA 75-2013, Standard for the Fire Protection of Information Technology Equipment, which covers the requirements for the protection of information technology equipment and information technology equipment areas.

Statement of Problem and Substantiation for Public Comment

NFPA 75 is in the 2015 Fall Revision Cycle. The NITMAM posting date is 10/16/2015. If there are no certified NITMAMs, the 2016 edition of NFPA 75 will be issued on 11/10/2015.

Related Public Comments for This Document

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<td>Public Comment No. 29-NFPA 70-2015 [Section No. 645.10(A)(4)]</td>
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<td>Public Comment No. 30-NFPA 70-2015 [Section No. 646.1]</td>
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Related Item
First Revision No. 3338-NFPA 70-2015 [Section No. 645.1]

Submitter Information Verification

Submitter Full Name: STANLEY KAUFMAN
Organization: CABLESAFE INCOFS
Affiliation: SPI
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 23 06:22:15 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3307-NFPA 70-2015
Statement: The rewording of the scope of Article 645 is to clarify the Panel’s intent of Article 645. This intent is clearly worded in 645.4 (2011 and 2014), but has been misinterpreted as being mandatory. The Panel requests that the Correlating Committee approve this scope editing.

Additionally, the Panel updated the edition date of NFPA 75 to the current edition.
Circuits and equipment shall comply with 645.3(A) through (G), as applicable.

Statement of Problem and Substantiation for Public Comment

The Panel added two new subparagraphs (H) and (I) to 645.3, "Other Articles." This editorial comment notes the need to change the introductory paragraph to recognize the new sections.

Related Item
First Revision No. 3350-NFPA 70-2015 [Section No. 645.6]

Submitter Information Verification
Submitter Full Name: Robert Jensen
Organization: dbi-Telecommunication Infrastr
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 10:10:20 EDT 2015

Committee Statement
Committee Action: Accepted
Resolution: SR-3308-NFPA 70-2015
Statement: This is an editorial correction of section number.
Public Comment No. 1837-NFPA 70-2015 [Section No. 645.3(B)]

(B) Wiring and Cabling in Other Spaces Used for Environmental Air (Plenums).
The following sections and tables shall apply to wiring and cabling in other spaces used for environmental air (plenums) above an information technology equipment room:

1. Wiring methods: 300.22(C)(1)
2. Class 2, Class 3, and PLTC cables: 725.135(C) and Table 725.154
3. Fire alarm systems: 760.53(B)(2), 725.135(C) and Table 760.154
4. Optical fiber cables: 770.113(C), and Table 770.154(a)
5. Communications circuits: 820.113(C) and Table 800.154(a), (b), and (c)
6. CATV and radio distribution systems: 820.113(C) and Table 820.154(a)

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 3341.

Related Item
First Revision No. 3341-NFPA 70-2015 [Section No. 645.3(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 10:57:00 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3309-NFPA 70-2015
Statement: This is an editorial correction of section numbers.
(B) Wiring and Cabling in Other Spaces Used for Environmental Air (Plenums).

The following sections and tables shall apply to wiring and cabling in other spaces used for environmental air (plenums) above an information technology equipment room:

1. Wiring methods: 300.22(C)(1)
2. Class 2, Class 3, and PLTC cables: 725.135(C) and Table 725.154
3. Fire alarm systems: 760.53(B)(2), 725.760.135(C) and Table 760.154
4. Optical fiber cables: 770.113(C), and Table 770.154(a)
5. Communications circuits: 820.800.113(C) and Table 800.154(a), (b), and (c)
6. CATV and radio distribution systems: 820.113(C) and Table 820.154(a)

Statement of Problem and Substantiation for Public Comment

This Public Comment corrects two typographical errors.

Related Public Comments for This Document

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Submitter Information Verification

Submitter Full Name: STANLEY KAUFMAN
Organization: CABLESAFE INCOFS
Affiliation: SPI
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 00:46:44 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3309-NFPA 70-2015
Statement: This is an editorial correction of section numbers.
Bonding and Grounding.

The non–current-carrying conductive members of optical fiber cables in an information technology equipment room shall be bonded and grounded in accordance with 770.114.

Statement of Problem and Substantiation for Public Comment

FR 3342 added the words "bonded and", correctly acknowledging that bonding and grounding are two separate but closely related topics, but did not include the word "bonding" to the title. 645.3(C) also references to 770.114, which states that "optical fiber cables shall be bonded to a grounded equipment rack or enclosure." This comment adds "bonding" to the title of paragraph 645.3(C).

Related Item

First Revision No. 3342-NFPA 70-2015 [Section No. 645.3(C)]

Submitter Information Verification

Submitter Full Name: ROBERT JENSEN
Organization: DBI-TELECOMMUNICATION INFRASTR
Affiliation: BICSI
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Aug 27 11:18:43 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3310-NFPA 70-2015
Statement: Panel 12 revised the title to include "Bonding and" to match the language in the text.
645.4 Special Requirements for Information Technology Equipment Room.

Alternate wiring methods to the provisions of Chapter 3 and Article 708 for power wiring, Parts I and III of Article 725 for signaling wiring, Section 708.14 and Parts I and V of Article 725 for optical fiber cabling, shall be permitted where all of the following conditions are met:

1. Disconnecting means complying with 645.10 are provided.
2. A heating/ventilating/air-conditioning (HVAC) system is provided in one of the methods identified in 645.4(2) a or b.
3. A separate HVAC system that is dedicated for information technology equipment use and is separated from other areas of occupancy; or
4. An HVAC system that serves other occupancies and meets all of the following:
   a. Also serves the information technology equipment room
   b. Provides fire/smoke dampers at the point of penetration of the room boundary
   c. Activates the damper operation upon initiation by smoke detector alarms, by operation of the disconnecting means required by 645.10, or by both

Informational Note: For further information, see NFPA 75.

2013


5. All information technology and communications equipment installed in the room is listed.
6. The room is occupied by, and accessible to, only those personnel needed for the maintenance and functional operation of the installed information technology equipment.
7. The room is separated from other occupancies by fire-resistant-rated walls, floors, and ceilings with protected openings.

Informational Note: For further information on room construction requirements, see NFPA 75.

2013


8. Only electrical equipment and wiring associated with the operation of the information technology room is installed in the room.

Informational Note: HVAC systems, communications systems, and monitoring systems such as telephone, fire alarm systems, security systems, water detection systems, and other related protective equipment are examples of equipment associated with the operation of the information technology room.

Statement of Problem and Substantiation for Public Comment

NFPA 75 is in the 2015 Fall Revision Cycle. The NITMAM posting date is 10/16/2015. If there are no certified NITMAMs, the 2016 edition of NFPA 75 will be issued on 11/10/2015.

Related Public Comments for This Document

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<td>Public Comment No. 29-NFPA 70-2015 [Section No. 645.10(A)(4)]</td>
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<td>Public Comment No. 30-NFPA 70-2015 [Section No. 646.1]</td>
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<td>Public Comment No. 25-NFPA 70-2015 [Section No. 645.1]</td>
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Related Item

First Revision No. 3354-NFPA 70-2015 [Section No. 645.5(E)]

Submitter Information Verification
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<th><strong>Submitter Full Name:</strong></th>
<th>STANLEY KAUFMAN</th>
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<td><strong>Organization:</strong></td>
<td>CABLESAFE INCOFS</td>
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<td>Tue Jun 23 06:27:56 EDT 2015</td>
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**Committee Statement**

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<tr>
<td><strong>Resolution:</strong></td>
<td>SR-3311-NFPA 70-2015</td>
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<tr>
<td><strong>Statement:</strong></td>
<td>Panel 12 removed references to Article 708 to resolve a conflict with Article 708 and made editorial corrections. Additionally, the Panel updated the reference to NFPA 75 to current edition.</td>
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</table>
Public Comment No. 1838-NFPA 70-2015 [ New Section after 645.5 ]

See Correlating Note below.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 3350.

Related Item
First Revision No. 3350-NFPA 70-2015 [Section No. 645.6]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: NFPA
City:
State:
Zip:
Submittal Date: Tue Sep 29 11:02:15 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Section 645.6 (I) was moved to 645.3 “Other Articles” and renumbered 645.3(I) by First Revision No. 3350 which was approved and appears in the FDR text on TerraView. The correction to 645.3 has been made by Second Revision No. 3308. This explanation complies with the Correlating Committee direction to reconsider the First Revision No. 3350 voting comment.
(E) Under Raised Floors.

Power cables, communications cables, connecting cables, interconnecting cables, cord-and-plug connections, and receptacles associated with the information technology equipment shall be permitted to be installed under a raised floor, provided the following conditions are met:

1. The raised floor is of approved construction, and the area under the floor is accessible.
2. Ventilation in the underfloor area is used for the information technology equipment room only, except as provided in 645.4(2).
3. Openings in raised floors for cords and cables protect cords and cables against abrasion and minimize the entrance of debris beneath the floor.

The installation of branch circuit conductors shall be in accordance with 645.5(E)(1). The installation of electrical supply cords, data cables, interconnecting cables, and grounding conductors shall be in accordance with 645.5(E)(2). The installation of optical fiber cables shall be in accordance with 645.5(E)(3).

(1) Installation Requirements for Branch Circuit Supply Conductors Under a Raised Floor.

(a) The supply conductors shall be installed in accordance with the requirements of 300.11.

(b) In addition to the wiring methods of 300.22(C), the following wiring methods shall also be permitted:

1. Rigid metal conduit
2. Rigid nonmetallic conduit
3. Intermediate metal conduit
4. Electrical metallic tubing
5. Electrical nonmetallic tubing
6. Metal wireway
7. Nonmetallic wireway
8. Surface metal raceway with metal cover
9. Surface nonmetallic raceway
10. Flexible metal conduit
11. Liquidtight flexible metal conduit
12. Liquidtight flexible nonmetallic conduit
13. Type MI cable
14. Type MC cable
15. Type AC cable
16. Associated metallic and nonmetallic boxes or enclosures
17. Type TC power and control tray cable
The following cords, cables and conductors shall be permitted to be installed under a raised floor:

1. Supply cords of listed information technology equipment in accordance with 645.5(B)
2. Interconnecting cables enclosed in a raceway
3. Equipment grounding conductors
4. In addition to wiring installed in compliance with 725.135(C), Types CL2R, CL3R, CL2, and CL3 and substitute cables including CMP, CMR, CM, and CMG installed in accordance with 725.154(A) shall be permitted under raised floors.

Informational Note: Figure 725.154(A) illustrates the cable substitution hierarchy for Class 2 and Class 3 cables.

5. Listed Type DP cable having adequate fire-resistant characteristics suitable for use under raised floors of an information technology equipment room

Informational Note: One method of defining fire resistance is by establishing that the cables do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Tray Flame Test" in UL 1685-2011, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable. Another method of defining fire resistance is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA “Vertical Flame Test — Cables in Cable Trays,” as described in CSA C22.2 No. 0.3-M-2001, Test Methods for Electrical Wires and Cables.

(3) Installation Requirements for Optical Fiber Cables Under a Raised Floor.

In addition to optical fiber cables installed in accordance with 770.113(C), Types OFNR, OFCR, OFN, and OFC shall be permitted under raised floors.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 3354

Related Item
First Revision No. 3354-NFPA 70-2015 [Section No. 645.5(E)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 11:06:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3312-NFPA 70-2015
Statement: Panel 12 revised 645.5(E) to improve clarity by eliminating the list items and the redundancies that were included. This complies with the Correlating Committee directive.

Updating the reference to CSA 22.2, the official CSA standard number is C22.2 NO. 0.3-09.
(E) Under Raised Floors.

Power raceways, power cables, communications cables, connecting cables, interconnecting raceways and cables, cord-and-plug connections, and receptacles associated with the information technology equipment shall be permitted to be installed under a raised floor, provided the following conditions are met:

(1) The raised floor is of approved construction, and the area under the floor is accessible.

(2) Ventilation in the underfloor area is used for the information technology equipment room only, except as provided in 645.4(2).

(3) Openings in raised floors for cords and cables protect cords and cables against abrasion and minimize the entrance of debris beneath the floor.

The installation of branch circuit conductors shall be in accordance with 645.5(E)(1). The installation of electrical supply cords, data cables, interconnecting cables, and grounding conductors shall be in accordance with 645.5(E)(2). The installation of optical fiber cables shall be in accordance with 645.5(E)(3).

(1) Installation Requirements for Branch Circuit Supply Conductors Under a Raised Floor.

(a) The supply conductors shall be installed in accordance with the requirements of 300.11.

(b) In addition to the wiring methods of 300.22(C), the following wiring methods shall also be permitted:

(1) Rigid metal conduit
(2) Rigid nonmetallic conduit
(3) Intermediate metal conduit
(4) Electrical metallic tubing
(5) Electrical nonmetallic tubing
(6) Metal wireway
(7) Nonmetallic wireway
(8) Surface metal raceway with metal cover
(9) Surface nonmetallic raceway
(10) Flexible metal conduit
(11) Liquidtight flexible metal conduit
(12) Liquidtight flexible nonmetallic conduit
(13) Type MI cable
(14) Type MC cable
(15) Type AC cable
(16) Associated metallic and nonmetallic boxes or enclosures
(17) Type TC power and control tray cable
Installation Requirements for Electrical Supply Cords, Data Cables, Interconnecting Cables and Grounding Conductors Under a Raised Floor.

The following cords, cables and conductors shall be permitted to be installed under a raised floor:

1. Supply cords of listed information technology equipment in accordance with 645.5(B)
2. Interconnecting cables enclosed in a raceway
3. Equipment grounding conductors
4. In addition to wiring installed in compliance with 725.135(C), Types CL2R, CL3R, CL2, and CL3 and substitute cables including CMP, CMR, CM, and CMG installed in accordance with 725.154(A) shall be permitted under raised floors.

Informational Note: Figure 725.154(A) illustrates the cable substitution hierarchy for Class 2 and Class 3 cables.

5. Listed Type DP cable having adequate fire-resistant characteristics suitable for use under raised floors of an information technology equipment room

Informational Note: One method of defining fire resistance is by establishing that the cables do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Tray Flame Test” in UL 1685-2011, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable. Another method of defining fire resistance is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA “Vertical Flame Test — Cables in Cable Trays,” as described in CSA C22.2 No. 0.3-M-2001, Test Methods for Electrical Wires and Cables.

Installation Requirements for Optical Fiber Cables Under a Raised Floor.

In addition to optical fiber cables installed in accordance with 770.113(C), Types OFNR, OFCR, OFN, and OFC shall be permitted under raised floors.

Statement of Problem and Substantiation for Public Comment

The term raceways should be added for clarification and to be specific about manufactured raceways or Contractor fabricated raceways for under raised floor applications. These fabricated assemblies are often fabricated from liquidtight flex with conductors installed and NEMA receptacles attached, with UL listing. They are technically raceways, power cable is a term more applicable to SO cord, USE cables or other types of cables.

Related Item
First Revision No. 1-NFPA 70-2015 [Section No. 90.2(A)]

Submitter Information Verification

Submitter Full Name: GLENN CLAYDEN
Organization: CLAYDEN AND ASSOC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 17 18:09:35 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Raceways are already specifically included. Raceways for branch circuits are covered in 645.5(E)(1)(b). Raceways for power and communications are covered in 645.5(E)(2)(2).
The supply conductors shall be installed in accordance with the requirements of 300.11.

Statement of Problem and Substantiation for Public Comment

For the life of me I never could figure out how 300.11 applies to the installation of conductors under a raised floor. Exactly what is the panel attempting to accomplish by referencing 300.11.

Related Item
First Revision No. 3354-NFPA 70-2015 [Section No. 645.5(E)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 16:28:04 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Chapters 1 through 4 (inclusive of section 300.11) apply to all installations unless modified by Chapters 5 through 7. This section reaffirms the securing requirement revisions made for the 2014 edition of the NEC.
Installation Requirements for Electrical Supply Cords, Data Cables, Interconnecting Cables and Grounding Conductors Under a Raised Floor.

The following cords, cables and conductors shall be permitted to be installed under a raised floor:

1. Supply cords of listed information technology equipment in accordance with 645.5(B)
2. Interconnecting cables enclosed in a raceway
3. Equipment grounding conductors
4. In addition to wiring, where the air space below a raised floor is not protected by an automatic fire suppression system, wiring under the raised floor shall be installed in compliance with 725.135(C), including Type CMP substituting for Types CL2P and CL3P.
5. Where the air space below a raised floor is protected by an automatic fire suppression system, wiring installed in compliance with 725.135(C) shall be permitted under the raised floor and Types CL2R, CL3R, CL2, and CL3 and substitute cables including CMP, CMR, CM, and CMG installed in accordance with 725.154(A) shall also be permitted under raised floors. Informational Note: Figure 725.154(A) illustrates the cable substitution hierarchy for Class 2 and Class 3 cables.
6. Listed Type DP cable having adequate fire-resistant characteristics suitable for use under raised floors of an information technology equipment room

Informational Note: One method of defining fire resistance is by establishing that the cables do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Tray Flame Test" in UL 1685-2011, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable. Another method of defining fire resistance is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA "Vertical Flame Test — Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M-2001, Test Methods for Electrical Wires and Cables.

Statement of Problem and Substantiation for Public Comment

The development schedule of the 2016 edition of NFPA 75, Standard for the Fire Protection of Information Technology Equipment is about 6 months ahead of the development schedule for NFPA 70. There are pending changes to the wiring requirements in NFPA 75 that will require correlating changes in Article 645.

The text of section 11.3.7 and the explanatory Annex Note A.11.3.7 in NFPA 75-2016 will be:

11.3.7* Signal wiring and cabling, including optical fiber cables, installed in an air space below a raised floor shall be listed.

11.3.7.1 Where the air space below a raised floor is protected by an automatic fire suppression system, signal wiring and cabling listed for plenum, riser and general-purpose use shall be permitted to be installed exposed to the airflow in an air space below a raised floor.

11.3.7.2 Where the air space below a raised floor is not protected by an automatic fire suppression system, only signal wiring and cabling listed for plenum use shall be permitted to be installed exposed to the airflow in an air space below a raised floor.

11.3.7.3 Where the air space below a raised floor is not protected by an automatic fire suppression system, signal wiring and cabling listed for plenum, riser and general-purpose use shall be permitted to be installed in metal raceway in an air space below a raised floor.

A11.3.7* See 9.1.1.3. The installation of general-purpose and riser cables exposed to the airflow in the air space below a raised floor is permitted only where the space is protected by an automatic fire suppression system.

Section 645.5(E) needs to be revised to permit the use on riser and general-purpose cables (Types CL2R, CL3R, OFNR, OFCR, CL2, CL3, OFN and OFC) only where the under floor space has automatic fire suppression in place.

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Submitter Information Verification
Submitter Full Name: STANLEY KAUFMAN
Organization: CABLESAFE INCOFS
Affiliation: SPI
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jun 24 00:23:03 EDT 2015

Committee Statement

Committee Action: Rejected but held
Resolution: Holding this revision, awaiting the issuance of NFPA 75-2017 for final language.
(2) Installation Requirements for Electrical Supply Cords, Data Cables, Interconnecting Cables and Grounding Conductors Under a Raised Floor.

The following cords, cables and conductors shall be permitted to be installed under a raised floor:

(1) Supply cords of listed information technology equipment in accordance with 645.5(B)

(2) Interconnecting cables enclosed in a raceway

(3) Equipment grounding conductors

(4) In addition to wiring installed in compliance with 725.135(C), Types CL2R, CL3R, CL2, and CL3 and substitute cables including CMP, CMR, CM, and CMG installed in accordance with 725.154(A) shall be permitted under raised floors. Informational Note: Figure 725.154(A) illustrates the cable substitution hierarchy for Class 2 and Class 3 cables.

(5) Listed Type DP cable having adequate fire-resistant characteristics suitable for use under raised floors of an information technology equipment room

Informational Note: One method of defining fire resistance is by establishing that the cables do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Tray Flame Test” in UL 1685-2011, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable. Another method of defining fire resistance is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA “Vertical Flame Test — Cables in Cable Trays,” as described in CSA C22.2 No. 0.3-M2001 2009, Test Methods for Electrical Wires and Cables.

Statement of Problem and Substantiation for Public Comment

Referenced current edition of CSA C22.2 0.3.

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<tr>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]
Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]
Public Comment No. 93-NFPA 70-2015 [Section No. 210.12(A)]
Public Comment No. 95-NFPA 70-2015 [Section No. 620.1]
Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack]
Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]
Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]
Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]
Public Comment No. 111-NFPA 70-2015 [Section No. 505.2]
Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]
Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]

Related Item
First Revision No. 3349-NFPA 70-2015 [Section No. 645.5(F)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 20:47:04 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3312-NFPA 70-2015
Statement: Panel 12 revised 645.5(E) to improve clarity by eliminating the list items and the redundancies that were included. This complies with the Correlating Committee directive.

Updating the reference to CSA 22.2, the official CSA standard number is C22.2 NO. 0.3-09.
Public Comment No. 44-NFPA 70-2015 [Section No. 645.5(E)(3)]

(3) Installation Requirements for Optical Fiber Cables Under a Raised Floor.

In addition to

1. Where the air space below a raised floor is not protected by an automatic fire suppression system, only optical fiber cables installed in accordance with 770.113(C) shall be permitted under the raised floor.

2. Where the air space below a raised floor is protected by an automatic fire suppression system, optical fiber cables installed in accordance with 770.113(C), Types OFNR, OFCR, OFN, and OFC shall be permitted under the raised floor.

Statement of Problem and Substantiation for Public Comment

The development schedule of the 2016 edition of NFPA 75, Standard for the Fire Protection of Information Technology Equipment is about 6 months ahead of the development schedule for NFPA 70. There are pending changes to the wiring requirements in NFPA 75 that will require correlating changes in Article 645.

The text of section 11.3.7 and the explanatory Annex Note A11.3.7 in NFPA 75-2016 will be:

11.3.7* Signal wiring and cabling, including optical fiber cables, installed in an air space below a raised floor shall be listed.

11.3.7.1 Where the air space below a raised floor is protected by an automatic fire suppression system, signal wiring and cabling listed for plenum, riser and general-purpose use shall be permitted to be installed exposed to the airflow in an air space below a raised floor.

11.3.7.2 Where the air space below a raised floor is not protected by an automatic fire suppression system, only signal wiring and cabling listed for plenum use shall be permitted to be installed exposed to the airflow in an air space below a raised floor.

11.3.7.3 Where the air space below a raised floor is not protected by an automatic fire suppression system, signal wiring and cabling listed for plenum, riser and general-purpose use shall be permitted to be installed in metal raceway in an air space below a raised floor.

A11.3.7* See 9.1.1.3. The installation of general-purpose and riser cables exposed to the airflow in the air space below a raised floor is permitted only where the space is protected by an automatic fire suppression system.

Section 645.5(E) will need to be revised to permit the use on riser and general-purpose cables (Types CL2R, CL3R, OFNR, OFCR, CL2, CL3, OFN and OFC) only where the under floor space has automatic fire suppression in place.

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<tr>
<td>First Revision No. 3354-NFPA 70-2015 [Section No. 645.5(E)]</td>
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</table>

Submitter Information Verification

Submitter Full Name: STANLEY KAUFMAN
Organization: CABLESAFE INCOFS
Affiliation: SPI
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 00:34:18 EDT 2015

Committee Statement

Committee Action: Rejected but held
Resolution: Holding this revision, awaiting the issuance of NFPA 75-2017 for final language.
Securing in Place.

Power cables; communications cables; connecting cables; interconnecting cables; and associated boxes, connectors, plugs, and receptacles that are listed as part of, or for, information technology equipment shall not be required to be secured in place where installed under raised floors.

Informational Note: Cables listed for information technology equipment are not required to be secured in place. For all other underfloor cables see 645.5(E) and 300.11.

Statement of Problem and Substantiation for Public Comment

FR #3349 added the words "where installed under raised floors" to ensure that cables or cables in raceway installed above a raised floor are secured in place. The Panel statement that "The panel retains the requirement of securing raceways" implies that the common practice of using ITE listed liquid-tight flexible conduit under a floor would require fastening in place. That was probably not the panel's intent, which probably meant to address raceways above the floor. An informational note is provided to clarify the sections of the code that apply to cables that are not listed for information technology equipment. 300.11 covers securing and supporting of supply conductors. 645.5(E) covers branch circuits under a raised floor. Readers might perceive a contradiction between 645.5(E)(2) and 645.5(F).

Related Item

First Revision No. 3349-NFPA 70-2015 [Section No. 645.5(F)]

Submitter Information Verification

Submitter Full Name: Robert Jensen
Organization: dbi-Telecommunication Infrastr
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 10:14:43 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3313-NFPA 70-2015
Statement: Added informational note referencing section 300.11 for securement requirements.
(4)
Additional means to prevent unintentional operation of remote disconnect controls shall be permitted.

Informational Note: For further information, see NFPA 75-2013, Standard for the Fire Protection of Information Technology Equipment.

Statement of Problem and Substantiation for Public Comment

NFPA 75 is in the 2015 Fall Revision Cycle. The NITMAM posting date is 10/16/2015. If there are no certified NITMAMs, the 2016 edition of NFPA 75 will be issued on 11/10/2015.

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<td>Public Comment No. 26-NFPA 70-2015 [Section No. 645.4]</td>
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Related Item
First Revision No. 3351-NFPA 70-2015 [Section No. 645.10(A)(4)]

Submitter Information Verification

Submitter Full Name: STANLEY KAUFMAN
Organization: CABLESAFE INCOFS
Affiliation: SPI
Street Address: 
City: 
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Submittal Date: Tue Jun 23 15:45:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3314-NFPA 70-2015
Statement: Panel 12 updated the reference to NFPA 75 to current edition.
Public Comment No. 1841-NFPA 70-2015 [ Section No. 645.10(B) ]

(B) Critical Operations Data Systems.
Remote disconnecting controls shall not be required for critical operations data systems when all of the following conditions are met:

(1) An approved procedure has been established and maintained for removing power and air movement within the room or zone.
(2) Qualified personnel are continuously available to advise emergency responders and to instruct them of disconnecting methods.
(3) A smoke-sensing fire detection system is in place.

Informational Note: For further information, see NFPA 72-2013, National Fire Alarm and Signaling Code.
(4) An approved fire suppression system suitable for the application is in place.
(5) Cables installed under a raised floor, other than branch-circuit wiring, and power cords are installed in compliance with 645.5(E)(2) or (E)(3), or in compliance with Table 645.10(B)(5).

Table 645.10(B)(5) Cables Installed Under Raised Floors

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Applicable Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branch circuits under raised floors</td>
<td>645.5(E)(1)</td>
</tr>
<tr>
<td>Supply cords of listed information technology Equipment</td>
<td>645.5(E)(2)(a), 300.22(C)</td>
</tr>
<tr>
<td>Class 2 &amp; Class 3 remote control, &amp; PLTC cables in other spaces used for</td>
<td>725.135(BC) and</td>
</tr>
<tr>
<td>environmental air (plenums)</td>
<td>Table 725.154</td>
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<tr>
<td>Optical fiber cable in other spaces used for environmental air (plenums)</td>
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<tr>
<td>Communications wire &amp; cable, cable routing assemblies, and</td>
<td>770.113(C) and</td>
</tr>
<tr>
<td>communications raceways in other spaces used for environmental air (</td>
<td>Table 770.154(a)</td>
</tr>
<tr>
<td>plenums)</td>
<td></td>
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<tr>
<td>Coaxial CATV &amp; radio distribution cables in other spaces used for</td>
<td>800.113(C) and</td>
</tr>
<tr>
<td>environmental air (plenums)</td>
<td>Tables 800.154(a), (b) &amp; (C)</td>
</tr>
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</table>

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 3350.

Related Item
First Revision No. 3355-NFPA 70-2015 [Section No. 645.10(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 11:17:38 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3315-NFPA 70-2015
(B) Critical Operations Data Systems.

Remote disconnecting controls shall not be required for critical operations data systems when all of the following conditions are met:

1. An approved procedure has been established and maintained for removing power and air movement within the room or zone.
2. Qualified personnel are continuously available to advise emergency responders and to instruct them of disconnecting methods.
3. A smoke-sensing fire detection system is in place.

Informational Note: For further information, see NFPA 72 - 2013, National Fire Alarm and Signaling Code.

4. An approved fire suppression system suitable for the application is in place.
5. Cables installed under a raised floor, other than branch-circuit wiring, and power cords are installed in compliance with 645.5(E)(2) or (E)(3), or in compliance with Table 645.10(B)(5).

Table 645.10(B)(5) Cables Installed Under Raised Floors

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<thead>
<tr>
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<td>645.5(E)(1)</td>
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<td>Supply cords of listed information technology Equipment</td>
<td>645.5(E)(2)(a), 300.22(C)</td>
</tr>
<tr>
<td>Class 2 &amp; Class 3 remote control, &amp; PLTC cables in other spaces used for environmental air (plenums)</td>
<td>725.135(BC) and Table 725.154</td>
</tr>
<tr>
<td>Optical fiber cable in other spaces used for environmental air (plenums)</td>
<td>770.113(C) and Table 770.154(a)</td>
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<tr>
<td>Communications wire &amp; cable, cable routing assemblies, and communications raceways in other spaces used for environmental air (plenums)</td>
<td>800.113(C) and Tables 800.154(a), (b) &amp; (c)</td>
</tr>
<tr>
<td>Coaxial CATV &amp; radio distribution cables in other spaces used for environmental air (plenums)</td>
<td>820.113(C) and Tables 820.154(a), (b) &amp; (c)</td>
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Statement of Problem and Substantiation for Public Comment

This Public Comment corrects numerous typographical errors in the text.

Related Item
First Revision No. 3355-NFPA 70-2015 [Section No. 645.10(B)]

Submitter Information Verification

Submitter Full Name: STANLEY KAUFMAN
Organization: CABLESAFE INCOFS
Affiliation: SPI
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jun 25 01:04:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3315-NFPA 70-2015
645.18 Surge Protection for Critical Operations Data Systems
Surge protection shall be provided for critical operations data systems.

Statement of Problem and Substantiation for Public Comment
FR 3356 added the new 645.18 to require surge protection for critical operations data systems. This requirement, which recognizes a standard best practice in all ITE rooms, is basically unenforceable. Use of surge protectors must be carefully engineered and can appear in many places within a data center, from upstream switchgear through distribution systems, equipment racks, and even integrated into the IT equipment itself. Improper use of surge equipment, such as clamping to an incorrect voltage, improper installation, or improper series-connected devices, can actually increase the risk of critical equipment shutdown. 645.18 gives no guidance to the installer or to the authority having jurisdiction. The entire requirement is not useful and is unenforceable. 645.18 should be deleted.

Related Item:
First Revision No. 3356-NFPA 70-2015 [New Section after 645.17]

Submitter Information Verification
Submitter Full Name: Robert Jensen
Organization: dbi-Telecommunication Infrastr
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 10:20:11 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Panel 12 reaffirms its position to include requirements for surge protection in critical operations data systems. The regulation is broad to allow various technologies to be used to comply with the rule. The Code is not intended as a design specification.
Public Comment No. 773-NFPA 70-2015 [Section No. 645.18]

645.18 Surge Protection for Critical Operations Data Systems
Surge protection shall be provided for critical operations data systems.

Statement of Problem and Substantiation for Public Comment

IEC's position is to delete proposed new section 645.18 (FR 3356).

The panel has not provided any substantiation that a problem exists. The panel has also not provided a location or energy level needed to meet this requirement. Most if not all Data Systems come with internal isolation transformers located within UPS equipment that act as a large inductor damping or eliminating transients as they are created on the input to the equipment. Switching transients on the load side of the UPS are highly unlikely.

Related Item
First Revision No. 3356-NFPA 70-2015 [New Section after 645.17]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 19 14:51:37 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Panel 12 reaffirms its position to include requirements for surge protection in critical operations data systems. The regulation is broad to allow various technologies to be used to comply with the rule. The Code is not intended as a design specification.
646.1 Scope.

This article covers modular data centers.

Informational Note No. 1: Modular data centers include the installed information technology equipment (ITE) and support equipment, electrical supply and distribution, wiring and protection, working space, grounding, HVAC, and the like, that are located in an equipment enclosure.

Informational Note No. 2: For further information, see NFPA 75-2013, Standard for the Protection of Information Technology Equipment, which covers the requirements for the protection of information technology equipment and systems in an information technology equipment room.

Statement of Problem and Substantiation for Public Comment

NFPA 75 is in the 2015 Fall Revision Cycle. The NITMAM posting date is 10/16/2015. If there are no certified NITMAMs, the 2016 edition of NFPA 75 will be issued on 11/10/2015.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
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<tr>
<td>Public Comment No. 25-NFPA 70-2015 [Section No. 645.1]</td>
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<tr>
<td>Public Comment No. 26-NFPA 70-2015 [Section No. 645.4]</td>
<td></td>
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<tr>
<td>Public Comment No. 29-NFPA 70-2015 [Section No. 645.10(A)(4)]</td>
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<tr>
<td>First Revision No. 3396-NFPA 70-2015 [Section No. 646.1]</td>
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Submitter Information Verification

Submitter Full Name: STANLEY KAUFMAN
Organization: CABLESAFE INCOFS
Affiliation: SPI
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Jun 23 15:49:42 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3320-NFPA 70-2015
Statement: Panel 12 updated the reference to NFPA 75 to current edition.
Public Comment No. 46-NFPA 70-2015 [Section No. 646.3(B)]

(B) Wiring and Cabling in Other Spaces Used for Environmental Air (Plenums).

The following sections and tables shall apply to wiring and cabling in other spaces used for environmental air (plenums) above an information technology equipment room:

1. Wiring methods: 300.22(C)(1)
2. Class 2, Class 3, and PLTC cables: 725.135(C) and Table 725.154
3. Fire alarm systems: 760.53(B)(2), 725.135(C) and Table 760.154
4. Optical fiber cables: 770.113(C) and Table 770.154(a)
5. Communications circuits: 800.113(C) and Table 820.154(a), (b), and (c)
6. CATV and radio distribution systems: 820.113(C) and Table 820.154(a)

Informational Note: Environmentally controlled working spaces, aisles, and equipment areas in an MDC are not considered a plenum.

Statement of Problem and Substantiation for Public Comment

This Public Comment corrects five typographical errors in the text.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tr>
<td>Public Comment No. 45-NFPA 70-2015 [Section No. 645.3(B)]</td>
<td>Related Item</td>
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<td>First Revision No. 3398-NFPA 70-2015 [Section No. 646.3(B)]</td>
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Submitter Information Verification

Submitter Full Name: STANLEY KAUFMAN
Organization: CABLESAFE INCOFS
Affiliation: SPI
Street Address: City:
State:
Zip:
Submittal Date: Thu Jun 25 00:55:48 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3321-NFPA 70-2015
Statement: Panel 12 clarifies that 646.3(B) applies to all environmental air spaces (plenums) within the Modular Data Center. The Panel also edited the references in list items to the correct sections and tables.
Public Comment No. 540-NFPA 70-2015 [Section No. 646.3(B)]

(B) Wiring and Cabling in Other Spaces Used for Environmental Air (Plenums).

The following sections and tables shall apply to wiring and cabling in other spaces used for environmental air (plenums) above an information technology equipment room within a modular data center space:

1. Wiring methods: 300.22(C)(1)
2. Class 2, Class 3, and PLTC cables: 760.135(C) and Table 725.154
3. Fire alarm systems: 760.53(B)(2), 725.135(C) and Table 760.154
4. Optical fiber cables: 770.113(C) and Table 770.154(a)
5. Communications circuits: 800.113(C) and Table 770.154(a), (b), and (c)
6. CATV and radio distribution systems: 800.113(C) and Table 800.154(a)

Informational Note: Environmentally controlled working spaces, aisles, and equipment areas in an MDC are not considered a plenum.

Statement of Problem and Substantiation for Public Comment

FR 3398 Revised the introductory paragraph in 646.3(B) to be in bullet form and to apply to spaces above an ITE room. ITE rooms are covered by Article 645. This is Article 646 for Modular Data Centers. This comment revises the text to apply to Modular Data Centers. The reference to CATV in 646.3(B)(6) is revised to show the correct NEC section.

Related Item
First Revision No. 3398-NFPA 70-2015 [Section No. 646.3(B)]

Submitter Information Verification

Submitter Full Name: Robert Jensen
Organization: dbi-Telecommunication Infrastr
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 10:24:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3321-NFPA 70-2015
Statement: Panel 12 clarifies that 646.3(B) applies to all environmental air spaces (plenums) within the Modular Data Center. The Panel also edited the references in list items to the correct sections and tables.
(F) Cable Routing Assemblies _and_ Communications Wires, Cables, Raceways, and Equipment.

Parts I, II, III, IV, and V of Article 800 shall apply to cable routing assemblies, communications wires, cables, raceways, and equipment installed in an MDC. Only communications wires and cables listed in accordance with 800.179, cable routing assemblies and communications raceways listed in accordance with 800.182, and communications equipment listed in accordance with 800.170 shall be permitted to be installed in an MDC.

Informational Note: See Part I of Article 100 for a definition of communications equipment.

**Statement of Problem and Substantiation for Public Comment**

FR 3401 changed the title of 646.3(F) from "Communications Equipment" to "Cable Routing Assemblies, Communications Wires, Cable, Raceways, and Equipment." This editorial comment inserts the word "AND" to distinguish cable routing assemblies from communications equipment; cable routing assemblies are not communications wires, cables, raceways or equipment.

**Related Item**

First Revision No. 3401-NFPA 70-2015 [Section No. 646.3(F)]

**Submitter Information Verification**

Submitter Full Name: Robert Jensen  
Organization: dbi-Telecommunication Infrastr  
Affiliation: BICSI  
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State:  
Zip:  
Submittal Date: Fri Sep 04 10:29:02 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR  
Resolution: SR-3322-NFPA 70-2015  
Statement: Panel 12 inserted the word "and" to distinguish cable routing assemblies from communications equipment; cable routing assemblies are not communications wires, cables, raceways or equipment.
Public Comment No. 1842-NFPA 70-2015 [Section No. 646.3(H)]

(H) Storage Batteries.

Installation of storage batteries shall comply with Article 480.

Exception: Batteries that are part of listed and labeled equipment and installed in accordance with the listing requirements shall not be required to be installed in compliance with Article 480.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that FR 3403 be rewritten to comply with the NEC Style Manual.

Related Item
First Revision No. 3403-NFPA 70-2015 [Section No. 646.3(H)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 11:18:29 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3323-NFPA 70-2015
Statement: Panel 12 made editorial revisions to comply with Correlating Committee directive by rewording the section to be Style Manual compliant while maintaining the intended requirements and permissions.
(H) Storage Batteries.

Installation of storage batteries shall comply with Article 480.

Exception: Batteries that are part of listed and labeled equipment and installed in accordance with the listing requirements shall not be required to be installed in compliance with Article 480.

Informational Note: Batteries that are integrated components within a listed device are not subject to Article 480. Battery systems that are assembled at the site are subject to all of the provisions of Article 480.

Statement of Problem and Substantiation for Public Comment

Batteries that are components within a piece of listed information technology equipment (ITE) are included in the safety listing of that product and are not subject to Article 480 for stationary batteries. Such systems, although listed, might not always have a label. Batteries that are in a battery cabinet (e.g., UPS systems) or are assembled on racks in battery rooms fall under Article 480. In the latter case, the individual single-cell or multi-cell container should be listed and, depending upon the size of the container, might be labeled. These components are assembled into a system which can include such things as inter-cell, inter-tier, and inter-rack connectors, overcurrent protective devices, monitoring system, or other elements which together constitute a battery system. If factory-assembled, as in the case of a battery cabinet, the cabinet might be listed and labeled. When a battery system is assembled at site, the system will not be listed or labeled, although the individual components might be listed or recognized. This comment removes the words "and labeled." It also adds a new informational note to clarify that batteries embedded into listed ITE equipment are not covered by Article 480.

Related Item
First Revision No. 3403-NFPA 70-2015 [Section No. 646.3(H)]

Submitter Information Verification

Submitter Full Name: Robert Jensen
Organization: dbi-Telecommunication Infrastr
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 10:32:54 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3323-NFPA 70-2015
Statement: Panel 12 made editorial revisions to comply with Correlating Committee directive by rewording the section to be Style Manual compliant while maintaining the intended requirements and permissions.
Public Comment No. 339-NFPA 70-2015 [Section No. 646.7(B)]

(B) MDCs Connected to Branch Circuits and Feeders.

Modular data centers that connect to a branch circuit or a feeder circuit shall have a short-circuit current rating not less than the available fault current of the branch circuit or feeder. The short-circuit current rating of the MDC shall be based on the short-circuit current rating of a listed and labeled MDC or the short-circuit current rating established utilizing an approved method.

Informational Note No. 1: UL 508A-2001 2013, Standard for Industrial Control Panels, Supplement SB, is an example of an approved method.

Informational Note No. 2: This requirement does not apply to listed and labeled equipment connected to branch circuits located inside of the MDC equipment enclosure.

Statement of Problem and Substantiation for Public Comment

Referenced current edition of UL 508A.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
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<tbody>
<tr>
<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
<td>Referenced current edition of UL 508A.</td>
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</table>

Related Item

First Revision No. 3349-NFPA 70-2015 [Section No. 645.5(F)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sat Aug 01 23:32:40 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3324-NFPA 70-2015
Statement: Panel 12 updated reference to the current edition of UL508A. Also changed Informational Note No. 2 to an exception in order to be compliant with Style Manual while retaining the intended exception.
MDCs Powered from Separate MDC System Enclosures.

Modular data center equipment enclosures, powered from a separate MDC system enclosure that is part of the specific MDC system, shall have a short-circuit current rating coordinated with the powering module in accordance with 110.10.


Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
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<tr>
<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
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<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
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<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
<td>Referenced current edition.</td>
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<td>Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]</td>
<td>Referenced current edition.</td>
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<td>Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]</td>
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<td>Referenced current edition.</td>
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<td>Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]</td>
<td>Referenced current edition.</td>
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<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
<td>Referenced current edition.</td>
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<tr>
<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
<td>Referenced current edition.</td>
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<tr>
<td>Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]</td>
<td>Referenced current edition.</td>
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<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
<td>Referenced current edition.</td>
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<td>Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]</td>
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<td>Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]</td>
<td>Referenced current edition.</td>
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<td>Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]</td>
<td>Referenced current edition.</td>
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<tr>
<td>Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]</td>
<td>Referenced current edition.</td>
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<tr>
<td>Public Comment No. 339-NFPA 70-2015 [Section No. 646.7(B)]</td>
<td>Referenced current edition.</td>
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Related Item

First Revision No. 3349-NFPA 70-2015 [Section No. 645.5(F)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
<table>
<thead>
<tr>
<th>Committee Statement</th>
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<td><strong>Committee Action:</strong></td>
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<tr>
<td><strong>Resolution:</strong></td>
</tr>
<tr>
<td><strong>Statement:</strong></td>
</tr>
</tbody>
</table>
646.13 Other Electrical Equipment.

Only listed information technology equipment shall be permitted to be installed in an MDC. Electrical equipment that is an integral part of the MDC, including information technology equipment, lighting, control, power, HVAC (heating, ventilation, and air-conditioning), emergency lighting, alarm circuits, and so forth, shall comply with the requirements for its use and installation and shall be listed and labeled.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 3404. Additionally, the entire section must be revised to comply with the NEC Style Manual.

Related Item

First Revision No. 3406-NFPA 70-2015 [Section No. 646.13]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 11:19:32 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3326-NFPA 70-2015
Statement: Panel 12 removed the first sentence for clarification. The sentence implied that only listed information technology equipment could be installed in the MDC, which is incorrect.
Only listed information technology equipment shall be permitted to be installed in an MDC. Electrical equipment that is an integral part of the MDC, including information technology equipment, lighting, control, power, HVAC (heating, ventilation, and air-conditioning), emergency lighting, alarm circuits, and so forth, shall comply with the requirements for its use and installation and shall be listed and labeled.

Statement of Problem and Substantiation for Public Comment

This is an editorial comment to add clarity. The language that was added in FR 3406 could be easily misinterpreted to mean that nothing but ITE could be installed in an MDC... which of course was not the intent. This comment follows the format of 645.4(3), which states: "All information technology and communications equipment installed in the room is listed."

Related Item
First Revision No. 3406-NFPA 70-2015 [Section No. 646.13]

Submitter Information Verification
Submitter Full Name: Robert Jensen
Organization: dbi-Telecommunication Infrastr
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 10:39:01 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3326-NFPA 70-2015
Statement: Panel 12 removed the first sentence for clarification. The sentence implied that only listed information technology equipment could be installed in the MDC, which is incorrect.
650.1 Scope.
This article covers those electrical circuits and parts of electrically operated pipe organs that are employed for the control of the keyboards and of the sounding apparatus, typically organ pipes.

Informational Note: The typical pipe organ is a very large musical instrument. See Informational Note Figure 650.1.

Informational Note Figure 650.1 The illustration shows the pipes of a pipe organ.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs that further consideration be given to the comments expressed in voting relative to the usefulness of the Informational Note and Figure. Additionally, the entire section must be revised to comply with the NEC Style Manual.

Related Item
First Revision No. 3318-NFPA 70-2015 [Section No. 650.1]
First Revision No. 3326-NFPA 70-2015 [New Section after 650.8]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 11:20:21 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3316-NFPA 70-2015
Statement: The revised text complies with the Correlating Committee directive. The Panel has deleted the illustration and added additional text to the informational note for clarity. The revision to the Informational Note makes the section in compliance with the Style Manual.
668.1 Scope.

The provisions of this article apply to the installation of the electrical components and accessory equipment of electrolytic cells, electrolytic cell lines, and process power supply for the production of aluminum, cadmium, chlorine, copper, fluorine, hydrogen peroxide, magnesium, sodium, sodium chlorate, and zinc.

Not covered by this article are cells used as a source of electric energy and for electroplating processes and cells used for the production of hydrogen.

Informational Note No. 1: In general, any cell line or group of cell lines operated as a unit for the production of a particular metal, gas, or chemical compound may differ from any other cell lines producing the same product because of variations in the particular raw materials used, output capacity, use of proprietary methods or process practices, or other modifying factors to the extent that detailed Code requirements become overly restrictive and do not accomplish the stated purpose of this Code.


Statement of Problem and Substantiation for Public Comment

Referenced current edition.

Related Item

First Revision No. 3334-NFPA 70-2015 [Section No. 668.11(B)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 01 02:50:37 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3317-NFPA 70-2015
Statement: The panel updated the standard referenced in Informational note 2 to the current edition and kept the wording “Standard for” to correlate with the title of IEEE463. The scope was editorially revised to remove the superfluous words “The provisions of”. 
Public Comment No. 1301-NFPA 70-2015 [Sections 670.5(1), 670.5(2)]

<table>
<thead>
<tr>
<th>Sections 670.5(1), 670.5(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Industrial machinery shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with 670.3(A)(4).</td>
</tr>
<tr>
<td>(2) Industrial machinery shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault-current calculation was performed and be of sufficient durability to withstand the environment involved.</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

"Short-circuit current" is the correct terminology.

Related Item
First Revision No. 3336-NFPA 70-2015 [Section No. 670.5]

Submitter Information Verification

- **Submitter Full Name:** John Kovacik
- **Organization:** UL LLC
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Thu Sep 24 18:38:25 EDT 2015

Committee Statement

- **Committee Action:** Accepted
- **Resolution:** SR-3336-NFPA 70-2015
- **Statement:** "Short-circuit current" is the correct terminology.
Public Comment No. 755-NFPA 70-2015 [Section No. 670.5(2)]

(2)
Industrial machinery shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault-current calculation was performed and be of sufficient durability to withstand the environment involved.

Statement of Problem and Substantiation for Public Comment

IEC's position is to delete 670.5 - (FR 3336)

The code already requires that equipment be installed according to available fault current, so adding this requirement is redundant. The installer/supplier already has the responsibility/liability to install the proper equipment based on the characteristics of the system. This proposal puts too much liability on the contractor/supplier because after installation various factors can change which will affect the available fault current. Feeders can be reworked, transformers can be changed with different impedance values, motor loads can be added to the existing system and similar factors that can change the available fault current. In the case of a lawsuit, the installer will have the burden of proof that the installation was done according to code and would result in unnecessary costs for defending an installation that was installed correctly, but that had variables change that are out of their control. A better proposal would be to require the owner to relabel the equipment after any alteration to the system.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Comment No. 749-NFPA 70-2015 [Section No. 700.5(E)]</td>
<td>Related Comment</td>
</tr>
<tr>
<td>Public Comment No. 750-NFPA 70-2015 [Section No. 701.5(D)]</td>
<td>Related Comment</td>
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<tr>
<td>Public Comment No. 751-NFPA 70-2015 [Section No. 702.5]</td>
<td>Related Comment</td>
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<tr>
<td>Public Comment No. 752-NFPA 70-2015 [Section No. 708.24(E)]</td>
<td>Related Comment</td>
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<tr>
<td>Public Comment No. 630-NFPA 70-2015 [Section No. 409.23]</td>
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<tr>
<td>Public Comment No. 631-NFPA 70-2015 [Section No. 430.99]</td>
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<td>Public Comment No. 748-NFPA 70-2015 [Section No. 620.51(D)(2)]</td>
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<tr>
<td>Public Comment No. 754-NFPA 70-2015 [Section No. 440.10(B)]</td>
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<td>First Revision No. 3336-NFPA 70-2015 [Section No. 670.5]</td>
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Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 18 20:50:59 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: First Revision No. 3336 added requirements to ensure that industrial machinery is properly installed and eases enforcement. Requiring a field marking of the available fault current, at the industrial machinery, ensures the equipment is installed where fault currents do not exceed the equipment’s short circuit current rating as required in 670.5 (1).
Public Comment No. 775-NFPA 70-2015 [Section No. 670.6]

Industrial machinery with safety interlock circuits shall have surge protection installed.

Statement of Problem and Substantiation for Public Comment

IEC’s position is to delete 670.6 (FR 3357)

No substantiation has been provided by the submitter that a surge protection device is needed for industrial machinery with safety interlocks. The proposed text does not provide where the surge protection is located, and does not provide how to rate or size the surge protection. This is a design issue and the user of the standard may very well have surge protection upstream of the machine and adding another unit may be redundant and not necessary.

Related Item
First Revision No. 3357-NFPA 70-2015 [New Section after 670.5]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 19 15:05:39 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The committee reaffirms its position to include requirements for surge protection in industrial machinery. Technical substantiation was provided in the committee statement to First Revision No. 3357 and Public Input No. 4156. The regulation is broad to allow various technologies to be used to comply with the rule.
680.4 Approval of Equipment.
All electrical equipment installed in the water, walls, or decks of pools, fountains, and similar installations shall comply with the provisions of this article. Equipment and products shall be listed for swimming pool and spa use.

Statement of Problem and Substantiation for Public Comment

Wanting equipment and products used in the swimming pool and spa environment to be listed is a good thing, but listed for what? Prior to the 2005 NEC revision cycle, the NEC Technical Correlating Committee issued a directive to all of the Code Making Panels to clear up what "listed for the purpose" meant in their particular articles. In other words, don't just tell the user of the Code that something has to be "listed for the purpose" but tell us what that purpose is. That 2005 Code cycle was when CMP-17 changed 680.23(A)(2) from "transformers or power supplies used to supply underwater luminaires shall be listed for the purpose" to "transformers or power supplies used to supply underwater luminaires shall be listed for swimming pool and spa use." The presently proposed text would allow any equipment that was "listed" to used in the swimming pool and spa environment. This equipment could be "listed" for a dry location. Simply trying to close a loop-hole here gentleman.

Related Item
Public Input No. 3834-NFPA 70-2014 [Section No. 680.4]
First Revision No. 4851-NFPA 70-2015 [Section No. 680.4]

Submitter Information Verification
Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 16:27:51 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-4815-NFPA 70-2015
Statement: The text "listed" alone would allow for listed units that would require the Inspection Authority to search in various databases of the certification agencies while conducting inspection in the field. This is inconvenient and sometimes difficult. The text "and labeled" was added as this would mandate a certification (listing) mark on the product or its smallest unit container for small components such as wire connectors. The text "for swimming pool use" was not added to this section as it would then apply to all electrical products used in the Article. This would include conduit, wire connectors and grounding and bonding equipment that are not listed for swimming pool use. Text such as "identified for swimming pool and spa use" would be appropriate in other sections of the Article.
680.7, Grounding and Bonding Terminals.

Grounding and bonding terminals shall be identified for use in wet and corrosive environments. Field-installed grounding and bonding connections in a damp, wet, or corrosive environment shall be composed of copper, copper alloy, or stainless steel. They shall be listed for direct burial or concrete-encasement use.

Statement of Problem and Substantiation for Public Comment

Ground clamps listed and identified for use with rebar are typically listed for concrete encasement (not just direct burial if at all). These rebar ground clamps are used regularly for the equipotential bonding grid at swimming pool structures. By adding "or concrete-encasement" will enhance this requirement.

Related Item

Public Input No. 3883-NFPA 70-2014 [New Section after 680.5]
First Revision No. 4852-NFPA 70-2015 [New Section after 680.6]

Submitter Information Verification

Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 16:59:32 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4816-NFPA 70-2015
Statement: The requirements for grounding and bonding equipment in UL 467 do not at present have an option of a rating "wet or corrosive environments". Requirements in UL 467 for a rating of direct burial would mandate materials that have proven resistant to the corrosive environments around swimming pool equipment: stainless steel, copper and high copper content copper alloys. The text "or concrete encasement" is not necessary as the marking for the listed terminal would be "direct burial or DB". The text "and labeled" was added as this would mandate a certification (listing) mark on the product or its smallest unit container for small components such as wire connectors. The text "listed" alone would allow for listed units that would require the Inspection Authority to search in various databases of the certification agencies while conducting inspection in the field. This is inconvenient and sometimes difficult.
680.21 Motors.

(A) Wiring Methods.

The wiring to a pool motor shall comply with (A)(1) unless modified for specific circumstances by (A)(2), (A)(3), (A)(4), or (A)(5).

(1) General.

Where branch circuits for pool-associated motors are subject to physical damage and/or installed in wet, damp, or corrosive environments, that portion of the branch circuit shall be installed in rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, or Type MC cable, suitable for the conditions subject to that location.

Wiring methods installed in these locations shall contain an insulated copper equipment grounding conductor sized in accordance with Table 250.122 but not smaller than 12 AWG.

Where installed in dry, noncorrosive environments, branch circuits shall comply with the general requirements in Chapter 3.

(2) Flexible Connections.

Where necessary to employ flexible connections at or adjacent to the motor, liquidtight flexible metal or liquidtight flexible nonmetallic conduit with listed fittings shall be permitted.

(3) Cord-and-Plug Connections.

Pool-associated motors shall be permitted to employ cord-and-plug connections. The flexible cord shall not exceed 900 mm (3 ft) in length. The flexible cord shall include a copper equipment grounding conductor sized in accordance with 250.122 but not smaller than 12 AWG. The cord shall terminate in a grounding-type attachment plug.

(B) Double Insulated Pool Pumps.

A listed cord-and-plug-connected pool pump incorporating an approved system of double insulation that provides a means for grounding only the internal and nonaccessible, non–current-carrying metal parts of the pump shall be connected to any wiring method recognized in Chapter 3 that is suitable for the location. Where the bonding grid is connected to the equipment grounding conductor of the motor circuit in accordance with the second sentence of 680.26(B)(6)(a), the branch-circuit wiring shall comply with 680.21(A).

(C) GFCI Protection.

Outlets supplying pool pump motors connected to single-phase, 120-volt through 240-volt branch circuits, whether by receptacle or by direct connection, shall be provided with ground-fault circuit-interrupter protection for personnel.

(D) SPGFCI Protection. Outlets supplying pool pump motors connected to single-phase and three-phase branch circuits, rated more that 150 volts to ground and up to 600 volts between ungrounded conductors, 100 amperes or less, whether by receptacle or by direct connection, shall be provided with special-purpose ground-fault circuit-interrupter protection for personnel.

Additional Proposed Changes

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<tr>
<th>File Name</th>
<th>Description</th>
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<tr>
<td>GFCI_Classes.pdf</td>
<td>GFCI Classes A, C, and D tripping Characteristics</td>
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Statement of Problem and Substantiation for Public Comment

The committee resolution of PI-2207 was: "GFCIs rated in excess of 250 volts do not always provide protection against "let-go" (devices trip at up to 20 mA) which is important when dealing with bodies of water due to the risk of drowning".

The submitter agrees with the committee that GFCI classes C, D and E (collectively referred to as SPGFCIs) don't provide let-go protection because of the 20 mA trip level which is above the let-go threshold. Yet, SPGFCIs provide protection against ventricular fibrillation, the condition that typically leads to cardiac arrest resulting in drowning. SPGFCIs use the same tripping characteristics of Class A GFCIs (A graph of the tripping characteristics is submitted with the support material of this public comment). The only difference is that the start of the curve (i.e. tripping action) is delayed from 6 mA to 20 mA (moved to the right).

Accordingly, SPGFCIs provide the exact protection level of Class A GFCIs for ground faults of 20 mA and higher. In other words, SPGFCIs are guaranteed to interrupt the source of power fast enough, and therefore protecting the person in the water from drowning, because the current going through the swimmer’s heart is interrupted.

During the first draft meeting, CMP 2 recognized SPGFCIs as a potential improvement to safety and created FR-339 and FR-347 to include a new definition for SPGFCIs and an installation requirement in Article 210.8(B) respectively.

Related Item

Public Input No. 2207-NFPA 70-2014 [Section No. 680.21(C)]
First Revision No. 339-NFPA 70-2015 [New Definition after Definition: Ground-Fault Circuit Inter...]
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

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<th>NEHAD EL-SHERIF</th>
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<td>Littelfuse Startco</td>
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Committee Statement

<table>
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<tr>
<td>Resolution:</td>
<td>This comment does not address the elevated risk of submersion, electroshock drowning, in a body of water and that muscular constriction starts at a level well below ventricular fibrillation. Due to the fact that muscular constriction would result in loss of body control, the ability to stay afloat or get out of the body of water would be severely impaired, leading to a high possibility of drowning. There is no substantiation that larger pumps have created an issue for occupants within the body of water. The higher trip level of the SPGFCI is not adequate for prevention of drowning.</td>
</tr>
</tbody>
</table>
(1) **General.**

Where branch circuits for pool-associated motors that are subject to physical damage and/or installed in, shall be installed in a wiring method that is identified for protection against physical damage. Branch circuits installed in wet, damp, or corrosive environments, that portion of the branch circuit, shall be installed in rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, reinforced thermosetting resin conduit, or Type MC cable, suitable for the conditions subject to a wiring method that is identified for the specific condition(s) at that location. Wiring methods installed in these locations shall contain an insulated copper equipment grounding conductor sized in accordance with Table 250.122 but not smaller than 12 AWG.

Where installed in dry, noncorrosive environments, branch circuits shall comply with the general requirements in Chapter 3.

**Statement of Problem and Substantiation for Public Comment**

This Comment is intended to simplify the Panel's stated goal of simplifying the wiring methods permitted for branch circuits to pool associated motors. However, some serious oversights are corrected in this Comment. For example, all PVC conduit is not identified for protection against physical damage or for all corrosive environments. Only Schedule 80 is suitable for protection against physical damage. PVC conduit in Schedules 40 and 80 are suitable for some but not all corrosive conditions. The manufacturers can and will willingly provide the list of corrosive conditions the PVC conduit is suitable for. Type RTRC conduit is not permitted where subject to physical damage unless identified for such use. This is stated in 355.12(C) under "Uses Not Permitted." Where subject to physical damage unless identified for such use. The UL White Book indicates only RTRC conduit with a suffix "XW" is suitable for protection against physical damage.

The term "identified" is defined in Article 100 and is recommended for use in this Section. It means recognized as suitable for the use. Manufacturers, product standards or the NEC in the XXX.10 and XXX.12 sections identify the Uses Permitted and Not Permitted. Furthermore, these wiring methods are required to be listed which provides information to the installer and inspector that the wiring method is suitable for the application.

**Related Item**

First Revision No. 4855-NFPA 70-2015 [Section No. 680.21(A)]

**Submitter Information Verification**

**Submitter Full Name:** Phil Simmons  
**Organization:** Simmons Electrical Services  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Thu Sep 17 23:19:14 EDT 2015

**Committee Statement**

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-4818-NFPA 70-2015  
**Statement:** Wiring methods that have been specifically evaluated for the type of corrosive environment around swimming pool pumps and sanitation chemicals are not as yet readily available. Made revisions to correlate with new Section 680.14. The wiring methods have had acceptable field history in swimming pool installations. The First Draft text referencing resistance to physical damage is not necessary as it applies to all wiring methods.
Public Comment No. 783-NFPA 70-2015 [Section No. 680.22(A)]

(A) Receptacles.

(1) Required Receptacle, Location.
Where a permanently installed pool is installed, no fewer than one 125-volt, 15- or 20-ampere receptacle on a general-purpose branch circuit shall be located not less than 1.83 m (6 ft) from, and not more than 6.0 m (20 ft) from, the inside wall of the pool. This receptacle shall be located not more than 2.0 m (6 ft 6 in.) above the floor, platform, or grade level serving the pool.

(2) Circulation and Sanitation System, Location.
Receptacles that provide power for water-pump motors or for other loads directly related to the circulation and sanitation system shall be located at least 1.83 m (6 ft) from the inside walls of the pool. These receptacles shall have GFCI protection and be of the grounding type.

(3) Other Receptacles, Location.
Other receptacles shall be not less than 1.83 m (6 ft) from the inside walls of a pool.

(4) GFCI Protection.
All 15- and 20-ampere, single-phase, 125-volt receptacles located within 6.0 m (20 ft) of the inside walls of a pool shall be protected by a ground-fault circuit interrupter.

(5) SPGFCI Protection
All 100 amperes or less, single-phase and three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, located within 6.0 (20 ft) of the inside walls of a pool shall be protected by a special-purpose ground-fault circuit interrupter.

(6) Measurements.
In determining the dimensions in this section addressing receptacle spacings, the distance to be measured shall be the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, doorway with hinged or sliding door, window opening, or other effective permanent barrier.

Additional Proposed Changes

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<tr>
<th>File Name</th>
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<tr>
<td>GFCI_Classes.pdf</td>
<td>Tripping characteristics of Classes A, C, and D GFCIs</td>
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Statement of Problem and Substantiation for Public Comment

The committee resolution of PI-2206 was: “GFCIs rated in excess of 250 volts do not always provide protection against "let-go" (devices trip at up to 20 mA) which is important when dealing with bodies of water due to the risk of drowning”.

The submitter agrees with the committee that GFCI classes C, D and E (collectively referred to as SPGFCIs) don’t provide let-go protection because of the 20 mA trip level which is above the let-go threshold. Yet, SPGFCIs provide protection against ventricular fibrillation, the condition that typically leads to cardiac arrest resulting in drowning. SPGFCIs use the same tripping characteristics of Class A GFCIs (A graph of the tripping characteristics is submitted with the support material of this public comment). The only difference is that the start of the curve (i.e. tripping action) is delayed from 6 mA to 20 mA (moved to the right).

Accordingly, SPGFCIs provide the exact protection level of Class A GFCIs for ground faults of 20 mA and higher. In other words, SPGFCIs are guaranteed to interrupt the source of power fast enough, and therefore protecting the person in the water from drowning, because the current going through the swimmer’s heart is interrupted.

During the first draft meeting, CMP 2 recognized SPGFCIs as a potential improvement to safety and created FR-339 and FR-347 to include a new definition for SPGFCIs and an installation requirement in Article 210.8(B) respectively.

Related Item

Public Input No. 2206-NFPA 70-2014 [Section No. 680.22(A)(4)]
First Revision No. 339-NFPA 70-2015 [New Definition after Definition: Ground-Fault Circuit Inter.]
First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: NEHAD EL-SHERIF
Organization: Littelfuse Startco
Street Address: National Fire Protection Association Report http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
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Public Comment No. 1100-NFPA 70-2015 [Section No. 680.22(A)(2)]

(2) Circulation and Sanitation System, Location.

Receptacles that provide power for water-pump motors or for other loads directly related to the circulation and sanitation system shall be located at least 1.83 m (6 ft) from the inside walls of the pool. These receptacles shall have GFCI protection and be of the grounding type, or not less than 900 mm (3 ft) from the inside walls of the pool if they meet all of the following conditions:

(1) Consist of a single receptacle
(2) Employ a locking configuration
(3) Be of the grounding type
(4) Include GFCI protection

Statement of Problem and Substantiation for Public Comment

This section got fouled up when the consistent distance of 1.83 m (6 ft) was desired and created for Article 680 during the 2008 NEC Code cycle. Prior to this 1.83 (6 ft) consistent distance for all or most measurements in Article 680, all receptacle outlets had to be at least 3.0 m (10 ft) from the water's edge except for the pool pump motor receptacle outlet, which could be located up to 1.5 m (5 ft) from the pool if it meet certain conditions (single, locking and grounding type, GFCI protected). This single and locking configuration eliminates someone plugging in a radio or something like that into the receptacle dedicated to the pool pump motor and setting the radio right beside the pool's edge. Pool equipment (including motors) are installed in close proximity to pools and spas on a regular basis. Since this change in the 2008 NEC, this is a common complaint among pool contractors and installers is that the NEC would no longer allow the receptacle for the pool pump motor to be located in close proximity to the pool as well. this restriction typically results in the motor being hard-wired. Any equipment located within 1.5 m (5 ft) of the pool would have to be bonded to the equipotential bonding grid. Any electrical equipment (pool pump motor) would have to be connected to the equipotential bonding grid regardless of it's location to the pool. With the single, locking and grounding type, GFCI-protected receptacle, I see no hazard that this allowance would create. This same basic requirement was part of the Code for years prior to the 2008 NEC and resulted in no major issues that I'm aware of.

Related Item
First Revision No. 4856-NFPA 70-2015 [Section No. 680.22(A)(2)]
Public Input No. 358-NFPA 70-2014 [Section No. 680.22(A)(2)]
Public Input No. 4351-NFPA 70-2014 [Section No. 680.22(A)(2)]

Submitter Information Verification

Submitter Full Name: L. Keith Lofland
Organization: International Association of Electrical Inspectors (IAEI)
Affiliation: None
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 17:17:32 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The 3 foot requirement would be new material not subject to the proper public review. As was discussed in the panel meeting during the PI stage, most equipment packages are being supplied without the required twistlock cord cap, thus creating a field modification to a piece of listed equipment. A receptacle placed 3 ft. from the inside walls of the pool would place the pump and other related equipment within the reach of occupants of the pool. Ground fault protection for personnel is not considered sufficient in this area.
(7) Low-Voltage Gas-Fired Electronic Luminaires, Fired Luminaires, Decorative Fireplaces, Fire Pits and Similar Equipment

Listed and labeled low-voltage gas-fired electronically ignited luminaires and outdoor luminaire lighting appliances with fired luminaires, decorative fireplaces, fire pits and similar equipment using low-voltage ignitors that do not require grounding, that do not exceed the low-voltage contact limit, and that are supplied by listed and labeled transformers or power supplies that comply with 680.23(A)(2) with outputs that do not exceed the low-voltage contact limit, shall be permitted to be located less than 1.5 m (5 ft) from the inside walls of the pool. Metallic luminaires and outdoor luminaire lighting appliances, equipment, shall be bonded in accordance with the requirements in 680.26(B). Transformers or power supplies supplying this type of equipment shall be installed in accordance with the requirements in 680.24. Metallic gas piping shall be bonded in accordance with the requirements in 250.104(B) and 680.26(B)(7).

Statement of Problem and Substantiation for Public Comment

Clarification of the meaning of “outdoor luminated lighting appliances” is required. This type of equipment includes gas-fired fireplaces, fire pits and similar equipment. In addition, clarification is needed that it is the equipment power supply that is “low voltage.” The text “and labeled” was added to replicate similar changes made by the Panel.

Related Item

First Revision No. 4857-NFPA 70-2015 [New Section after 680.22(B)(6)]

Submitter Information Verification

Submitter Full Name: Gary Siggins
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 14:16:55 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-4819-NFPA 70-2015
Statement: Clarification of the meaning of “outdoor luminated lighting appliances” is required. This type of equipment includes gas-fired fireplaces, fire pits and similar equipment. In addition, clarification is needed that it is the equipment power supply that is “low voltage.” The text “and labeled” was added to replicate similar changes made by the Panel.
Transformers and Power Supplies.

Transformers and power supplies used for the supply of underwater luminaires, together with the transformer or power supply enclosure, shall be listed, labeled and identified, for swimming pool and spa use. The transformer or power supply shall incorporate either a transformer of the isolated winding type, with an ungrounded secondary that has a grounded metal barrier between the primary and secondary windings, or one that incorporates an approved system of double insulation between the primary and secondary windings.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item

Public Comment No. 929-NFPA 70-2014 [Section No. 680.23(A)(2)]
First Revision No. 4803-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Committee Statement

Committee Action: Accepted
Resolution: SR-4820-NFPA 70-2015
Statement: The text “listed” alone would allow for listed units that would require the Inspection Authority to search in various databases of the certification agencies while conducting inspection in the field. This is inconvenient and sometimes difficult. The text “and labeled” was added as this would mandate a certification (listing) mark on the product. The additional text “and identified” accurately reflects the Definitions in Chapter 1. It is appropriate in this instance as there are Listed and Labeled transformers readily available that are not intended for swimming pool installations.
(1) Construction.

The junction box shall be listed, labeled and identified as a swimming pool junction box and shall comply with the following conditions:

(1) Be equipped with threaded entries or hubs or a nonmetallic hub
(2) Be comprised of copper, brass, suitable plastic, or other approved corrosion-resistant material
(3) Be provided with electrical continuity between every connected metal conduit and the grounding terminals by means of copper, brass, or other approved corrosion-resistant metal that is integral with the box

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Related Item
Public Comment No. 930-NFPA 70-2014 [Section No. 680.24(A)(1)]
First Revision No. 4803-NFPA 70-2015 [Global Input]

Submitter Information Verification
Committee Statement

Committee Action: Accepted
Resolution: SR-4821-NFPA 70-2015
Statement: The text “listed” alone would allow for listed units that would require the Inspection Authority to search in various databases of the certification agencies while conducting inspection in the field. This is inconvenient and sometimes difficult. The text “and labeled” was added as this would mandate a certification (listing) mark on the product. The additional text “and identified” accurately reflects the Definitions in Chapter 1. It is appropriate in this instance as there are Listed and Labeled equipment readily available that are not intended for swimming pool installations.
Public Comment No. 1055-NFPA 70-2015 [Section No. 680.25(1)]

(1) Feeders.
Where feeders are subject to physical damage and/or installed in wet, damp, or corrosive environments, that portion of the feeder shall be installed in rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, or reinforced thermosetting resin conduit, or listed cable wiring method, suitable for the conditions. Where installed in dry, noncorrosive environments, feeders shall comply with the general requirements in Chapter 3. Wiring methods installed in wet, damp, or corrosive environments shall contain an insulated copper or covered equipment grounding conductor sized in accordance with Table 250.122, but not less than 12 AWG copper or 10 AWG aluminum or copper-clad aluminum, shall be required.

Statement of Problem and Substantiation for Public Comment

There is lack of substantiation for what constitutes a defined "corrosive environment" and for adding copper as the "only" acceptable equipment grounding conductor when installed in wet, damp or corrosive environment. Section 250.118 permits copper, aluminum, or copper-clad aluminum that is insulated, covered, or bare as an equipment grounding conductor, so is the covered aluminum conductor in Type SE Cable, which is acceptable in a wet location above ground, considered a "corrosive environment"? For example, there is no evidence that Type SE-R Cable supplied from an exterior meter/main service equipment (wet location), that then enters the structure (on its path to an interior remote panelboard that may supply branch circuits to a pool application) is a shock hazard, yet it would be prohibited under the new language. However, if the FR 4863 is accepted as written it would have a negative impact on the use of a well-established and listed product that has a proven track record in wet, damp and dry locations. In addition, physical damage when considering corrosive locations is well established in Section 338.12(A)(1), (2) and (3) and if a specific location is determined to be a corrosive environment, Section 250.120(B) would also provide guidance. Type SE Cable, Both Style U and R have been used for many years in wet and damp locations which are arguably considered corrosive environments without any serious issues. The FR proposed by CMP 17 did not provide any guidance on what they considered a "corrosive environment" to support the new language.

Related Item
First Revision No. 4863-NFPA 70-2015 [Section No. 680.25(1)]

Submitter Information Verification

Submitter Full Name: John Weritz
Organization: The Aluminum Association
Affiliation: The Aluminum Association
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 12:47:01 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: See action taken in Second Revision No. 4817. The editorial additions to the code are considered new material, and therefore have not been reviewed by the public during the PI stage. Regarding the listed wiring method addition, the area around and near the pool is subject to conditions that require a prescriptive robust wiring method to maintain the protections needed for bodies of water that are subject to human activities. The panel needs more information regarding the PVC coated cable being acceptable for these locations. Also we need information regarding the ability of AL and copper-clad aluminum to withstand the exposure to the corrosive environments associated with pools and spas.
Public Comment No. 1243-NFPA 70-2015 [Section No. 680.25(1)]

(1) Feeders.
Where feeders are subject to physical damage and/or installed in wet, damp, or corrosive environments, that portion of the feeder shall be installed in rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, or reinforced thermosetting resin conduit, suitable for the conditions. Where installed in dry, noncorrosive environments, feeders shall comply with the general requirements in Chapter 3. Wiring methods installed in wet, damp, or corrosive environments shall contain an insulated copper equipment grounding conductor sized in accordance with Table 250.122, but not less than 12 AWG shall be required.

Informational Note: This would include the feeder/branch circuit to a self-contained spa or hot tub disconnect whether the disconnecting means has supplementary overcurrent device(s) in it or not.

Statement of Problem and Substantiation for Public Comment

There are a lot of AHJs that can't agree if you have to have an insulated EGC inside of the building to a hot tub disconnect. Some say you do if the disconnect has the GFCI breaker in it, because then it is a feeder. Then you don't if you put the GFCI in the main service then put a nonfusible disconnect by the hot tub, then it is a branch circuit. I have seen NM cable from the service to the hot tub disconnect for as long as I have been in the field, but then in the last couple years there has been confusion on this.

Related Item
First Revision No. 4863-NFPA 70-2015 [Section No. 680.25(1)]

Submitter Information Verification

Submitter Full Name: Brent Schoulte
Organization: South Dakota Electrical Comm
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 15:31:19 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The condition described in the Informational Note is covered by 680.42 and 680.43. There is no need to add this note at this location. This is a violation of the NEC style manual as you can't have requirements in an informational note.
Public Comment No. 731-NFPA 70-2015 [Section No. 680.25(1)]

(1) Feeders.
Where feeders are subject to physical damage, and/or, the wiring method shall be identified for protection against such damage. Wiring methods installed in wet, damp, or corrosive environments, that portion of the feeder shall be installed in rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit, or reinforced thermosetting resin conduit, suitable for the conditions shall be identified for such locations. Where installed in dry, noncorrosive environments, feeders shall comply with the general requirements in Chapter 3. Wiring methods installed in wet, damp, or corrosive environments shall contain an insulated copper equipment grounding conductor sized in accordance with Table 250.122, but not smaller than 12 AWG shall be required.

Statement of Problem and Substantiation for Public Comment

This Comment is intended to simplify the Panel's stated goal of simplifying the wiring methods permitted for feeders. However, some serious oversights are corrected in this Comment. For example, all PVC conduit is not identified for protection against physical damage or for all corrosive environments. Only Schedule 80 is suitable for protection against physical damage. PVC conduit in Schedules 40 and 80 are suitable for some but not all corrosive conditions. The manufacturers can and will willingly provide the list of corrosive conditions the PVC conduit is suitable for. Type RTRC conduit is not permitted where subject to physical damage unless identified for such use. This is stated in 355.12(C) under "Uses Not Permitted." Where subject to physical damage unless identified for such use. The UL White Book indicates only RTRC conduit with a suffix "XW" is suitable for protection against physical damage.

The word "less" is replaced with "smaller" because "less" refers to quantity and "smaller" refers to the size which is the subject of the size of the equipment grounding conductor. The ending phrase "shall be required" is repetitive of the requirement earlier in the sentence as thus is shown being deleted.

Related Item
First Revision No. 4863-NFPA 70-2015 [Section No. 680.25(1)]

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City: 
State: 
Zip: 
Submittal Date: Thu Sep 17 21:48:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4829-NFPA 70-2015
Statement: A modification required due to the creation of 680.14.
**Public Comment No. 1305-NFPA 70-2015 [Section No. 680.42(A) [Excluding any Sub-Sections]]**

Listed and labeled packaged spa or hot tub equipment assemblies or self-contained spas or hot tubs utilizing a factory-installed or assembled control panel or panelboard shall be permitted to use flexible connections as covered in 680.42(A)(1) and (A)(2).

**Additional Proposed Changes**

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**Related Item**

Public Input No. 931-NFPA 70-2014 [Section No. 680.42(A) [Excluding any Sub-Sections]]

First Revision No. 4803-NFPA 70-2015 [Global Input]

**Submitter Information Verification**

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 
City:
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**Committee Statement**

| Committee Action: | Accepted |
| Resolution: | SR-4822-NFPA 70-2015 |
| Statement: | The Panel agrees with public comment clarifying certain equipment be "listed and labeled" instead of just "listed." Listing agencies do not consider a product to be listed unless the listing mark has been applied. |
Public Comment No. 1308-NFPA 70-2015 [ Section No. 680.42(B) ]

(B) Bonding.

Bonding by metal-to-metal mounting on a common frame or base shall be permitted. The metal bands or hoops used to secure wooden staves shall not be required to be bonded as required in 680.26.

Equipotential bonding of perimeter surfaces in accordance with 680.26(B)(2) shall not be required to be provided for spas and hot tubs where all of the following conditions apply:

1. The spa or hot tub shall be listed, labeled and identified as a self-contained spa for aboveground use.
2. The spa or hot tub shall not be identified as suitable only for indoor use.
3. The installation shall be in accordance with the manufacturer’s instructions and shall be located on or above grade.
4. The top rim of the spa or hot tub shall be at least 710 mm (28 in.) above all perimeter surfaces that are within 760 mm (30 in.), measured horizontally from the spa or hot tub. The height of nonconductive external steps for entry to or exit from the self-contained spa shall not be used to reduce or increase this rim height measurement.

Informational Note: For information regarding listing requirements for self-contained spas and hot tubs, see ANSI/UL 1563 - 2010, Standard for Electric Spas, Equipment Assemblies, and Associated Equipment.

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other NRTL's have similar requirements.

**Related Item**

Public Input No. 932-NFPA 70-2014 [Section No. 680.42(B)]

First Revision No. 4803-NFPA 70-2015 [Global Input]

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<td>UNDERWRITERS LABORATORIES LLC</td>
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Public Comment No. 1309-NFPA 70-2015 [Section No. 680.43 [Excluding any Sub-Sections]]

A spa or hot tub installed indoors shall comply with the provisions of Parts I and II of this article except as modified by this section and shall be connected by the wiring methods of Chapter 3.

Exception No. 1: Listed and Labeled spa and hot tub packaged units rated 20 amperes or less shall be permitted to be cord-and-plug-connected to facilitate the removal or disconnection of the unit for maintenance and repair.

Exception No. 2: The equipotential bonding requirements for perimeter surfaces in 680.26(B)(2) shall not apply to a listed and labeled, self-contained spa or hot tub installed above a finished floor.

Exception No. 3: For a dwelling unit(s) only, where a listed and labeled spa or hot tub is installed indoors, the wiring method requirements of 680.42(C) shall also apply.

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Statement of Problem and Substantiation for Public Comment

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As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
Public Input No. 933-NFPA 70-2014 [Section No. 680.43 [Excluding any Sub-Sections]]
First Revision No. 4803-NFPA 70-2015 [Global Input]

Submitter Information Verification
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<tr>
<th><strong>Submitter Full Name:</strong></th>
<th>JEFFREY FECTEAU</th>
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<tr>
<td><strong>Organization:</strong></td>
<td>UNDERWRITERS LABORATORIES LLC</td>
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<tr>
<td><strong>Affiliation:</strong></td>
<td>UL</td>
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<td><strong>Street Address:</strong></td>
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<td><strong>Submittal Date:</strong></td>
<td>Thu Sep 24 18:57:27 EDT 2015</td>
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**Committee Statement**

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<tr>
<td><strong>Resolution:</strong></td>
<td>SR-4824-NFPA 70-2015</td>
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<tr>
<td><strong>Statement:</strong></td>
<td>The Panel agrees with public comment clarifying certain equipment be &quot;listed and labeled&quot; instead of just &quot;listed.&quot; Listing agencies do not consider a product to be listed unless the listing mark has actually been applied.</td>
</tr>
</tbody>
</table>
Public Comment No. 1310-NFPA 70-2015 [ Section No. 680.43(D) ]

(D) Bonding.

The following parts shall be bonded together:

1. All metal fittings within or attached to the spa or hot tub structure.
2. Metal parts of electrical equipment associated with the spa or hot tub water circulating system, including pump motors, unless part of a listed, labeled and identified self-contained spa or hot tub.
3. Metal raceway and metal piping that are within 1.5 m (5 ft) of the inside walls of the spa or hot tub that are not separated from the spa or hot tub by a permanent barrier.
4. All metal surfaces that are within 1.5 m (5 ft) of the inside walls of the spa or hot tub and that are not separated from the spa or hot tub area by a permanent barrier.
   
   Exception: Small conductive surfaces not likely to become energized, such as air and water jets and drain fittings, where not connected to metallic piping, towel bars, mirror frames, and similar nonelectrical equipment, shall not be required to be bonded.

5. Electrical devices and controls that are not associated with the spas or hot tubs and that are located less than 1.5 m (5 ft) from such units; otherwise, they shall be bonded to the spa or hot tub system.

Additional Proposed Changes

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**Related Item**

Public Input No. 934-NFPA 70-2014 [Section No. 680.43(D)]
First Revision No. 4803-NFPA 70-2015 [Global Input]

**Submitter Information Verification**

**Submitter Full Name:** JEFFREY FECTEAU  
**Organization:** UNDERWRITERS LABORATORIES LLC  
**Affiliation:** UL  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Thu Sep 24 19:01:52 EDT 2015

**Committee Statement**

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-4825-NFPA 70-2015  
**Statement:** The text "listed" alone would allow for listed units that would require the Inspection Authority to search in various databases of the certification agencies while conducting inspection in the field. This is inconvenient and sometimes difficult. The text "and labeled" was added as this would mandate a certification (listing) mark on the product. The additional text "and identified" accurately reflects the Definitions in Chapter 1. It is appropriate in this instance as there are Listed and Labeled equipment readily available that are not intended for spa installations.
Public Comment No. 1311-NFPA 70-2015 [Section No. 680.44(A)]

(A) Listed Units.
If so marked, a listed, labeled and identified self-contained unit or listed and labeled packaged equipment assembly that includes integral ground-fault circuit-interrupter protection for all electrical parts within the unit or assembly (pumps, air blowers, heaters, lights, controls, sanitizer generators, wiring, and so forth) shall be permitted without additional GFCI protection.

Additional Proposed Changes

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Related Item
Public Input No. 935-NFPA 70-2014 [Section No. 680.44(A)]
First Revision No. 4803-NFPA 70-2015 [Global Input]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Committee Statement

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<td>Resolution:</td>
<td>SR-4826-NFPA 70-2015</td>
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<td>Statement:</td>
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680.58 GFCI Personnel Protection for Adjacent Receptacle Outlets.

(1) All 15- or 20-ampere, single-phase 125-volt through 250-volt receptacles located within 6.0 m (20 ft) of a fountain edge shall be provided with GFCI protection.

(2) All 100 amperes or less, single-phase and three-phase receptacles rated more than 150 volts to ground and up to 600 volts between ungrounded conductors, located within 6.0 (20 ft) of a fountain edge shall be provided with SPGFCI protection.

Additional Proposed Changes

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<td>GFCI_Classes.pdf</td>
<td>Tripping Characteristics of GFCI classes A, C, and D</td>
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Statement of Problem and Substantiation for Public Comment

The committee resolution of PI-2208 was: “GFCIs rated in excess of 250 volts do not always provide protection against "let-go" (devices trip at up to 20 mA) which is important when dealing with bodies of water due to the risk of drowning”.

The submitter agrees with the committee that GFCI classes C, D and E (collectively referred to as SPGFCIs) don't provide let-go protection because of the 20 mA trip level which is above the let-go threshold. Yet, SPGFCIs provide protection against ventricular fibrillation, the condition that typically leads to cardiac arrest resulting in drowning. SPGFCIs use the same tripping characteristics of Class A GFCIs (A graph of the tripping characteristics is submitted with the support material of this public comment). The only difference is that the start of the curve (i.e. tripping action) is delayed from 6 mA to 20 mA (moved to the right).

Accordingly, SPGFCIs provide the exact protection level of Class A GFCIs for ground faults of 20 mA and higher. In other words, SPGFCIs are guaranteed to interrupt the source of power fast enough, and therefore protecting the person in the water from drowning, because the current going through the swimmer’s heart is interrupted.

During the first draft meeting, CMP 2 recognized SPGFCIs as a potential improvement to safety and created FR-339 and FR-347 to include a new definition for SPGFCIs and an installation requirement in Article 210.8(B) respectively.

Submitter Information Verification

Submitter Full Name: NEHAD EL-SHERIF
Organization: Littelfuse Startco
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Sep 20 16:07:52 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This comment does not address the elevated risk of submersion, electroshock drowning, in a body of water and that muscular constriction starts at a level well below ventricular fibrillation. Due to the fact that muscular constriction would result in loss of body control, the ability to stay afloat or get out of the body of water would be severely impaired, leading to a high possibility of drowning. There is no substantiation that larger pumps have created an issue for occupants within the body of water. The higher trip level of the SPGFCI is not adequate for prevention of drowning.
Public Comment No. 1313-NFPA 70-2015 [Section No. 680.62(A)(1)]

(1) Listed Units.
If so marked, a listed, labeled and identified self-contained unit or listed and labeled packaged equipment assembly that includes integral ground-fault circuit-interrupter protection for all electrical parts within the unit or assembly (pumps, air blowers, heaters, lights, controls, sanitizer generators, wiring, and so forth) shall be permitted without additional GFCI protection.

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Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

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Related Item
Public Input No. 936-NFPA 70-2014 [Section No. 680.62(A)(1)]
First Revision No. 4803-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4827-NFPA 70-2015
Statement: The text “listed” alone would allow for listed units that would require the Inspection Authority to search in various databases of the certification agencies while conducting inspection in the field. This is inconvenient and sometimes difficult. The text “and labeled” was added as this would mandate a certification (listing) mark on the product. The additional text “and identified” accurately reflects the Definitions in Chapter 1. It is appropriate in this instance as there are Listed and Labeled equipment readily available that are not intended for therapeutic pool and tub installations.
Public Comment No. 787-NFPA 70-2015 [Section No. 680.62(A)(2)]

(2) Other Units.
A therapeutic tub or hydrotherapeutic tank rated 3 phase or rated over 250 volts or with a heater load of more than 50 amperes shall not require the supply to be protected by a special-purpose ground-fault circuit interrupter.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

The committee resolution of PI-2209 was: "GFCIs rated in excess of 250 volts do not always provide protection against "let-go" (devices trip at up to 20 mA) which is important when dealing with bodies of water due to the risk of drowning".

The submitter agrees with the committee that GFCI classes C, D and E (collectively referred to as SPGFCIs) don’t provide let-go protection because of the 20 mA trip level which is above the let-go threshold. Yet, SPGFCIs provide protection against ventricular fibrillation, the condition that typically leads to cardiac arrest resulting in drowning. SPGFCIs use the same tripping characteristics of Class A GFCIs (A graph of the tripping characteristics is submitted with the support material of this public comment). The only difference is that the start of the curve (i.e. tripping action) is delayed from 6 mA to 20 mA (moved to the right).

Accordingly, SPGFCIs provide the exact protection level of Class A GFCIs for ground faults of 20 mA and higher. In other words, SPGFCIs are guaranteed to interrupt the source of power fast enough, and therefore protecting the person in the water from drowning, because the current going through the swimmer’s heart is interrupted.

During the first draft meeting, CMP 2 recognized SPGFCIs as a potential improvement to safety and created FR-339 and FR-347 to include a new definition for SPGFCIs and an installation requirement in Article 210.8(B) respectively.

Related Item

- Public Input No. 2209-NFPA 70-2014 [Section No. 680.62(A)(2)]
- First Revision No. 339-NFPA 70-2015 [New Definition after Definition: Ground-Fault Circuit Inter...]
- First Revision No. 347-NFPA 70-2015 [Section No. 210.8(B)]

Submitter Information Verification

Submitter Full Name: NEHAD EL-SHERIF
Organization: Littelfuse Startco
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Sep 20 16:16:40 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This comment does not address the elevated risk of submersion, electroshock drowning, in a body of water and that muscular constriction starts at a level well below ventricular fibrillation. Due to the fact that muscular constriction would result in loss of body control, the ability to stay afloat or get out of the body of water would be severely impaired, leading to a high possibility of drowning. There is no substantiation that larger pumps have created an issue for occupants within the body of water. The higher trip level of the SPGFCI is not adequate for prevention of drowning.
680.74 - Bonding
(A) - General
The following parts shall be bonded together:
(1) All metal fittings within or attached to the tub structure that are in contact with the circulating water
(2) Metal parts of electrical equipment associated with the tub water circulating system, including pump and blower motors
(3) Metal-sheathed cables and raceways and metal piping that are within 1.5 m (5 ft) of the inside walls of the tub and not separated from the tub by a permanent barrier
(4) All exposed metal surfaces that are within 1.5 m (5 ft) of the inside walls of the tub and not separated from the tub area by a permanent barrier
(5) Electrical devices and controls that are not associated with the hydromassage tubs and that are located within 1.5 m (5 ft) from such units

Exception No. 1: Small conductive surfaces not likely to become energized, such as air and water jets, supply valve assemblies, and drain fittings not connected to metallic piping, and towel bars, mirror frames, and similar nonelectrical equipment not connected to metal framing shall not be required to be bonded.

Exception No. 2: Double-insulated motors and blowers shall not be bonded.
(B) - All metal parts required to be bonded by this section shall be bonded together using a solid copper bonding jumper, insulated, covered, or bare, not smaller than 8 AWG. The bonding jumper(s) shall be required for equipotential bonding in the area of the hydromassage bathtub and shall not be required to be extended or attached to any remote panelboard, service equipment, or any electrode. In all installations a bonding jumper long enough to terminate on a replacement non-double-insulated pump or blower motor shall be provided and shall be terminated to the equipment grounding conductor of the branch circuit of the motor when a double-insulated circulating pump or blower motor is used.

Statement of Problem and Substantiation for Public Comment
This rule gets more and more absurd every three years. There has never been a documented incident (that I can find) to warrant its existence, and now we are going to have a rule that will have inspectors mandating that towel bars within 5' of a bathtub be bonded!

Related Item
First Revision No. 4870-NFPA 70-2015 [Section No. 680.74]

Submitter Information Verification
Submitter Full Name: RYAN JACKSON
Organization: RYAN JACKSON
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:59:17 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The Panel has not been provided with any test or factual information to resolve the need for the entire set of bonding requirements in or around hydromassage bathtubs. The towel bar issue has already been addressed by First Revision No. 4870 on Section 680.74(A) Exception 1.
680.81  Equipment Approval.

Lifts shall be listed for swimming pool and spa use.

Exception No. 1: Lifts where the battery is removed for charging at another location and the battery is rated less than or equal to the low-voltage contact limit shall not be required to be listed or labeled.

Exception No. 2: Solar-operated or -recharged lifts where the solar panel is attached to the lift and the battery is rated less than or equal to 24 volts shall not be required to be listed or labeled.

Exception No. 3: Lifts that are supplied from a source not exceeding the low-voltage contact limit and supplied by listed transformers or power supplies that comply with 680.23(A)(2) shall not be required to be listed or labeled.

Statement of Problem and Substantiation for Public Comment

Wanting equipment and products used in the swimming pool and spa environment to be listed is a good thing, but listed for what? Prior to the 2005 NEC revision cycle, the NEC Technical Correlating Committee issued a directive to all of the Code Making Panels to clear up what "listed for the purpose" meant in their particular articles. In other words, don’t just tell the user of the Code that something has to be "listed for the purpose" but tell us what that purpose is. That 2005 Code cycle was when CMP-17 changed 680.23(A)(2) from "transformers or power supplies used to supply underwater luminaires shall be listed for the purpose" to "transformers or power supplies used to supply underwater luminaires shall be listed for swimming pool and spa use." The presently proposed text would allow any lift that was "listed" to used in the swimming pool and spa environment. This lift could be "listed" for a dry locations only.

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4830-NFPA 70-2015
Statement: The revision allows any lift to be used in the swimming pool and spa environment.
690.1 Scope.
This article applies to solar PV systems, other than those covered by Article 691, including the array circuit(s), inverter(s), and controller(s) for such systems. [See Figure 690.1(a) and Figure 690.1(b).] The systems covered by this article may be interactive with other electrical power production sources or stand-alone or both, and may or may not be connected to energy storage systems such as batteries. These PV systems may have ac or dc output for utilization.

Informational Note: Article 691 covers the installation of large-scale PV electric supply stations.

Figure 690.1(a) Identification of PV Power Source Components With or Without DC-to-DC Converters.

Figure 690.1(b) Identification of PV System Components in Common Configurations.
Additional Proposed Changes

<table>
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<tr>
<th>File Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>690.1_Proposal_NEC2017a.pdf</td>
<td>This document contains graphics that need to be included in Figure 690.1(b) to represent typical system configurations available in the market today.</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

The graphics shown in the first revision of 2017 NEC Figure 690.1(b) only shows one possible configuration of an ac coupled multimode system. A second configuration using a common ac bus for both inverters is already available in the market today. The first of the two graphics in the uploaded file represents such a configuration.
The graphics shown in the first revision of 2017 NEC Figure 690.1(b) only shows an dc coupled stand-alone system. A second configuration using a common ac bus for both inverters is already available in the market today. We suggest calling this configuration ac coupled stand-alone system. The second of the two graphics in the uploaded file represents such a configuration.

**Related Item**

First Revision No. 949-NFPA 70-2015 [Section No. 690.1]

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Submitter Full Name:</strong> Michael Mendik</td>
</tr>
<tr>
<td><strong>Organization:</strong> SMA America</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Committee Statement</th>
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</thead>
<tbody>
<tr>
<td><strong>Committee Action:</strong> Rejected</td>
</tr>
<tr>
<td><strong>Resolution:</strong> The submitter makes a recommendation that is not consistent with the other figures. One of purposes of the diagrams is to show that the PV system disconnect separates the PV system from all other conductors of other systems.</td>
</tr>
</tbody>
</table>
690.1 Scope.
This article applies to solar PV systems, other than those covered by Article 691, including the array circuit(s), inverter(s), and controller(s) for such systems. [See Figure 690.1(a) and Figure 690.1(b).] The systems covered by this article may be interactive with other electrical power production sources or stand-alone or both, and may or may not be connected to energy storage systems such as batteries. These PV systems may have ac or dc output for utilization.

Informational Note: Article 691 covers the installation of large-scale PV electric supply stations.

Figure 690.1(a) Identification of PV Power Source Components With or Without DC-to-DC Converters.

Figure 690.1(b) Identification of PV System Components in Common Configurations.
Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to consider the use of consistent terminology.

Related Item
First Revision No. 949-NFPA 70-2015 [Section No. 690.1]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-928-NFPA 70-2015
Statement: This revision addresses the errors in the First Draft.
690.1 Scope.
This article applies to solar PV systems, other than those covered by Article 691, including the array circuit(s), inverter(s), and controller(s) for such systems. [See Figure 690.1(a) and Figure 690.1(b).]
The systems covered by this article may be interactive with other electrical power production sources or stand-alone or both, and may or may not be connected to energy storage systems such as batteries. These PV systems may have ac or dc output for utilization.

Informational Note: Article 691 covers the installation of large-scale PV electric supply stations.

Figure 690.1(a) Identification of PV Power Source Components With or Without DC-to-DC Converters.

Figure 690.1(b) Identification of PV System Components in Common Configurations.
Statement of Problem and Substantiation for Public Comment

Note 4 in Figure 1(a) states there are possible custom designs, but the figure showing dc-dc converters in series with the PV string or modules will lead AHJs to insist on that location. The Note should read "Custom PV power source designs occur and the use and location of some components are design options.

Related Item
First Revision No. 949-NFPA 70-2015 [Section No. 690.1]

Submitter Information Verification
Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 16:30:16 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-928-NFPA 70-2015
Statement: This revision addresses the errors in the First Draft.
Engineering Supervision.  Designed and approved
Supervised by a licensed professional engineer competent in the specific area under supervision.

Statement of Problem and Substantiation for Public Comment
The correlating committee is concerned about the use of the term Engineering Supervision. The edits in this comment remove the problematic language about engineers approving anything.

Related Item
First Revision No. 1002-NFPA 70-2015 [New Definition after Definition: Electrical Production and ...]

Submitter Information Verification
Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 22:37:55 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: See SR 929. This also addresses the correlating committee’s concern and indirectly addresses the concern in this PC.
Engineering Supervision.
Designed and approved (or certified) by a licensed professional engineer competent in the specific area under supervision.

Statement of Problem and Substantiation for Public Comment

There is a subtle difference between the definitions of Engineering Supervision within Article 690 and 691 that we don't believe was intentional but could cause confusion if left in the current state. We suggest to make both definitions the same to avoid interpretation that Engineering Supervision within Article 690 is different than that of 691.

Related Item
First Revision No. 1002-NFPA 70-2015 [New Definition after Definition: Electrical Production and ...]

Submitter Information Verification
Submitter Full Name: JASON SPOKES
Organization: SUNPOWER CORP
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:12:29 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: See SR 929. Adding "certified" adds a word not used in the NEC. The language in 691 and 690 related to engineering have been changed to address the submitter’s concern. This is consistent with other uses of the term "engineering supervision" throughout the Code.
Engineering Supervision.
Designed and approved by a licensed professional engineer competent engaged primarily in the specific area under supervision design of PV systems.

Statement of Problem and Substantiation for Public Comment

TerraView is incorrectly highlighting the entire definition as new. The proposed revision is to replace "competent in the specific area under supervision" with "engaged primarily in the design of PV systems".

SunPower believe that it will be very difficult for an AHJ to objectively determine whether an engineer is "competent in the specific area under supervision". Therefore, we propose using language that was modeled after the engineering supervision requirement specified in NEC 240.86(A). We also believe that it is critical that the engineer be experienced with designing PV systems. In our experience, many licensed electrical engineers lack the experience required to correctly design PV systems because of its unique characteristics. Namely, it is a current and voltage limited generator. Many licensed engineers are very experienced with designing electrical systems that deliver electricity to loads connected the grid, which is a source with "infinite" current. Since the purpose of this definition is to define the credentials of the supervising engineer that will be permitted to use alternative methods to meet the requirements in article 690, it is imperative that this person have direct experience designing PV systems. Otherwise, the engineer might make mistakes that could have dangerous consequences. We believe the requested revision to this definition will reduce the chances that this could happen.

Related Item
First Revision No. 1002-NFPA 70-2015 [New Definition after Definition: Electrical Production and ...]

Submitter Information Verification
Submitter Full Name: MARK ALBERS
Organization: SUNPOWER
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 18:45:01 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: See SR 929. The submitter makes a good case for limiting the definition in Article 690 to engineers engaged in PV design. However, to say that an engineer must be primarily engaged in PV design is far too restrictive as a competent engineer may be involved in the 3 or 4 areas where they even spread their efforts and are competent in all these areas. The usage of engineering supervision elsewhere in 690 has been revised to address some of the concerns of the submitter.
Engineering Supervision.
Designed and approved by a licensed professional engineer competent in the specific area under supervision.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that this First Revision be reviewed and the panel take action on the use of the word “approved” as it is a defined term and does not fit the definition. The panel is also directed to review the definitions for compliance with the NEC Style Manual.

Related Item
First Revision No. 1002-NFPA 70-2015 [New Definition after Definition: Electrical Production and ...]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 11:28:18 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-929-NFPA 70-2015
Statement: This definition has been removed because it is problematic and difficult to universally define.
Public Comment No. 702-NFPA 70-2015 [Definition: Engineering Supervision.]

Engineering Supervision.
Designed and approved by a licensed professional engineer competent in the specific area under supervision.

Statement of Problem and Substantiation for Public Comment

This definition should be removed; as stated in Article 90.1 Purpose "This code is not intended as a design specification or an instruction manual for untrained persons." The code doesn't define designed and competent engineer, one could argue that a civil engineer is competent in the specific area of fault current studies or relay settings for a substation.

Related Item
Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

Submitter Information Verification

Submitter Full Name: Scott Humphrey
Organization: LA County DPW
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 18:15:55 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-929-NFPA 70-2015
Statement: This definition has been removed because it is problematic and difficult to universally define.
Generating Capacity.
The sum of parallel-connected inverter maximum continuous output power at 40°C in kilowatts.

Statement of Problem and Substantiation for Public Comment

The use of the term parallel-connected clarifies the definition and removes any chance of ambiguity

Related Item
First Revision No. 1002-NFPA 70-2015 [New Definition after Definition: Electrical Production and ...]

Submitter Information Verification
Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address: City: State: Zip: Submittal Date: Mon Sep 14 16:39:23 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-930-NFPA 70-2015
Statement: The use of the term parallel-connected clarifies the definition and removes ambiguity.
Photovoltaic System Voltage.
The direct current (dc) voltage of any PV source or PV output circuit. For multiwire installations, the PV system voltage is the highest voltage between any two dc conductors.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs the Panel to clarify the definition and the informational note.

Related Item
First Revision No. 954-NFPA 70-2015 [New Definition after Definition: Photovoltaic System Voltage...]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 11:34:28 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-932-NFPA 70-2015
Statement: The panel changed the term from “reference” to “functional” so that it does not conflict with the concepts in Article 517 and matches the International Electrotechnical Committee’s use of the term internationally.
Public Comment No. 1018-NFPA 70-2015 [Definition: Reference Grounded PV System.]

Reference Grounded PV System.
A PV system that has an electrical reference to ground that is not solidly grounded.

Informational Note: The reference to ground is often a fuse, circuit breaker, resistance device, non-isolated grounded ac circuit, or electronic means that is part of a listed ground-fault protection system. Conductors in these systems that are normally at ground potential may have voltage to ground during fault conditions.

Statement of Problem and Substantiation for Public Comment

This public comment deletes this new definition to address concerns expressed by the correlating committee. Rather than defining a new term, typical PV system configurations are still described in 690.41(A). The informational note used in the definition is revised and used to inform 690.41(A).

Related Item
First Revision No. 954-NFPA 70-2015 [New Definition after Definition: Photovoltaic System Voltag...]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 00:46:18 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-932-NFPA 70-2015
Statement: The panel changed the term from “reference” to “functional” so that it does not conflict with the concepts in Article 517 and matches the International Electrotechnical Committee’s use of the term internationally.
Public Comment No. 1324-NFPA 70-2015 [ Section No. 690.4(B) ]

(B) Equipment.
Inverters, motor generators, PV modules, PV panels, ac PV modules, dc combiners, dc-to-dc converters, and charge controllers intended for use in PV systems shall be listed and labeled or field labeled for the PV application.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
Public Input No. 941-NFPA 70-2014 [Section No. 690.35(G)]
First Revision No. 982-NFPA 70-2015 [Section No. 690.35]
First Revision No. 957-NFPA 70-2015 [Section No. 690.4(B)]
Public Input No. 1903-NFPA 70-2014 [Section No. 690.4(B)]
Public Input No. 873-NFPA 70-2014 [Section No. 690.4(B)]
Public Input No. 945-NFPA 70-2014 [Section No. 690.81]
First Revision No. 1010-NFPA 70-2015 [Sections Part IX., 690.80, 690.81, 690.85]
<table>
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<tr>
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<td><strong>Committee Action:</strong></td>
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<tr>
<td><strong>Resolution:</strong></td>
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<td><strong>Statement:</strong></td>
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</table>
Public Comment No. 586-NFPA 70-2015 [Section No. 690.4(B)]

(B) Equipment.

Inverters, motor generators, PV modules, PV panels, ac PV modules, dc combiners, dc-to-dc converters, and charge controllers intended for use in PV systems shall be listed or field labeled for the PV application.

Statement of Problem and Substantiation for Public Comment

Change "ac PV module" to "ac module." The term "ac PV module" is not defined in 690.2. Section 690.8 used the term "ac module."

Related Public Comments for This Document

<table>
<thead>
<tr>
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<th>Relationship</th>
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<tr>
<td>Public Comment No. 889-NFPA 70-2015 [Section No. 690.4(D)]</td>
<td>Related Item</td>
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<tr>
<td>First Revision No. 957-NFPA 70-2015 [Section No. 690.4(B)]</td>
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Submitter Information Verification

Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address: City: State: Zip:
Submittal Date: Wed Sep 09 16:23:28 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-933-NFPA 70-2015
Statement: The addition of "PV" does not improve the understanding of the sentence. 690.2 actually has both "ac module" and "ac PV module" in the definition.
Multiple PV Systems.

Multiple PV systems shall be permitted to be installed in or on a single building or structure. Where the PV systems are remotely located from each other, a directory in accordance with 705.10 shall be provided at each dc PV system disconnecting means.

Statement of Problem and Substantiation for Public Comment

Disconnecting means for PV systems may be either ac or dc per the new set of drawings showing identification of PV system components. Deleting the term "dc" provides for complying with the requirements

Related Item

First Revision No. 963-NFPA 70-2015 [Section No. 690.4(D)]

Submitter Information Verification

Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 14 16:43:29 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-934-NFPA 70-2015 PC 889 - The Panel acknowledges that this section addresses only the PV system disconnecting means, which is covered in 690.13.
Statement: The panel removed the word "dc" from 690.4(D) in the first revision, but it was not properly reflected in the first draft.
Multiple PV systems shall be permitted to be installed in or on a single building or structure. Where the PV systems are remotely
located from each other, a directory in accordance with 705.10 shall be provided to indicate each dc PV system disconnecting means.

Statement of Problem and Substantiation for Public Comment

The language is misleading. I believe the intent is for the directory to define the location for each "PV system" disconnecting means. For instance, with microinverters, the current language will require a sign at each dc disconnect which is located at each microinverter. It is only necessary to have disconnecting means at the output of a "PV system." The proposed language clarifies this objective.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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</thead>
<tbody>
<tr>
<td>Public Comment No. 586-NFPA 70-2015 [Section No. 690.4(B)]</td>
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<tr>
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Submitter Information Verification

Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 17:36:51 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-934-NFPA 70-2015 PC 889 - The Panel acknowledges that this section addresses only the PV system disconnecting means, which is covered in 690.13.
Statement: The panel removed the word “dc” from 690.4(D) in the first revision, but it was not properly reflected in the first draft.
690.7. Maximum Voltage.

PV system dc conductors on or in one- and two family dwellings shall be permitted to have a maximum voltage of 600 volts or less. PV system dc conductors on or in other types of buildings shall be permitted to have a maximum voltage of 1000 volts or less.

(A) Photovoltaic Source and Output Circuits.

In a dc PV source circuit or output circuit, the maximum PV system voltage for that circuit shall be calculated in accordance with one of the following methods:

1. The sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the open-circuit voltage temperature coefficients in accordance with the instructions included in the listing or labeling of the module.

2. For crystalline and multicrystalline silicon modules, the sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the correction factor provided in Table 690.7(A).

   Informational Note: One source for statistically valid, lowest-expected, ambient temperature design data for various locations is the chapter titled Extreme Annual Mean Minimum Design Dry Bulb Temperature found in the ASHRAE Handbook — Fundamentals, 2009, 2013. These temperature data can be used to calculate maximum voltage using the manufacturer’s temperature coefficients relative to the rating temperature of 25°C.

3. For PV systems with a generating capacity of 100 kilowatts or greater, an industry standard method shall be permitted to be used under engineering supervision.


Maximum voltage shall be corrected using one of the three following methods to calculate the module voltage:

1. The open-circuit voltage temperature coefficients module voltage in accordance with the instructions included in the listing of the module.

2. For crystalline and multicrystalline silicon modules, the correction factors provided in Table 690.7(A) shall be permitted to be used.

3. For PV systems with a generating capacity of 100 kilowatts or greater, alternate methods shall be permitted to be used under engineering supervision.


The maximum voltage shall be used to determine the voltage rating of conductors, cables, disconnects, overcurrent devices, and other equipment.

Table 690.7(A) Voltage Correction Factors for Crystalline and Multicrystalline Silicon Modules

<table>
<thead>
<tr>
<th>Correction Factors for Ambient Temperatures Below 25°C (77°F). (Multiply the rated open circuit voltage by the appropriate correction factor shown below.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ambient Temperature (°C)</strong></td>
</tr>
<tr>
<td>24 to 20</td>
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<tr>
<td>19 to 15</td>
</tr>
<tr>
<td>14 to 10</td>
</tr>
<tr>
<td>9 to 5</td>
</tr>
<tr>
<td>4 to 0</td>
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<tr>
<td>–1 to –5</td>
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<td>–6 to –10</td>
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<td>–11 to –15</td>
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<td>–16 to –20</td>
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<td>–21 to –25</td>
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<tr>
<td>–26 to –30</td>
</tr>
<tr>
<td>–31 to –35</td>
</tr>
<tr>
<td>–36 to –40</td>
</tr>
</tbody>
</table>
(B) DC-to-DC Converter Source and Output Circuits.

In a dc-to-dc converter source and output circuit, the maximum voltage shall be calculated in accordance with 690.7(B) (1) or (2).

(1) For circuits connected to the output of a single dc-to-dc converter, the maximum voltage shall be the maximum rated voltage output of the dc-to-dc converter.

(2) For circuits connected to the output of two or more series-connected dc-to-dc converters, the maximum voltage shall be determined in accordance with the instructions included in the listing or labeling of the dc-to-dc converter.

(C) Bipolar Source and Output Circuits.

For 2-wire circuits connected to bipolar systems, the maximum voltage shall be the highest voltage between the conductors of the 2-wire circuit if all of the following conditions apply:

(1) One conductor of each circuit of a bipolar subarray is referenced to ground to prevent overvoltage of the circuit. The operation of ground-fault or arc-fault devices (abnormal operation) shall be permitted to interrupt the ground reference when the entire bipolar array becomes two distinct arrays isolated from each other and the utilization equipment.

(2) Each circuit is connected to a separate subarray.

Statement of Problem and Substantiation for Public Comment


Related Public Comments for This Document

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Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 93-NFPA 70-2015 [Section No. 210.12(A)]
Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]
Referenced correct SDO name, standard name, number, and edition.

Public Comment No. 95-NFPA 70-2015 [Section No. 620.1]

Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack.]

Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]

Public Comment No. 111-NFPA 70-2015 [Section No. 505.2]

Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]

Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]

Related Item
First Revision No. 1020-NFPA 70-2015 [Section No. 690.7]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 01 22:19:09 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-936-NFPA 70-2015
Statement:

1. The informational note, formerly under 690.7(A)(2) is moved directly under 690.7(A) and the last phrase is removed to make it generally applicable. Also, the ASHRAE reference is updated.

2. In 690.7(A)(3), the word “kilowatts” is changed to “kW” to match the style manual.

3. The language related to “engineering supervision” is revised to be more specific as to what engineers are allowed to perform this calculation. Competency of professional electrical engineers is governed by the licensing boards.

4. The duplicative language related to voltage calculations is removed.
Maximum Voltage.

PV system dc conductors on or in one- and two-family dwellings shall be permitted to have a maximum voltage of 600 volts or less. PV system dc conductors on or in other types of buildings shall be permitted to have a maximum voltage of 1000 volts or less.

(A) Photovoltaic Source and Output Circuits.

In a dc PV source circuit or output circuit, the maximum PV system voltage for that circuit shall be calculated in accordance with one of the following methods:

1. The sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the open-circuit voltage temperature coefficients in accordance with the instructions included in the listing or labeling of the module.

2. For crystalline and multicrystalline silicon modules, the sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the correction factor provided in Table 690.7(A).

   Informational Note: One source for statistically valid, lowest-expected, ambient temperature design data for various locations is the chapter titled Extreme Annual Mean Minimum Design Dry Bulb Temperature found in the ASHRAE Handbook — Fundamentals, 2009. These temperature data can be used to calculate maximum voltage using the manufacturer’s temperature coefficients relative to the rating temperature of 25°C.

3. For PV systems with a generating capacity of 100 kilowatts, kW or greater, an industry standard method shall be permitted to be used under engineering supervision.


Maximum voltage shall be corrected using one of the three following methods to calculate the module voltage:

1. The open-circuit voltage temperature coefficients module voltage in accordance with the instructions included in the listing of the module.

2. For crystalline and multicrystalline silicon modules, the correction factors provided in Table 690.7(A) shall be permitted to be used.

3. For PV systems with a generating capacity of 100 kilowatts, kW or greater, alternate methods shall be permitted to be used under engineering supervision.


The maximum voltage shall be used to determine the voltage rating of conductors, cables, disconnects, overcurrent devices, and other equipment.

Table 690.7(A) Voltage Correction Factors for Crystalline and Multicrystalline Silicon Modules

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(B) DC-to-DC Converter Source and Output Circuits.

In a dc-to-dc converter source and output circuit, the maximum voltage shall be calculated in accordance with 690.7(B) (1) or (2).

(1) For circuits connected to the output of a single dc-to-dc converter, the maximum voltage shall be the maximum rated voltage output of the dc-to-dc converter.

(2) For circuits connected to the output of two or more series-connected dc-to-dc converters, the maximum voltage shall be determined in accordance with the instructions included in the listing or labeling of the dc-to-dc converter.

(C) Bipolar Source and Output Circuits.

For 2-wire circuits connected to bipolar systems, the maximum voltage shall be the highest voltage between the conductors of the 2-wire circuit if all of the following conditions apply:

(1) One conductor of each circuit of a bipolar subarray is referenced to ground to prevent overvoltage of the circuit. The operation of ground-fault or arc-fault devices (abnormal operation) shall be permitted to interrupt the ground reference when the entire bipolar array becomes two distinct arrays isolated from each other and the utilization equipment.

(2) Each circuit is connected to a separate subarray.

Statement of Problem and Substantiation for Public Comment

Corrections are made to comply with the NEC style manual and to use consistent language for PV source circuits.

Related Item
First Revision No. 1020-NFPA 70-2015 [Section No. 690.7]
First Revision No. 1020-NFPA 70-2015 [Section No. 690.7]

Submitter Information Verification

Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 17:07:42 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-936-NFPA 70-2015
Statement: 1. The informational note, formerly under 690.7(A)(2) is moved directly under 690.7(A) and the last phrase is removed to make it generally applicable. Also, the ASHRAE reference is updated.

2. In 690.7(A)(3), the word “kilowatts” is changed to “kW” to match the style manual.

3. The language related to “engineering supervision” is revised to be more specific as to what engineers are allowed to perform this calculation. Competency of professional electrical engineers is governed by the licensing boards.

4. The duplicative language related to voltage calculations is removed.
PV system dc conductors on or in one- and two family dwellings shall be permitted to have a maximum voltage of 600 volts or less. PV system dc conductors on or in other types of buildings shall be permitted to have a maximum voltage of 1000 volts or less.

PV system dc conductors and equipment not on or in a building with a maximum voltage of 1500V or less do not need to comply with Article 490.

Statement of Problem and Substantiation for Public Comment

In PI#3181 it was proposed to raise the voltage limit in the scope of Art. 490 from 1000V to 2000V. The substantiation for PI#3181 pointed out that product standards for HV equipment begin at 2000V and that recent changes to product standards for low voltage equipment have raised requirements suitable for higher voltages up to 1500V or 2000V in some cases.

In particular, for the PV industry there has been a lot of work done to revise product standards for switches, circuit breakers, fuses, modules, power conversion, etc. to cover PV system voltages up to at least 1500V. Such systems should not have to use the approaches in Art. 490, which are intended to address medium voltage installations at 2.4kV and higher using HV equipment. The burden such requirements place on PV systems are not justified at system voltages of 1500V or less using appropriately rated and approved equipment.

PI#3181 was resolved, but in their Resolution statement the CMP wrote "Increasing the upper limit may be practical in microenvironments such as those covered in Articles 690 or 694...:" which indicates that it would be appropriate to narrow the scope of PI#3181 to just PV, and move it to Art. 690 and 691, which we are now doing with this Public Comment and a related one for a revision to 691.8.

Note that we would like to get both revisions accepted: this one to 690.7 and the related one for 691.8. However if the CMP feels that they cannot accept this 690.7 proposal, please consider the 691.8 proposal separately and on its own merit.

Related Public Comments for This Document

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Submitter Information Verification

Submitter Full Name: JIM EICHNER
Organization: SCHNEIDER ELECTRIC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 15:37:00 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-935-NFPA 70-2015
Statement: The lead sentence was added to clearly define what maximum voltage is in PV system dc circuits.

A dash is added between "two" and "family" for consistency of terminology.

In the first and second sentence, the word "conductors" is changed to "circuits" for clarity.

A sentence was added to the first paragraph to address equipment in the dc portion PV systems up to 1500V off of buildings. The listing process covers the proper requirements for 1500Vdc and corresponds to 1000Vac above which Article 490 applies.
Public Comment No. 477-NFPA 70-2015 [Section No. 690.7 [Excluding any Sub-Sections]]

PV system dc conductors on or in one- and two family dwellings shall be permitted to have a maximum system voltage of 600 volts or less. PV system dc conductors on or in other types of buildings shall be permitted to have a maximum system voltage of 1000 volts or less.

Statement of Problem and Substantiation for Public Comment

It's the system voltage that we are discussing, not the conductor insulation voltage.

Related Item
First Revision No. 1020-NFPA 70-2015 [Section No. 690.7]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Aug 30 16:33:26 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-935-NFPA 70-2015
Statement: The lead sentence was added to clearly define what maximum voltage is in PV system dc circuits.

A dash is added between "two" and "family" for consistency of terminology.

In the first and second sentence, the word "conductors" is changed to "circuits" for clarity.

A sentence was added to the first paragraph to address equipment in the dc portion PV systems up to 1500V off of buildings. The listing process covers the proper requirements for 1500Vdc and corresponds to 1000Vac above which Article 490 applies.
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Statement of Problem and Substantiation for Public Comment

Editorial note: A "dash" should be added between the words "two" and "family."

Related Item
First Revision No. 1020-NFPA 70-2015 [Section No. 690.7]

Submitter Information Verification

Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-935-NFPA 70-2015
Statement: The lead sentence was added to clearly define what maximum voltage is in PV system dc circuits.

A dash is added between "two" and "family" for consistency of terminology.

In the first and second sentence, the word "conductors" is changed to "circuits" for clarity.

A sentence was added to the first paragraph to address equipment in the dc portion PV systems up to 1500V off of buildings. The listing process covers the proper requirements for 1500Vdc and corresponds to 1000Vac above which Article 490 applies.
Photovoltaic Source and Output Circuits.

In a dc PV source circuit or output circuit, the maximum PV system voltage for that circuit shall be calculated in accordance with one of the following methods:

1. The sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the open-circuit voltage temperature coefficients in accordance with the instructions included in the listing or labeling of the module.

2. For crystalline and multicrystalline silicon modules, the sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the correction factor provided in Table 690.7(A).

   Informational Note: One source for statistically valid, lowest-expected, ambient temperature design data for various locations is the chapter titled Extreme Annual Mean Minimum Design Dry Bulb Temperature found in the ASHRAE Handbook — Fundamentals, 2009. These temperature data can be used to calculate maximum voltage using the manufacturer’s temperature coefficients relative to the rating temperature of 25°C.

3. For PV systems with a generating capacity of 100 kilowatts or greater, an industry standard method shall be permitted to be used under engineering supervision.


Maximum voltage shall be corrected using one of the three following methods to calculate the module voltage:

- For crystalline and multicrystalline silicon modules, the correction factors provided in Table 690.7(A) shall be permitted to be used.

- For PV systems with a generating capacity of 100 kilowatts or greater, alternate methods shall be permitted to be used under engineering supervision.


The maximum voltage shall be used to determine the voltage rating of conductors, cables, disconnects, overcurrent devices, and other equipment.

Table 690.7(A) Voltage Correction Factors for Crystalline and Multicrystalline Silicon Modules

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Statement of Problem and Substantiation for Public Comment

This text repeats what is already said more succinctly in 1-3 above.

Related Item

First Revision No. 1020-NFPA 70-2015 [Section No. 690.7]
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<th>BRIAN LYDIC</th>
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### Committee Statement

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(A) Photovoltaic Source and Output Circuits.
In a dc PV source circuit or output circuit, the maximum PV system voltage for that circuit shall be calculated in accordance with one of the following methods:

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Statement of Problem and Substantiation for Public Comment

SunPower would like to thank the CMP for adopting a version of our proposal to add provisions for using the Sandia Model to calculate the Maximum PV System Voltage. It appears that two versions of 690.7(A) were included in the First Draft version of 690.7. SunPower...
supports using the first version and removing the second version as it more clearly states the requirements.

**Related Item**
First Revision No. 1020-NFPA 70-2015 [Section No. 690.7]

**Submitter Information Verification**
- **Submitter Full Name:** MARK ALBERS
- **Organization:** SUNPOWER
- **Submitter Date:** Fri Oct 02 11:53:03 EDT 2015

**Committee Statement**

**Committee Action:** Rejected but see related SR

**Resolution:** SR-936-NFPA 70-2015

**Statement:**
1. The informational note, formerly under 690.7(A)(2) is moved directly under 690.7(A) and the last phrase is removed to make it generally applicable. Also, the ASHRAE reference is updated.

2. In 690.7(A)(3), the word “kilowatts” is changed to “kW” to match the style manual.

3. The language related to “engineering supervision” is revised to be more specific as to what engineers are allowed to perform this calculation. Competency of professional electrical engineers is governed by the licensing boards.

4. The duplicative language related to voltage calculations is removed.
Photovoltaic Source and Output Circuits.

In a dc PV source circuit or output circuit, the maximum PV system voltage for that circuit shall be calculated in accordance with one of the following methods:

1. The sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the open-circuit voltage temperature coefficients in accordance with the instructions included in the listing or labeling of the module.

2. For crystalline and multicrystalline silicon modules, the sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the correction factor provided in Table 690.7(A).

   Informational Note: One source for statistically valid, lowest-expected, ambient temperature design data for various locations is the chapter titled Extreme Annual Mean Minimum Design Dry Bulb Temperature found in the ASHRAE Handbook — Fundamentals, 2009. These temperature data can be used to calculate maximum voltage using the manufacturer’s temperature coefficients relative to the rating temperature of 25°C.

3. For PV systems with a generating capacity of 100 kilowatts or greater, an industry standard method shall be permitted to be used under engineering supervision.


Maximum voltage shall be corrected using one of the three following methods to calculate the module voltage: The open-circuit voltage temperature coefficients module voltage in accordance with the instructions included in the listing of the module.

- For crystalline and multicrystalline silicon modules, the correction factors provided in Table 690.7(A) shall be permitted to be used.

- For PV systems with a generating capacity of 100 kilowatts or greater, alternate methods shall be permitted to be used under engineering supervision.


The maximum voltage shall be used to determine the voltage rating of conductors, cables, disconnects, overcurrent devices, and other equipment.

### Table 690.7(A) Voltage Correction Factors for Crystalline and Multicrystalline Silicon Modules

<table>
<thead>
<tr>
<th>Ambient Temperature (°C)</th>
<th>Factor</th>
<th>Ambient Temperature (°F)</th>
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<tbody>
<tr>
<td>24 to 20</td>
<td>1.02</td>
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<td>1.10</td>
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<tr>
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</tr>
<tr>
<td>–36 to –40</td>
<td>1.25</td>
<td>–32 to –40</td>
</tr>
</tbody>
</table>

**Statement of Problem and Substantiation for Public Comment**

This appears to be an editing error in the draft. The deleted text duplicates the other text in the section.

**Related Item**

Public Input No. 1909-NFPA 70-2014 [Section No. 690.7(A)]
Public Input No. 4095-NFPA 70-2014 [Section No. 690.7(A)]
Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING, INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jul 20 16:58:46 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-936-NFPA 70-2015
Statement:

1. The informational note, formerly under 690.7(A)(2) is moved directly under 690.7(A) and the last phrase is removed to make it generally applicable. Also, the ASHRAE reference is updated.

2. In 690.7(A)(3), the word “kilowatts” is changed to “kW” to match the style manual.

3. The language related to “engineering supervision” is revised to be more specific as to what engineers are allowed to perform this calculation. Competency of professional electrical engineers is governed by the licensing boards.

4. The duplicative language related to voltage calculations is removed.
(A) Photovoltaic Source and Output Circuits.

In a dc PV source circuit or output circuit, the maximum PV system voltage for that circuit shall be calculated in accordance with one of the following methods:

Informational Note: One source for statistically valid, lowest-expected, ambient temperature design data for various locations is the chapter titled Extreme Annual Mean Minimum Design Dry Bulb Temperature found in the ASHRAE Handbook — Fundamentals, 2009. These temperature data can be used to calculate maximum voltage using the manufacturer’s temperature coefficients relative to the rating temperature of 25°C.

1. The sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the open-circuit voltage temperature coefficients in accordance with the instructions included in the listing or labeling of the module.

2. For crystalline and multicrystalline silicon modules, the sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the correction factor provided in Table 690.7(A).

Informational Note: One source for statistically valid, lowest-expected, ambient temperature design data for various locations is the chapter titled Extreme Annual Mean Minimum Design Dry Bulb Temperature found in the ASHRAE Handbook — Fundamentals, 2009. These temperature data can be used to calculate maximum voltage using the manufacturer’s temperature coefficients relative to the rating temperature of 25°C.

3. For PV systems with a generating capacity of 100 kilowatts or greater, an industry standard method shall be permitted to be used under engineering supervision.


Maximum voltage shall be corrected using one of the three following methods to calculate the module voltage:

1. The open-circuit voltage temperature coefficients module voltage in accordance with the instructions included in the listing of the module.

2. For crystalline and multicrystalline silicon modules, the correction factors provided in Table 690.7(A) shall be permitted to be used.

3. For PV systems with a generating capacity of 100 kilowatts or greater, alternate methods shall be permitted to be used under engineering supervision.


The maximum voltage shall be used to determine the voltage rating of conductors, cables, disconnects, overcurrent devices, and other equipment.

Table 690.7(A) Voltage Correction Factors for Crystalline and Multicrystalline Silicon Modules

<table>
<thead>
<tr>
<th>Correction Factors for Ambient Temperatures Below 25°C (77°F). (Multiply the rated open circuit voltage by the appropriate correction factor shown below.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature (°C)</td>
</tr>
<tr>
<td>24 to 20</td>
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</tbody>
</table>
Statement of Problem and Substantiation for Public Comment

The "informational Note" should be moved to the beginning of the section. Currently the draft has located this note under list item (2). This location suggests to the reader that it only applies to list item (2). This information equally applies to list item (1) and (3). A better location would be at the top of the list items as then it would be clear the "Informational Note" applies to all list items (1) through (3).

Related Item
First Revision No. 1020-NFPA 70-2015 [Section No. 690.7]

Submitter Information Verification

Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 09 16:36:27 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-936-NFPA 70-2015
Statement: 1. The informational note, formerly under 690.7(A)(2) is moved directly under 690.7(A) and the last phrase is removed to make it generally applicable. Also, the ASHRAE reference is updated.

2. In 690.7(A)(3), the word “kilowatts” is changed to “kW” to match the style manual.

3. The language related to “engineering supervision” is revised to be more specific as to what engineers are allowed to perform this calculation. Competency of professional electrical engineers is governed by the licensing boards.

4. The duplicative language related to voltage calculations is removed.
Public Comment No. 995-NFPA 70-2015 [Section No. 690.7(A)]

(A) Photovoltaic Source and Output Circuits.

In a dc PV source circuit or output circuit, the maximum PV system voltage for that circuit shall be calculated in accordance with one of the following methods:

1. The sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the open-circuit voltage temperature coefficients in accordance with the instructions included in the listing or labeling of the module.

2. For crystalline and multicrystalline silicon modules, the sum of the PV module rated open-circuit voltage of the series connected modules corrected for the lowest expected ambient temperature using the correction factor provided in Table 690.7(A).

   Informational Note: One source for statistically valid, lowest-expected, ambient temperature design data for various locations is the chapter titled Extreme Annual Mean Minimum Design Dry Bulb Temperature found in the ASHRAE Handbook — Fundamentals, 2009. These temperature data can be used to calculate maximum voltage using the manufacturer’s temperature coefficients relative to the rating temperature of 25°C.

3. For PV systems with a generating capacity of 100 kilowatts or greater, an approved industry standard method shall be permitted to be used under engineering supervision.


Maximum voltage shall be corrected using one of the three following methods to calculate the module voltage:

1. The open-circuit voltage temperature coefficients module voltage in accordance with the instructions included in the listing of the module.

2. For crystalline and multicrystalline silicon modules, the correction factors provided in Table 690.7(A) shall be permitted to be used.

3. For PV systems with a generating capacity of 100 kilowatts or greater, alternate methods shall be permitted to be used under engineering supervision.


The maximum voltage shall be used to determine the voltage rating of conductors, cables, disconnects, overcurrent devices, and other equipment.

Table 690.7(A) Voltage Correction Factors for Crystalline and Multicrystalline Silicon Modules

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Statement of Problem and Substantiation for Public Comment

The correlating committee requested to rephrase this provision and the definition of engineering supervision. This comment allows the AHJ to decide what is an approved method. In reality, many AHJs require this type of calculation to be done by a design professional who is often an engineer.
Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 22:47:27 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-936-NFPA 70-2015
Statement:

1. The informational note, formerly under 690.7(A)(2) is moved directly under 690.7(A) and the last phrase is removed to make it generally applicable. Also, the ASHRAE reference is updated.

2. In 690.7(A)(3), the word “kilowatts” is changed to “kW” to match the style manual.

3. The language related to “engineering supervision” is revised to be more specific as to what engineers are allowed to perform this calculation. Competency of professional electrical engineers is governed by the licensing boards.

4. The duplicative language related to voltage calculations is removed.
Public Comment No. 492-NFPA 70-2015 [Section No. 690.7(B)]

(B) DC-to-DC Converter Source and Output Circuits.
In a dc-to-dc converter source and output circuit, the maximum voltage shall be calculated in accordance with 690.7(B) (1) or (2).

(1) Single dc-to-dc Converter. For circuits connected to the output of a single dc-to-dc converter, the maximum voltage shall be the maximum rated voltage output of the dc-to-dc converter.

(2) Two or More Series-connected dc-to-dc Converters. For circuits connected to the output of two or more series-connected dc-to-dc converters, the maximum voltage shall be determined in accordance with either of the following methods:
   (a) The instructions included in the listing or labeling of the dc-to-dc converter.
   (b) If instructions are not included in the listing or labeling of the dc-to-dc converter, the maximum voltage shall be the sum of the maximum rated voltage output of the dc-to-dc converters in series.

Statement of Problem and Substantiation for Public Comment

DC-DC Converter instructions are not required to provide a method to calculate the maximum voltage when connecting them in series. In my experience most do not provide this information. Therefore a second method must be given in the code in the instance where the manufacturer does not provide the required method to calculate the maximum voltage. That is simply to sum up the maximum voltages of the individual devices.

Related Item
Public Input No. 4060-NFPA 70-2014 [Section No. 690.7(B)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 01 19:50:55 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-937-NFPA 70-2015
Statement: The maximum voltage is the sum of the devices if no end-to-end control of the circuit has been evaluated. The list was reworded to remove the second list within the list and to remove repetitious language.
(C) Bipolar Source and Output Circuits.
For 2-wire circuits connected to bipolar systems, the maximum voltage shall be the highest voltage between the conductors of the 2-wire circuit if all of the following conditions apply: One conductor of each circuit of a bipolar subarray is referenced connected to ground to prevent overvoltage of the circuit. The operation of ground-fault or arc-fault devices (abnormal operation) shall be permitted to interrupt the ground reference when the entire bipolar array becomes a ground detector. At the detection of a ground-fault, the entire bipolar array shall become two distinct arrays isolated from each other and the utilization equipment. Each circuit is connected to a separate subarray to prevent overvoltage of either circuit.

Statement of Problem and Substantiation for Public Comment
This comment is to address the correlating committees concerns about use of terms related to reference grounding of PV systems. This revised language is consistent with the revised version of 690.41(A) and 250.21. Simply stated, the voltage of a bipolar array can be considered the highest voltage between the two conductors in a bipolar subarray provided that, in the event of a ground-fault, the two subarrays are isolated from one another so that their voltages cannot be additive. It is also not needed to state that the Bipolar PV system is isolated from utilization equipment since that is already a requirement in 690.41(B).

Related Item
First Revision No. 1020-NFPA 70-2015 [Section No. 690.7]

Submitter Information Verification
Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address: 
City:  
State:  
Zip:  
Submittal Date: Thu Sep 24 23:27:08 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-938-NFPA 70-2015
Statement: The section was rewritten to better comply with the style manual and to be more understandable. The term "reference ground" is changed to "functional ground" to correlate with the rest of the Code.
Photovoltaic Source Circuit Currents.

The maximum current shall be calculated by one of the following methods:

1. The sum of parallel PV module rated short-circuit currents multiplied by 125 percent.

2. For PV systems with a generating capacity of 100 kilowatts or greater, an industry standard method, performed under engineering supervision, that accounts for the maximum current variables of elevation, array orientation, and irradiance. The calculated maximum current value used by this method shall not be less than 70 percent of the value calculated using 690.8(A)(1) (a). The wire size shall not be smaller than the minimum wire size for the wiring terminal of the equipment, and the minimum wire size based on the product ratings and installation instructions.

Informational Note: One industry standard method for calculating maximum current of a PV system is available from Sandia National Laboratories, reference SAND 2004-3535, Photovoltaic Array Performance Model. This model is used by the System Advisor Model simulation program provided by the National Renewable Energy Laboratory.

Statement of Problem and Substantiation for Public Comment

As written the calculations could result in use of a smaller wire size than is appropriate for the equipment.

We suggest appending the following text to the end of item (2): “The wire size shall not be smaller than the minimum wire size for the wiring terminal of the equipment, and the minimum wire size based on the product ratings and installation instructions.”

Related Item

First Revision No. 966-NFPA 70-2015 [Section No. 690.8(A)(1)]

Submitter Information Verification

Submitter Full Name: Timothy Zgonena
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:54:26 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This valid concern is an issue for all electrical equipment. All electrical terminals have requirements for wire size, CU or AL, number of strands, etc... This PC would necessitate warnings added throughout the Code.
(1) Photovoltaic Source Circuit Currents.

The maximum current shall be calculated by one of the following methods:

(1) The sum of parallel PV module rated short-circuit currents multiplied by 125 percent

(2) For PV systems not mounted on building and with a generating capacity of 100 kilowatts or greater, an industry standard method, performed under engineering supervision, that accounts for the maximum current variables of elevation, array orientation, and irradiance. The calculated maximum current value used by this method shall not be less than 70 percent of the value calculated using 690.8(A)(1) (a)

Informational Note: One industry standard method for calculating maximum current of a PV system is available from Sandia National Laboratories, reference SAND 2004-3535, Photovoltaic Array Performance Model. This model is used by the System Advisor Model simulation program provided by the National Renewable Energy Laboratory.

**Statement of Problem and Substantiation for Public Comment**

SunPower views the addition of 690.8(A)(1)(b) has serious risk for the PV industry. If this adjustment is not calculated correctly, conductors and equipment will overheat because they are carrying more current then they are capable of carrying, which could cause a fire. The situations where this provision is needed are limited. Additionally, there are not well established public resources for the environmental data that would need to be used for this adjustment. Whereas, the ASHRAE handbook provides an established resource for the temperature data needed to apply the Sandia Model to the maximum PV System voltage calculation, the same is not true for maximum irradiance data. As a result the risks associated with this proposal out weigh the advantages. For this reason, SunPower and other members of SEIA opposed introducing this concept into the 2017 NEC and it was not submitted as a SEIA proposal for the First Draft hearing. Since this concept has been introduced and adopted by CMP 4, we recommend that the risk associated with this proposal be limited by not allowing it to be used for PV systems on buildings. This will limit the consequences if this provision is incorrectly used and the mistake causes a fire.

**Related Item**

First Revision No. 966-NFPA 70-2015 [Section No. 690.8(A)(1)]

**Submitter Information Verification**

Submitter Full Name: MARK ALBERS
Organization: SUNPOWER
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 18:21:36 EDT 2015

**Committee Statement**

Committee Action: Rejected
Resolution: Limiting this to non-buildings does not remove the circuit from hazard. With the clarification provided in SR 939, the parameter that must be simulated is properly focused upon. Numerous simulation programs exist that are capable of making this calculation accurately.
Public Comment No. 493-NFPA 70-2015 [Section No. 690.8(A)(1)]

(1) Photovoltaic Source Circuit Currents.
The maximum current shall be calculated by one of the following methods:
(a) The sum of parallel PV module rated short-circuit currents multiplied by 125 percent
(b) For PV systems with a generating capacity of 100 kilowatts or greater, an industry standard method, performed under engineering supervision, that accounts for the maximum current variables of elevation, array orientation, and irradiance. The calculated maximum current value used by this method shall not be less than 70 percent of the value calculated using 690.8(A)(1) (a)

Informational Note: One industry standard method for calculating maximum current of a PV system is available from Sandia National Laboratories, reference SAND 2004-3535, Photovoltaic Array Performance Model. This model is used by the System Advisor Model simulation program provided by the National Renewable Energy Laboratory.

Statement of Problem and Substantiation for Public Comment
Incorrect level 3 identifier according to the style manual.

Related Item
First Revision No. 966-NFPA 70-2015 [Section No. 690.8(A)(1)]

Submitter Information Verification
Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 01 20:37:03 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-939-NFPA 70-2015
Statement: The numbering was inconsistent with the style manual.
The panel includes the word “-connected” to modify the word parallel for clarity.
The language related to engineering supervision is revised to more clearly define what an engineer must do to meet this provision. The competency of professional engineers is governed by the licensing boards.
The First Draft recognized the variables of current as irradiance, elevation, and orientation. In the rewording for the SR, it is made clearer that elevation and orientation are modifiers of the local irradiance. Irradiance on the surface of the PV array is what establishes how much current is available.
Public Comment No. 996-NFPA 70-2015 [Section No. 690.8(A)(1)]

(1) Photovoltaic Source Circuit Currents.

The maximum current shall be calculated by one of the following methods:

(1) The sum of parallel PV module rated short-circuit currents multiplied by 125 percent

(2) For PV systems with a generating capacity of 100 kilowatts or greater, an approved industry standard method, performed under engineering supervision, that accounts for, calculates, the maximum current variables of elevation, array orientation, and irradiance 3-hour current based on the simulated irradiance on the PV array. The calculated maximum current value used by this method shall not be less than 70 percent of the value calculated using 690.8(A)(1) (a)

Informational Note: One industry standard method for calculating maximum current of a PV system is available from Sandia National Laboratories, reference SAND 2004-3535, Photovoltaic Array Performance Model. This model is used by the System Advisor Model simulation program provided by the National Renewable Energy Laboratory.

Statement of Problem and Substantiation for Public Comment

This comment clarifies that the maximum current is a 3-hour value that is based on simulated irradiance on the PV array. The variables of elevation and orientation are relevant to current as they adjust the irradiance on the PV array so ultimately irradiance is the only true factor that determines current. Mentioning the other two factors of elevation and orientation may be confusing to AHJs.

Related Item

First Revision No. 966-NFPA 70-2015 [Section No. 690.8(A)(1)]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 23:00:44 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-939-NFPA 70-2015
Statement: The numbering was inconsistent with the style manual.

The panel includes the word “connected” to modify the word parallel for clarity.

The language related to engineering supervision is revised to more clearly define what an engineer must do to meet this provision. The competency of professional engineers is governed by the licensing boards.

The First Draft recognized the variables of current as irradiance, elevation, and orientation. In the rewording for the SR, it is made clearer that elevation and orientation are modifiers of the local irradiance. Irradiance on the surface of the PV array is what establishes how much current is available.
Public Comment No. 1085-NFPA 70-2015 [Section No. 690.8(B)]

(B) Conductor Ampacity.

PV system currents shall be considered to be continuous. Circuit conductors shall be sized to carry not less than the larger of 690.8(B)(1) or (2) or where protected by adjustable electronic overcurrent protection as per 690.9(B) Exception 2, not less than the current in 690.8(B)(3).

(1) One hundred and twenty-five percent of the maximum currents calculated in 690.8(A) before the application of adjustment and correction factors

Exception: Circuits containing an assembly, together with its overcurrent device(s), that is listed for continuous operation at 100 percent of its rating shall be permitted to be used at 100 percent of its rating.

(2) The maximum currents calculated in 690.8(A) after the application of adjustment and correction factors

(3) The rating or setting of the adjustable electronic overcurrent protection in accordance with Art. 240.4

Statement of Problem and Substantiation for Public Comment

Our PI#4744 and PI #4749 were intended to revise the rules for sizing of overcurrent protective devices in PV source and output circuits so that adjustable electronic trip devices could be sized more traditionally (per Art. 240) rather than having to be sized for 125% of the PV short circuit current in the existing 690.9 approach, ensuring they can never trip in the forward direction. While thermal devices such as fuses can be damaged or fail to clear properly when faced with low fault currents, the same is not true of adjustable electronic overcurrent devices. By allowing the rating or setting of such devices in accordance with Art. 240, the devices can provide protection in the forward direction, without risk of being damaged or failing to clear properly, and the devices and the conductors they protect may be made smaller in some situations.

Those PI's were resolved, so we are submitting two related Public Comments: this one on 690.8(B) and a related one on 690.9(B). We feel the intent of the original PI's may not have been clear by the way they were structured, and so these Public Comments attempt to achieve the same objectives in a different way.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
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<td>Public Comment No. 1090-NFPA 70-2015 [Section No. 690.9(B)]</td>
<td>Related Item</td>
</tr>
<tr>
<td>Public Input No. 4744-NFPA 70-2014 [Section No. 690.8(A)(2)]</td>
<td>Public Input No. 4749-NFPA 70-2014 [Section No. 690.9(B)]</td>
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</tbody>
</table>

Submitter Information Verification

Submitter Full Name: JIM EICHNER
Organization: SCHNEIDER ELECTRIC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 16:16:20 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-940-NFPA 70-2015
Statement: The panel recognizes that electronic overcurrent protective devices are well-suited to PV circuits in that they can react accurately to overload and fault conditions and adequately protect PV output circuit conductors in a PV array. The word “listed” was added in front of “adjustable electronic overcurrent protective devices” to make it clear that non-listed equipment should not be allowed in this type of application. The word “protection” is changed to “protective device” in two
places for consistency with the rest of the Code.
690.9 Overcurrent Protection.

(A) Circuits and Equipment.

PV system dc circuit and inverter output conductors and equipment shall be protected against overcurrent. Overcurrent protection devices are not required for circuits with sufficient ampacity for the highest available current. Circuits connected to current limited supplies (e.g., PV modules, dc-to-dc converters, output circuits) and also connected to sources having higher current availability (e.g., parallel strings of modules, utility power) shall be protected at the higher current source connection.

Exception: An overcurrent device shall not be required for PV modules or PV source circuit or dc-to-dc converters source circuit conductors sized in accordance with 690.8(B) where one of the following applies:

1. There are no external sources such as parallel-connected source circuits, batteries, or backfeed from inverters.
2. The short-circuit currents from all sources do not exceed the ampacity of the conductors and the maximum overcurrent protective device size rating specified for the PV module or dc-to-dc converter.

Informational Note: Photovoltaic system dc circuits are current limited circuits that only need overcurrent protection when connected in parallel to higher current sources. Where necessary, the overcurrent device is installed at the higher current source end of the circuit.

(B) Overcurrent Device Ratings.

Overcurrent devices used in any dc portion of a PV system shall be listed for use in PV systems. Overcurrent device ratings shall be not less than 125 percent of the maximum currents calculated in 690.8(A).

Exception: Circuits containing an assembly, together with its overcurrent device(s), that is listed for continuous operation at 100 percent of its rating shall be permitted to be used at 100 percent of its rating.

(C) Photovoltaic Source and Output Circuits.

A single overcurrent protection device, where required, shall be permitted to protect the PV modules and conductors of each source circuit or the conductors of each output circuit. Where single overcurrent protection devices are used to protect PV source or output circuits, all overcurrent devices shall be placed in the same polarity for all circuits within a PV system. The overcurrent devices shall be accessible but shall not be required to be readily accessible.

Informational Note: Due to improved ground-fault protection required in PV systems by 690.41(B), a single overcurrent protection device in either the positive or negative conductors of a PV system in combination with this ground-fault protection provides adequate overcurrent protection.

(D) Power Transformers.

Overcurrent protection for a transformer with a source(s) on each side shall be provided in accordance with 450.3 by considering first one side of the transformer, then the other side of the transformer, as the primary.

Exception: A power transformer with a current rating on the side connected toward the -interactive inverter output, not less than the rated continuous output current of the inverter, shall be permitted without overcurrent protection from the inverter.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that FR 972 be rewritten to comply with the NEC Style Manual. Wherever the phrase “overcurrent protection device” is used in this subsection rewrite, replace with the phrase “overcurrent protective device.”

Related Item
First Revision No. 972-NFPA 70-2015 [Section No. 690.9]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 11:35:48 EDT 2015

Committee Statement

Committee Rejected but see related SR
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<td><strong>Resolution:</strong></td>
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<td><strong>Statement:</strong></td>
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(A) Circuits and Equipment.

PV system dc circuit and inverter output conductors and equipment shall be protected against overcurrent. Overcurrent protective devices are not required for circuits with sufficient ampacity for the highest available current. Circuits connected to current limited supplies (e.g., PV modules, dc-to-dc converters, interactive inverter output circuits) and also connected to sources having higher current availability (e.g., parallel strings of modules, utility power) shall be protected at the higher current source connection.

Exception: An overcurrent device shall not be required for PV modules or PV source circuit or dc-to-dc converters source circuit conductors sized in accordance with 690.8(B) where one of the following applies:

1. There are no external sources such as parallel-connected source circuits, batteries, or backfeed from inverters.
2. The short-circuit currents from all sources do not exceed the ampacity of the conductors and the maximum overcurrent protective device size rating specified for the PV module or dc-to-dc converter.

Informational Note: Photovoltaic system dc circuits are current limited circuits that only need overcurrent protection when connected in parallel to higher current sources. Where necessary, the overcurrent device is installed at the higher current source end of the circuit.

Statement of Problem and Substantiation for Public Comment

This comment addresses two issues raised by the correlating committee. The term “protective” device is used instead of protection device. Also, the addition of the words “interactive inverter” to output circuits was part of the FR but inadvertently dropped from the draft. This comment reinstates those words.

Related Item
First Revision No. 972-NFPA 70-2015 [Section No. 690.9]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 23:16:43 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-941-NFPA 70-2015
Statement: The term "protective device" is used instead of "protection device" for consistency of terminology. Also, the addition of the words "interactive inverter" to "output circuits" was part of the FR but inadvertently dropped from the draft. This revision reinstates those words.
Public Comment No. 1090-NFPA 70-2015 [Section No. 690.9(B)]

(B) Overcurrent Device Ratings.

Overcurrent devices used in any dc portion of a PV system shall be listed for use in PV systems. Overcurrent device ratings shall be not less than 125 percent of the maximum currents calculated in 690.8(A).

Exception (1): Circuits containing an assembly, together with its overcurrent device(s), that is listed for continuous operation at 100 percent of its rating shall be permitted to be used at 100 percent of its rating.

Exception (2): Adjustable electronic overcurrent protection devices may be rated or set in accordance with Art. 240.4

Statement of Problem and Substantiation for Public Comment

Our PI#4744 and PI #4749 were intended to revise the rules for sizing of overcurrent protective devices in PV source and output circuits so that adjustable electronic trip devices could be sized more traditionally (per Art. 240) rather than having to be sized for 125% of the PV short circuit current in the existing 690.9 approach, ensuring they can never trip in the forward direction. While thermal devices such as fuses can be damaged or fail to clear properly when faced with low fault currents, the same is not true of adjustable electronic overcurrent devices. By allowing the rating or setting of such devices in accordance with Art. 240, the devices can provide protection in the forward direction, without risk of being damaged or failing to clear properly, and the devices and the conductors they protect may be made smaller in some situations.

Those PI's were resolved, so we are submitting two related Public Comments: this one on 690.9(B) and a related one on 690.8(B). We feel the intent of the original PI's may not have been clear by the way they were structured, and so these Public Comments attempt to achieve the same objectives in a different way.

Related Public Comments for This Document

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<td>Public Input No. 4749-NFPA 70-2014 [Section No. 690.9(B)]</td>
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Submitter Information Verification

Submitter Full Name: JIM EICHER
Organization: SCHNEIDER ELECTRIC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 16:31:34 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-942-NFPA 70-2015
Statement: The newly defined “PV system dc circuit” addresses all the circuits that would require listed PV overcurrent devices.

The exceptions are turned into a list to reduce the number exceptions in Article 690 and to fix style issues.

The panel accepts the addition of the words “and labeled” as originally voted on in the First Revision language.

The new informational note to 690.9(B)(3) clarifies that listed devices can prevent backfeed current.
Public Comment No. 1314-NFPA 70-2015 [Section No. 690.9(B)]

(B) Overcurrent Device Ratings.

Overcurrent devices used in any dc portion of a PV system shall be listed, labeled and identified for use in PV systems. Overcurrent device ratings shall be not less than 125 percent of the maximum currents calculated in 690.8(A).

Exception: Circuits containing an assembly, together with its overcurrent device(s), that is listed and labeled for continuous operation at 100 percent of its rating shall be permitted to be used at 100 percent of its rating.

Additional Proposed Changes

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<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term "and labeled" was added after "listed" during the First Revision Stage, the words "and labeled" after "listed" be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms "listed" and "labeled," most importantly, to clarify and establish a distinction between the terms "listed" and "labeled" which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of "listed and labeled." As such, UL is submitting comments to request that the words "and labeled" be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer's attestation that the product is in compliance with the appropriate standard. NRTL's conduct factory surveillance of products, surveillance is one method to validate the manufacturer's attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the "Listing" is not impacted, as the "listing" is created at the completion of the "original" certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a "listing" has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, not labeled, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that "Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards." Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item

Public Input No. 937-NFPA 70-2014 [Section No. 690.9(C)]
First Revision No. 972-NFPA 70-2015 [Section No. 690.9]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Committee Statement

Committee Action: Rejected but see related SR  
Resolution: SR-942-NFPA 70-2015  
Statement: The newly defined "PV system dc circuit" addresses all the circuits that would require listed PV overcurrent devices.  
The exceptions are turned into a list to reduce the number exceptions in Article 690 and to fix style issues.  
The panel accepts the addition of the words "and labeled" as originally voted on in the First Revision language.  
The new informational note to 690.9(B)(3) clarifies that listed devices can prevent backfeed current.
Public Comment No. 989-NFPA 70-2015 [Section No. 690.9(B)]

(B) Overcurrent Device Ratings.
Overcurrent devices used in any dc portion of a PV system source circuits shall be listed for use in PV systems. Overcurrent device ratings shall be not less than 125 percent of the maximum currents calculated in 690.8(A).

Exception: Circuits containing an assembly, together with its overcurrent device(s), that is listed for continuous operation at 100 percent of its rating shall be permitted to be used at 100 percent of its rating.

Statement of Problem and Substantiation for Public Comment

Not all dc portions of a renewable energy system is exposed to the special considerations specific to PV source circuits, and listed dc components appropriate for those applications are readily available and have been used successfully and safely for years. The proposed revision acknowledges this, and uses PV source circuits as defined in 690 to clarify that it is the nature of PV source circuits, not merely dc, that triggers the higher requirement to be listed for PV systems.

Related Item
Public Input No. 3776-NFPA 70-2014 [Section No. 690.9]

Submitter Information Verification
Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 22:02:20 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-942-NFPA 70-2015
Statement: The newly defined "PV system dc circuit" addresses all the circuits that would require listed PV overcurrent devices. The exceptions are turned into a list to reduce the number exceptions in Article 690 and to fix style issues. The panel accepts the addition of the words "and labeled" as originally voted on in the First Revision language. The new informational note to 690.9(B)(3) clarifies that listed devices can prevent backfeed current.
Public Comment No. 1710-NFPA 70-2015 [Section No. 690.9(C)]

(C) Photovoltaic Source and Output Circuits.
A single overcurrent protection device, where required, shall be permitted to protect the PV modules and conductors of each source circuit or the conductors of each output circuit. Where single overcurrent protection devices are used to protect PV source or output circuits, all overcurrent devices shall be placed in the same polarity for all circuits within a PV system. The overcurrent devices shall be accessible but shall not be required to be readily accessible. For PV systems designed under engineering supervision and not on or in one or two family dwellings, blocking diodes rated for the maximum PV system voltage and for the current required by 690.9(B) shall be permitted as overcurrent protection devices for PV source and output circuits.

Informational Note: Due to improved ground-fault protection required in PV systems by 690.41(B), a single overcurrent protection device in either the positive or negative conductors of a PV system in combination with this ground-fault protection provides adequate overcurrent protection.

Statement of Problem and Substantiation for Public Comment
The OCPD used in PV source and PV output circuits only serve one purpose, to interrupt backfeed current when a fault occurs somewhere between the PV modules and the OCPD. However, the OCPD also needs to be sized to allow the normal operating current to pass through it without activating the OCPD. For a typical PV source circuit, the various derating factors would require that I use a 12A fuse when I have a PV module Isc of 6A. The 12A fuse will not blow until have more than 16 to 20A of fault current flowing through it. As a result, I could feed a fault on a PV source circuit with 6A from the PV modules connected to that string and another 20A from the parallel connected strings forever. This amount of current is more than sufficient to cause a fire. This is not a theoretical concept as there are cases where this situation has already occurred.

A preferred OCPD would allow the device to carry the required current during normal operation conditions and NOT allow any backfeed current to flow through the device during a fault condition. A blocking diode would provide this capability. However, the NEC as written does not allow for blocking diodes to be used as OCPDs. Thus, we propose that 690.9(C) be revised to allow for this superior solution to be implemented. This approach is not new; it has been used in PV systems in Japan for many years. However, we recognize that it would be new in the United States. Thus, we propose that in this code cycle it only be permitted to be used in systems designed under engineering supervision and not in residential systems. This will allow for this solution be used on a limited basis to demonstrate that it will also work well here in the US. In future code cycles, this restriction could be removed.

Related Item
First Revision No. 972-NFPA 70-2015 [Section No. 690.9]

Submitter Information Verification
Submitter Full Name: MARK ALBERS
Organization: SUNPOWER
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 17:16:48 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-942-NFPA 70-2015
Statement: The newly defined “PV system dc circuit” addresses all the circuits that would require listed PV overcurrent devices.

The exceptions are turned into a list to reduce the number exceptions in Article 690 and to fix style issues.

The panel accepts the addition of the words “and labeled” as originally voted on in the First Revision language.

The new informational note to 690.9(B)(3) clarifies that listed devices can prevent backfeed current.
Public Comment No. 999-NFPA 70-2015 [Section No. 690.9(C)]

(C) Photovoltaic Source and Output Circuits.

A single overcurrent protection device, where required, shall be permitted to protect the PV modules and conductors of each source circuit or the conductors of each output circuit. Where single overcurrent protection devices are used to protect PV source or output circuits, all overcurrent devices shall be placed in the same polarity for all circuits within a PV system. The overcurrent devices shall be accessible but shall not be required to be readily accessible.

Informational Note: Due to improved ground-fault protection required in PV systems by 690.41(B), a single overcurrent protective device in either the positive or negative conductors of a PV system in combination with this ground-fault protection provides adequate overcurrent protection.

Statement of Problem and Substantiation for Public Comment

Changes protection to “protective” as directed by the correlating committee.

Related Item
First Revision No. 972-NFPA 70-2015 [Section No. 690.9]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 23:22:01 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-943-NFPA 70-2015
Statement: The revision changes "protection" to "protective" for consistency of terminology.
Public Comment No. 1169-NFPA 70-2015 [Section No. 690.10]

690.10  Stand-Alone Systems.

The premises wiring system shall be adequate to meet the requirements of this Code for a similar installation, connected to a service. The wiring on the supply side of the building or structure disconnecting means shall comply with the requirements of this Code, except as modified by 690.10(A) through (D).

(A) Inverter Output.

The ac output from a stand-alone inverter(s) shall be permitted to supply ac power to the building or structure disconnecting means at current levels less than the calculated load connected to that disconnect. The inverter output rating or the rating of an alternate energy source shall be equal to or greater than the load posed by the largest single utilization equipment connected to the system. Calculated general lighting loads shall not be considered as a single load.

(B) Sizing and Protection.

The circuit conductors between the inverter output and the building or structure disconnecting means shall be sized based on the output rating of the inverter. These conductors shall be protected from overcurrents in accordance with Article 240. The overcurrent protection shall be located at the output of the inverter.

(C) Single 120-Volt Supply.

The inverter output of a stand-alone solar PV system shall be permitted to supply 120 volts to single-phase, 3-wire, 120/240-volt service equipment or distribution panels where there are no 240-volt outlets and where there are no multiwire branch circuits. In all installations, the rating of the overcurrent device connected to the output of the inverter shall be less than the rating of the neutral bus in the service equipment. This equipment shall be marked with the following words or equivalent:

WARNING
SINGLE 120-VOLT SUPPLY. DO NOT CONNECT MULTI-WIRE BRANCH CIRCUITS!

The warning sign(s) or label(s) shall comply with 110.21(B).

(D) Back-Fed Circuit Breakers.

Plug-in type back-fed circuit breakers connected to the stand-alone output of a stand-alone inverter or multimode inverter shall be secured in accordance with 408.36(D). Circuit breakers marked “line” and “load” shall not be back-fed. PV system shall be installed in accordance with 705.175.

Statement of Problem and Substantiation for Public Comment

This comment removes the content of 690.10 and replaces it with a reference to the new Article 705.175 where the content of 690.10 was moved.

Related Item
First Revision No. 1045-NFPA 70-2015 [New Part after III.]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address: City: State: Zip:

Submittal Date: Wed Sep 23 23:34:11 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: The deleted language is included in the new Article 710.
690.10 Stand-Alone Systems.

The premises wiring system shall be adequate to meet the requirements of this Code for a similar installation connected to a service. The wiring on the supply side of the building or structure disconnecting means shall comply with the requirements of this Code, except as modified by 690.10(A) through (D).

(A) Inverter Output.

The ac output from a stand-alone inverter(s) shall be permitted to supply ac power to the building or structure disconnecting means at current levels less than the calculated load connected to that disconnect. The inverter output rating or the rating of an alternate energy source shall be equal to or greater than the load posed by the largest single utilization equipment connected to the system. Calculated general lighting loads shall not be considered as a single load.

(B) Sizing and Protection.

The circuit conductors between the inverter output and the building or structure disconnecting means shall be sized based on the output rating of the inverter. These conductors shall be protected from overcurrents in accordance with Article 240. The overcurrent protection shall be located at the output of the inverter.

(C) Single 120-Volt Supply.

The inverter output of a stand-alone solar PV system shall be permitted to supply 120 volts to single-phase, 3-wire, 120/240-volt service equipment or distribution panels where there are no 240-volt outlets and where there are no multiwire branch circuits. In all installations, the rating of the overcurrent device connected to the output of the inverter shall be less than the rating of the neutral bus in the service equipment. This equipment shall be marked with the following words or equivalent:

WARNING
SINGLE 120-VOLT SUPPLY. DO NOT CONNECT MULTIWIRE BRANCH CIRCUITS!

The warning sign(s) or label(s) shall comply with 110.21(B).

(D) Energy Storage or Backup Power System Requirements.

Energy storage or backup power supplies are not required.

(E) Back-Fed Circuit Breakers.

Plug-in type back-fed circuit breakers connected to the stand-alone output of a stand-alone inverter or multimode inverter shall be secured in accordance with 408.36(D). Circuit breakers marked “line” and “load” shall not be back-fed.

Statement of Problem and Substantiation for Public Comment

The public input states that (D) was deleted because the content was moved to the definition of a stand-alone system but the change to the definition was rejected by the CMP. (D) should therefore be left in.

The reason (D) was in 690.10 was because some AHJs were requiring storage to be installed on stand-alone systems that did not incorporate storage. Removing this could cause AHJs to start requiring storage on all stand-alone systems again.

Related Item

Public Input No. 3899-NFPA 70-2014 [Section No. 690.10(D)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 02 17:40:31 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Statement: The deleted language is included in the new Article 710.
Public Comment No. 1318-NFPA 70-2015 [Section No. 690.11]

690.11  Arc-Fault Circuit Protection (Direct Current).

Photovoltaic systems operating at 80 volts or greater shall be protected by a listed, labeled and identified PV arc-fault circuit interruptor or other system components listed and labeled to provide equivalent protection. The system shall detect and interrupt arcing faults resulting from a failure in the intended continuity of a conductor, connection, module, or other system component in the PV system dc circuits.

Informational Note: Annex A includes the reference for the Photovoltaic DC Arc-Fault Circuit Protection product standard.

Exception: For PV systems not installed on or in buildings, PV output circuits and dc-to-dc converter output circuits that are direct buried, installed in metallic raceways, or installed in enclosed metallic cable trays are permitted without arc-fault circuit protection. Buildings whose sole purpose is to house PV system equipment shall not be considered buildings according to this exception.

Additional Proposed Changes

<table>
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<th>Description</th>
<th>Approved</th>
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<tbody>
<tr>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
Public Input No. 939-NFPA 70-2014 [Section No. 690.11]
First Revision No. 971-NFPA 70-2015 [Section No. 690.11]
Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 19:30:17 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-945-NFPA 70-2015
Statement: The correlating committee comment requested a relook at the comments from the First Revision language. Bipolar systems are addressed by the addition of “between any two conductors”.

The terms related to listing and labeling were returned to the first revision language.
690.11 Arc-Fault Circuit Protection (Direct Current).

Photovoltaic systems operating at 80 volts or greater shall be protected by a listed PV arc-fault circuit interrupter or other system components listed to provide equivalent protection. The system shall detect and interrupt arcing faults resulting from a failure in the intended continuity of a conductor, connection, module, or other system component in the PV system dc circuits.

Informational Note: Annex A includes the reference for the Photovoltaic DC Arc-Fault Circuit Protection product standard.

Exception: For PV systems not installed on or in buildings, PV output circuits and dc-to-dc converter output circuits that are direct buried, installed in metallic raceways, or installed in enclosed metallic cable trays are permitted without arc-fault circuit protection as long as ground fault protection is provided. Buildings whose sole purpose is to house PV system equipment shall not be considered buildings according to this exception.

Statement of Problem and Substantiation for Public Comment

Removal of arc-fault protection is removing a level of safety with the installed system. Ground fault protection will provide both series and parallel fault protection for workers should the conductor become damaged.

Related Item
First Revision No. 936-NFPA 70-2015 [Section No. 230.29]

Submitter Information Verification

Submitter Full Name: WENDELL WHISTLER
Organization: ALASKA JOINT ELECTRICAL APPRENTICE
Affiliation: IBEW
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:53:14 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: All PV systems require ground-fault detection with one minor exception (690.41(B) Exception). Adding this language would have little or no impact on the requirements for PV systems and could be confusing to enforcement.
Public Comment No. 1849-NFPA 70-2015 [Section No. 690.11]

690.11 Arc-Fault Circuit Protection (Direct Current).
Photovoltaic systems operating at 80 volts or greater shall be protected by a listed PV arc-fault circuit interrupter or other system components listed to provide equivalent protection. The system shall detect and interrupt arcing faults resulting from a failure in the intended continuuity of a conductor, connection, module, or other system component in the PV system dc circuits.

Informational Note: Annex A includes the reference for the Photovoltaic DC Arc-Fault Circuit Protection product standard.

Exception: For PV systems not installed on or in buildings, PV output circuits and dc-to-dc converter output circuits that are direct buried, installed in metallic raceways, or installed in enclosed metallic cable trays are permitted without arc-fault circuit protection. Buildings whose sole purpose is to house PV system equipment shall not be considered buildings according to this exception.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 971.

Related Item
First Revision No. 971-NFPA 70-2015 [Section No. 690.11]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 11:36:33 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-945-NFPA 70-2015
Statement: The correlating committee comment requested a relook at the comments from the First Revision language. Bipolar systems are addressed by the addition of “between any two conductors”.

The terms related to listing and labeling were returned to the first revision language.
690.11  Arc-Fault Circuit Protection (Direct Current).

Photovoltaic systems operating at 80 volts or greater shall be protected by a listed PV arc-fault circuit interrupter or other system components listed to provide equivalent protection. The system shall detect and interrupt arcing faults resulting from a failure in the intended continuity of a conductor, connection, module, or other system component in the PV system dc circuits.

Informational Note: Annex A includes the reference for the Photovoltaic DC Arc-Fault Circuit Protection product standard.

Exception: For PV systems not installed on or in buildings, or for PV systems installed on or in buildings whose sole purpose is to house PV system equipment, PV output circuits and dc-to-dc converter output circuits that are direct buried, installed in metallic raceways, or installed in enclosed metallic cable trays are permitted without arc-fault circuit protection. Buildings whose sole purpose is to house PV system equipment shall not be considered buildings according to this exception, not required to comply with 690.11.

Statement of Problem and Substantiation for Public Comment

The wording saying basically that “some buildings shall not be considered buildings” does not sound very logical to me. My revised wording conveys the same meaning without creating a logical contradiction. Changed the wording to make it more clear that the exception allows noncompliance with 690.11.

Related Item
First Revision No. 971-NFPA 70-2015 [Section No. 690.11]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 02 18:02:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-945-NFPA 70-2015
Statement: The correlating committee comment requested a relook at the comments from the First Revision language. Bipolar systems are addressed by the addition of “between any two conductors”.

The terms related to listing and labeling were returned to the first revision language.
690.11 Arc-Fault Circuit Protection (Direct Current).
Photovoltaic systems operating at 80 volts or greater shall be protected by a listed PV arc-fault circuit interrupter or other system components listed to provide equivalent protection. The system shall detect and interrupt arcing faults resulting from a failure in the intended continuity of a conductor, connection, module, or other system component in the PV system dc circuits.

Informational Note: Annex A includes the reference for the Photovoltaic DC Arc-Fault Circuit Protection product standard.

Exception: For PV systems not installed on or in buildings, PV output circuits and dc-to-dc converter output circuits that are direct buried, installed in metallic raceways, or installed in enclosed metallic cable trays are permitted without arc-fault circuit protection. Buildings whose sole purpose is to house PV system equipment shall not be considered buildings according to this exception.

Statement of Problem and Substantiation for Public Comment
Enphase Energy supports the language proposed by CMP-4 especially at it applies to PV systems operating at 8-ovts or less. This limit is important because without it, intra-module disconnecting means would be required. This technology is not available today.

The removal of the previous list items is important as it described the behavior of the Arc-Fault Circuit Protection device. Description of behavior belongs in the safety standards where they can be adequately described and tested.

Related Item
First Revision No. 971-NFPA 70-2015 [Section No. 690.11]

Submitter Information Verification
Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 17:58:58 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-945-NFPA 70-2015
Statement: The correlating committee comment requested a relook at the comments from the First Revision language. Bipolar systems are addressed by the addition of “between any two conductors”.

The terms related to listing and labeling were returned to the first revision language.
690.12 Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

(A) Controlled Conductors.

Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

1. Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

2. Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(C) Initiation Device.

Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device shall comply with one of the following:

1. Where the PV system is connected in accordance with 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

2. Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

3. Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is “off” or “on.” The initiation device shall be lockable in the “off” position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

(D) Manually Reset.

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

(E) Equipment.

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection.

(F) Marking.

1. The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

   RAPID SHUTDOWN PV SYSTEM DISCONNECT

2. If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

Statement of Problem and Substantiation for Public Comment

I support FR 1008 to reduce the voltage within a rooftop PV array. This will ensure that fire service personnel do not become injured by accidentally coming into contact with a damaged PV array.
Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: P Cocker
Organization: Los Angeles County FD
Street Address:
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 15:55:02 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: No changes were recommended by the submitter.
690.12 Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

(A) Controlled Conductors.

Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(C) Initiation Device.

Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device shall comply with one of the following:

(1) Where the PV system is connected in accordance with 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

(2) Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

(3) Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is "off" or "on." The initiation device shall be lockable in the "off" position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

(D) Manually Reset.

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

(E) Equipment.

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection.

(F) Marking.

(1) The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

RAPID SHUTDOWN PV SYSTEM DISCONNECT

(2) If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

Statement of Problem and Substantiation for Public Comment

I support the proposed first revision language. Manual fire fighting efforts are necessary to control roof level fires for roof mounted PV arrays. PV arrays are expected to last over 20 years, with exposure to weather and natural hazards, and potentially minimal maintenance. The level of voltage output from PV assemblies must be reduced to allow safe and effective emergency response.
### Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

### Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name:</th>
<th>Richard Davis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization:</td>
<td>FM Global</td>
</tr>
<tr>
<td>Street Address:</td>
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<td>Thu Sep 24 13:16:23 EDT 2015</td>
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### Committee Statement

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<tr>
<td>Resolution:</td>
<td>No changes were recommended by the submitter.</td>
</tr>
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</table>
690.12 Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown function to reduce shock hazard for emergency responders, in accordance with 690.12 (A) through (E). (D).

(A) Controlled Conductors.

Requirements for controlled conductors shall apply only to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to outside the array boundary shall comply with 690.12(B)(1) and inside the array boundary shall comply with 690.12(B)(2).

1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

Controlled

1) Rapid shutdown equipment shall be installed to limit firefighter exposure to electrical hazards from the controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

1) Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown

Informational Note: The designation PV Equipment Safe for Proximity Fire Fighting identifies equipment and components that limit firefighter exposure to an electrical hazard within the array boundary after the Rapid Shutdown initiator has been activated. This designation addresses single point failures that might occur when the PV system is inadvertently damaged by firefighting operations or other mechanical damage or during a building fire. Control of electric shock hazard may be achieved by methods such as limiting access to exposed components that might become energized, reducing the potential difference between energized components, limiting the electric current that might flow in an electrical circuit involving personnel with increased resistance of the conductive circuit, or by a combination of such methods.
Initiation Device.

Where multiple PV systems are installed on a single service, a single device initiating all PV systems on that service shall initiate the rapid shutdown function of the PV system. The device "off" position shall indicate that the rapid shutdown function has been initiated. For one-family and two-family dwellings an initiation device(s) shall be located at a readily accessible location outside the building.

The rapid shutdown initiation device shall comply with devices shall consist of at least, one of the following:

1. Service disconnecting means.
2. PV system disconnecting means.
3. Readily accessible switch that plainly indicates whether the device is in the "off" or "on" position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled that remains energized upon loss of utility voltage from the utility.

(D) Manually Reset.

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

Where multiple PV systems are installed with rapid shutdown functions on a single service, the initiation device(s) shall consist of not more than six switches or six sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, or in a group of separate enclosures. These initiation device(s) shall initiate the rapid shutdown of all PV systems with rapid shutdown functions on that service. Additional auxiliary initiation devices, installed in accordance with rapid shutdown equipment listings, shall be permitted.

(E) Equipment.

(2) Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed and labeled for providing rapid shutdown protection.

(F) Marking.

(1) The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

RAPID SHUTDOWN PV SYSTEM DISCONNECT

If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Rapid shutdown equipment not meeting the requirements of 690.12(B)(2) shall be labeled Rapid Shutdown Equipment for PV.

Informational Note: Inverter input circuit conductors can remain energized for up to 15 minutes with inverters not listed for rapid shutdown.

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

Additional Proposed Changes

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<thead>
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<th>File Name</th>
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<tr>
<td>Proposal_690.12_NEC2017_FINAL.pdf</td>
<td>The uploaded file contains a legible version of all proposed changes to 690.12.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

These proposed revisions to 690.12, and 690.12(B)(2) in particular, are intended to enhance electrical protection within the array and significantly increase the safety of fire fighters working on roofs with PV equipment.

In order to measure an increase in safety, there should be a baseline for comparison. The number of PV-related fatalities of first responders is zero. According to the National Institute for Occupational Safety and Health database, between 1984 and 2013, there have been seven first responder deaths due to electrocution, and all were related to AC medium-voltage overhead or downed power lines. Not a single one was related to DC voltage from a PV array.
Committee Statement

Looking at the details of the first draft of 2017 NEC, it is not clear that the suggested 80V limit will result in an increase in first responder usage of a specific PV technology with a questionable effect on safety. The 80V limit is somewhat arbitrary and was chosen primarily because it is greater than most modules’ maximum voltage rather than corresponding to a recognized safety limit. It is also, coincidentally, the threshold at which module level electronics manufacturers can comply using currently available solutions. Additionally, UL 62109-1 and 2014 NEC outline 240VA as the safe limit (energy hazard), which is a lower power level than many modules in the market today.

As is often the case with the evolution of PV, we can look to European markets to offer some level of experience and guidance. A German study conducted by the Federal Ministry for Economic Affairs & Energy, TÜV Rheinland, and Fraunhofer was completed in March 2015 and titled “Assessment of the Fire Risk in Photovoltaic Systems and Elaboration of Safety Concepts for Minimization of Risks.” The study concluded that PV systems do not pose any particular threat to fire department personnel, provided they comply with safety clearances just as with any other live electrical equipment. Moreover, the vast majority of European PV systems do not utilize module-level electronics and there has never been a governing body that has enforced a code mandating module-level shutdown.

An additional report issued by Fraunhofer, Europe’s largest application-oriented research organization, was completed in May 2015 and titled “Recent Facts about Photovoltaics in Germany.” The report offered updated statistics regarding first responder safety and revealed a considerably successful record. With more than 1.4 million PV plants installed in Germany, to date no firefighter has been injured by PV power while putting out a fire. This significant fact becomes even more telling when you consider it was achieved in a market that does not mandate rapid shutdown at all, let alone module-level shutdown. The report goes on to state, “Comprehensive training courses for the fire brigade could eliminate any uncertainties firefighters may have. As with every electrical installation, it is possible to extinguish a fire using water from a distance of one to five meters. Based on investigations to date, all of the claims stating that the fire brigade could not extinguish a house fire due to the PV system have been found to be false.”

One must also look at the experience in the Australian market with very stringent requirements on generator shutdown put into force in 2012. Australia has today not only a leading role in the sheer numbers of PV installations but also in PV related fires. According to a report on metrosolar.com.au, as of November 2014, there have been more than 167 fires in Queensland alone, all related to the mandatory rooftop DC isolator.

An additional report issued by Fraunhofer, Europe’s largest application-oriented research organization, was completed in May 2015 and titled “Recent Facts about Photovoltaics in Germany.” The study concluded that PV systems do not pose any particular threat to fire department personnel, provided they comply with safety clearances just as with any other live electrical equipment. Moreover, the vast majority of European PV systems do not utilize module-level electronics and there has never been a governing body that has enforced a code mandating module-level shutdown.

Looking at the full picture, it turns out that there is no imminent need for a change of existing codes and procedures. It even shows, that adding an extra layer of complexity such as the mandatory DC isolators in Australia, might even increase the number of incidents and thus reduce the level of safety significantly, adding additional risk to every PV installation. One must conclude that every piece of equipment in a PV installation – especially if intended for an additional layer of safety – will have to be thoroughly specified and tested according to established standards.

As of today, there is no existing universal standard qualifying PV Equipment Safe for Proximity Fire Fighting. This standard still needs to be defined. It should account for the existing international experiences, defining a general safety objective, and shall not mandate the usage of a specific PV technology with a questionable effect on safety.

Looking at the details of the first draft of 2017 NEC, it is not clear that the suggested 80V limit will result in an increase in first responder safety. The 80V limit is somewhat arbitrary and was chosen primarily because it is greater than most modules’ maximum voltage rather than corresponding to a recognized safety limit. It is also, coincidentally, the threshold at which module level electronics manufacturers can comply using currently available solutions.

According to UL 1310, the safe voltage in dry conditions is 60V and 30V in wet conditions (also 2014 NEC Chapter 9, Table 11(B)). Additionally, UL 62109-1 and 2014 NEC outline 240VA as the safe limit (energy hazard), which is a lower power level than many modules in the market today.

The first draft of 2017 NEC removes the 240VA reference, while introducing an 80V limit. If first responders need to cut a hole in a roof and come into contact with a module, then they would potentially be exposing themselves to a higher voltage than prescribed by UL or current NEC. Even though the wiring between modules may not be live, the modules will remain energized. To cut through a roof in an area where PV exists would mean chopping through a module, potentially giving module power a path to ground and exposing firefighters to more than 300VA.

Furthermore, trusting rapid shutdown to reliably work without taking other personal safety measures could lead to perceived safety and a false sense of security. Therefore, there still needs to be a keep out zone for first responder guidance. If there is reason to get on the roof at all, it is also best to stay in the walkways and keep a safe clearance from the array. Thus, the proposed change in the first draft of 2017 NEC, 690.12 will not improve the safety of rooftop PV systems, but will only achieve an increase in system complexity, cost, maintenance, and add new risks.

Related Item

First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]
Public Input No. 3003-NFPA 70-2014 [Section No. 690.12]
Public Input No. 3723-NFPA 70-2014 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: Michael Mendik
Organization: SMA America
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 16:16:28 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected but see related SR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.</td>
</tr>
</tbody>
</table>

A section-by-section summary of the changes are described below.

**Main paragraph:**

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment” for consistency of terminology.

**Section (A):**

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

**Section (B):**

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a section for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

**Section (C):**

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.
Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
Public Comment No. 1266-NFPA 70-2015 [Section No. 690.12]

690.12  Rapid Shutdown of PV Systems on Buildings.
PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

A  Controlled Conductors.
Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

B  Controlled Limits.
The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

C  Initiation Device.
Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device shall comply with one of the following:

1) Where the PV system is connected in accordance with 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

2) Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

3) Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is “off” or “on.” The initiation device shall be lockable in the “off” position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

D  Manually Reset.
When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

E  Equipment.
Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection.

F  Marking.

1) The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

RAPID SHUTDOWN PV SYSTEM DISCONNECT

2) If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

Statement of Problem and Substantiation for Public Comment
I support this effort to reduce the voltage within the array in an emergency. The lower voltage will greatly reduce possibility of personnel injury in an emergency.

Related Item
Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitted Full Name:</th>
<th>Robert Hoover</th>
</tr>
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<tbody>
<tr>
<td>Organization:</td>
<td>Hagerstown Fire Department</td>
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Committee Statement

<table>
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<tr>
<th>Committee Action:</th>
<th>Rejected</th>
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<td>Resolution:</td>
<td>No changes were recommended by the submitter.</td>
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690.12  Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown function to reduce shock hazard for emergency responders, in accordance with 690.12 (A) through (E).

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

(A) Controlled Conductors.

Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors outside the array boundary shall apply to 690.12(B)(1) and inside the array boundary shall comply with 690.12(B)(2).

1. Outside the array boundary. Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

2. Inside the array boundary. The PV system shall comply with (a) or (b):

   (a) The PV array is listed and labeled as a rapid shutdown PV array. Such a PV array is installed and used in accordance with the instructions included with the rapid shutdown PV array listing and labeling or field labeling.

      Informational Note: A listed or labeled or field labeled rapid shutdown PV array is evaluated to provide an equivalent or lower shock hazard exposure as that provided by 690.12(B)(2)(b).
(b) Controlled conductors located inside the boundary or less not more than 1 m (3 ft) from the point of entry inside a penetration of the surface of the building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

This requirement

The requirement of 690.12(B)(2)(b) shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(C) Initiation Device.

Where multiple PV systems are installed on a single service, a single device that connected to that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted.

device. For one-family and two-family dwellings, an initiation device(s) shall be located at a readily accessible location outside the building.

The rapid shutdown initiation device(s) shall comply with. (s) shall consist of at least one of the following:

1. Where the PV system is connected in accordance with, 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

2. Where the PV system is connected in accordance with, 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is "off" or "on."

3. Service disconnecting means,

4. PV system disconnecting means.

5. Readily accessible switch that plainly indicates whether it is in the "off" or "on" position. The initiation device shall be lockable in the "off position."

Informational Note: - One example of why an initiation device that complies with 690.12(C)(3) would apply to, for example, be used is where a PV system with standby operation where conductors are not controlled, is connected to an optional standby system that remains energized upon loss of utility voltage, from the utility.

(D) Manually Reset.

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

(E) Where multiple PV systems are installed with rapid shutdown functions on a single service, the initiation device(s) shall consist of not more than six switches or six sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, or in a group of separate enclosures. These initiation device(s) shall initiate the rapid shutdown of all PV systems with rapid shutdown functions on that service. Where auxiliary initiation devices are installed, these auxiliary devices shall control all PV systems with rapid shutdown functions on that service.

(E) Equipment.

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed.

- and labeled
- and identified

for providing rapid shutdown protection.

(F) Marking.
The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

Rapid Shutdown PV System Disconnect

2. If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

Informational Note: Inverter input circuit conductors often remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Additional Proposed Changes

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<th>File Name</th>
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<td>Word document in track changes mode to more easily read the final version and better understand the actual changes to the document since TerraView does not fully accurately represent the changes.</td>
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Statement of Problem and Substantiation for Public Comment

This comment on the first revision is a product of the NFPA Fire Fighter Safety and PV Systems Task Group that has been involved in an ongoing dialogue since December 2014 that includes this recommended language for the 2017 version of 690.12. This Task Group is made up of over 20 participants from Code Making Panel 4, the solar industry, the fire service, the insurance industry, test laboratories, and other relevant stakeholders.

A section-by-section summary of the recommended changes are described below.

Main paragraph:
Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

Section (A):
This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off.

Section (B):
This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80Volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):
The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under
development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the "off" position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):
This section was removed since the three initiator options are all switches that have an "on" or "off" position. The new clarified wording requires that an initiator in the "off" position requires that the PV system be in the rapid shutdown mode. If not initiators are turned "off" and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the "off" position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):
The word identified was changed to "labeled" since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):
The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.

Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Affiliation: NFPA Fire Fighter Safety and PV Systems Task Group
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu Sep 24 20:37:56 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-7502-NFPA 70-2015
Statement: This comment on the first revision is a product of the NFPA Fire Fighter Safety and PV Systems Task Group that has been involved in an ongoing dialogue since December 2014 that includes this recommended language for the 2017 version of 690.12. This Task Group is made up of over 20 participants from Code Making Panel 4, the solar industry, the fire service, the insurance industry, test laboratories, and other relevant stakeholders.

A section-by-section summary of the recommended changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary.
Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for three methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80Volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will address these concerns. The second option allows for a prescriptive solution that limits the voltage in the PV array to 80 volts, consistent with the first draft language. The third option is to allow a PV array that has no exposed wire, no exposed metal, and is far enough from grounded parts to prevent contact with the array and ground.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
690.12 Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

(A) Controlled Conductors.

Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(C) Initiation Device.

Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device shall comply with one of the following:

(1) Where the PV system is connected in accordance with 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

(2) Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

(3) Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is "off" or "on." The initiation device shall be lockable in the "off" position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

(D) Manually Reset.

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

(E) Equipment.

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection.

(F) Marking.

(1) The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

RAPID SHUTDOWN PV SYSTEM DISCONNECT

(2) If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

Statement of Problem and Substantiation for Public Comment

Representing fire fighters, I support the effort to shut down PV systems to the module level during emergencies. The recent proliferation of solar systems in our jurisdiction is having an impact on fire fighter's ability to respond to fire emergencies. Access and egress and egress during roof top operations and the inability to control utilities for the entire structure are concerns. It is vital that the code development process recognizes the need to protect fire fighter safety. This proposal utilizes existing technology to do just that.
Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: RICHARD DOANE
Organization: CHICO FIRE-RESCE
Street Address: 
City: 
State: 
Zip:
Submittal Date: Fri Sep 25 09:17:03 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: No changes were recommended by the submitter.
690.12 Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

(A) Controlled Conductors.

Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(C) Initiation Device.

Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device shall comply with one of the following:

(1) Where the PV system is connected in accordance with 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

(2) Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

(3) Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is “off” or “on.” The initiation device shall be lockable in the “off” position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

(D) Manually Reset.

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

(E) Equipment.

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection.

(F) Marking.

(1) The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

RAPID SHUTDOWN PV SYSTEM DISCONNECT

(2) If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

Statement of Problem and Substantiation for Public Comment

Fire Marshals Association of Colorado supports the language in the First Revision as well as the work from the Firefighter Safety and PV System Task Group. PV system on rooftops can present a several hazards to firefighters, the most serious is electric shock in an emergency situation. This section and the proposed change is a significant step forward in improving firefighter safety.
Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: DAVID LOWREY
Organization: BOULDER CITY OF
Affiliation: Fire Marshals Association of Colorado (FMAC)
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 09:39:04 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: No changes were recommended by the submitter.
Public Comment No. 1408-NFPA 70-2015 [Section No. 690.12]

690.12 Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown function to reduce shock hazard for emergency responders, in accordance with 690.12 (A) through (E).
(A) Controlled Conductors.

Requirements for controlled conductors shall apply only to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors outside the array boundary shall apply with 690.12(B)(1) and, inside the array boundary shall comply with 690.12(B)(2).

1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 to 30 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

2) Rapid shutdown equipment shall be installed to limit firefighter exposure to electrical hazards from the controlled conductors located inside the array boundary and shall be listed and labeled as PV Equipment Safe for Proximity Fire Fighting. Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

Informational Note: The designation PV Equipment Safe for Proximity Fire Fighting identifies equipment and components that limit firefighter exposure to an electrical hazard within the array boundary after the Rapid Shutdown initiator has been activated. This designation addresses single point failures that might occur when the PV system is inadvertently damaged by firefighting operations or other mechanical damage or during a building fire. Control of electric shock hazard may be achieved by methods such as limiting access to exposed components that might become energized, reducing the potential difference between energized components, limiting the electric current that might flow in an electrical circuit involving personnel with increased resistance of the conductive circuit, or by a combination of such methods.

This requirement of 690.12(B)(2), shall become effective January 1, 2020, 2018.

Informational Note:

Inverter: Inverter, input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(C) Initiation Device.

The initiation device(s) shall initiate the rapid shutdown function of the PV system. The device “off” position shall indicate that the rapid shutdown function has been initiated. For one-family and two-family dwellings an initiation device(s) shall be located at a readily accessible location outside the building. Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device(s) shall consist of at least one of the following:

1) Where the PV system is connected in accordance with 705.12(D), and rapid shutdown initiates upon loss of voltage from the utility, the

   (1) Service disconnecting means shall be the initiation device.

   (2) Where the PV system is connected in accordance with 705.12(A), and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

   (3) Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible. The initiation device(s) shall be lockable in the “off” position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation that remains energized where conductors are not controlled, upon loss of utility voltage from the utility.

Where multiple PV systems are installed with rapid shutdown functions on a single service, the initiation device(s) shall consist of not more than six switches or six sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, or in a group of separate enclosures. These initiation device(s) shall initiate the rapid shutdown of all PV systems with rapid shutdown functions on that service. Additional auxiliary initiation devices, installed in accordance with rapid shutdown equipment listings, shall be permitted.

1) Manually Reset.

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

2) Equipment.

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, and labeled, and identified, for providing rapid shutdown protection.

Rapid shutdown equipment not meeting the requirements of 690.12(B)(2) shall be labeled Rapid Shutdown Equipment for PV.

Informational Note: Inverter input circuit conductors can remain energized for up to 15 minutes with inverters not listed for rapid shutdown.
Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

These proposed revisions to 690.12, and 690.12(B)(2) in particular, are intended to enhance electrical protection within the array and significantly reduce the risk of accidental shock to fire fighters. Importantly, SEIA understands and largely agrees with the Fire Service's intent to further enhance rapid shutdown requirements in the 2017 NEC. SEIA disagrees, however, with the specific requirement limits that have been aggressively promoted during this revision cycle and adopted by the NFPA's Fire Fighter Safety Task Group (Task Group). The incorporation of these limits into the NEC would effectively mandate module level electronics, resulting in a variety of negative consequences. SEIA is also opposed to the creation of two options for compliance, as this will likely create two distinct and different levels of safety and performance based on which compliance method the installing contractor selects. In SEIA's view, the 2017 NEC requirement for improving PV electrical safety for fire fighters should focus solely on the development of a new PV Equipment Safe for Proximity Fire Fighting standard and related equipment labeling.

SEIA's proposal is intended to address fire service safety concerns without the negative effects of prescribing a specific product technology. Reliance on a specific technology would, in SEIA's view, increase safety risks to service personnel, stifle innovation of potentially more effective rapid shutdown technologies, and decrease the value of solar PV to the consumer. Importantly, although SEIA strongly disagrees with the Task Group's proposal for a module level electronics mandate, SEIA accepts nearly all of the other proposed changes agreed upon by the Task Group. SEIA's proposed language, therefore, largely tracks the Task Group’s most recent language, with one obvious exception.

SEIA's strong contention is that, given the absence of any independent technical justification for the proposed module level electronics mandate, it is inappropriate for the NFPA to set voltage requirements within the array equipment. Indeed, the NFPA would be setting an arbitrary level of safety based solely on statements from a few existing product manufacturers and not fact-based testing involving a wide selection of performance criteria. Indeed, it would be unprecedented for the NFPA to adopt a code change of this magnitude without any independent technical justification. SEIA believes that the product safety standard development process is the only appropriate path for limits, such as acceptable voltage, to be explored and documented.

Using existing live electrical fire fighting methods and well-documented techniques, fire fighters are able to safely perform fire-fighting operations involving PV arrays. But as with nearly any product involving electricity, there are always opportunities to make safety improvements, particularly when new safety-related technologies become available. Indeed, the three-year code development cycle speaks to the need to continuously update and improve the NEC. The NFPA has also consistently recognized that improvements to the code must be adopted on an incremental basis.

In contrast, if the proposed language from the Task Group is accepted by the CMP without revision, the NFPA would be codifying the wholesale adoption of module level electronic technology over a single code cycle, and would be doing this in advance of any product safety standard or long-term product field testing for this new requirement. In its haste to address the legitimate concerns of several important stakeholders, the NFPA risks a variety of unintended, and significantly adverse, consequences.

There are multiple approaches to significantly reduce the risk of shock hazard to fire fighters operating within the PV array boundary. In contrast, a module level electronics mandate would favor certain technologies over others. This is an overly prescriptive approach which will create a disincentive to develop competing technologies and stifle innovation. It should also be recognized that nearly all module level electronic devices being sold today are principally designed for power conversion and monitoring—not rapid shutdown.

The long-term reliability of module level electronics is also relatively unproven. Indeed, few devices currently being sold for module level rapid shutdown have undergone long-term reliability testing in the field. In addition, rapid shutdown devices used within the array boundary must endure harsh environments, e.g., operating temperatures up to 190 degrees °F, humidity, and corrosion. These devices are also subject to large daily temperature cycles, which, pursuant to Sandia National Laboratories, result in increased stress on componentry and more difficult thermal management. Module level electronics also incorporate a variety of sophisticated semiconductor-based components and printed circuit board assemblies, which are particularly susceptible to high temperatures. Given
these risks, the better approach is to subject all rapid shutdown solutions to the rigors of long-term reliability testing before the wholesale adoption of any one technology.

Reliability is not only a concern for fire fighters but also for PV service personnel exposed to the inherent hazards of roof work. The concern here is that unreliable rapid shutdown devices will significantly, and unnecessarily, increase the amount of time PV installers and electricians spend on rooftops to replace or repair failed devices. And while PV installers and electricians recognize and accept the inherent risks of rooftop environments, no one should have to accept unnecessary exposure to such hazards.

Based on the foregoing, further improvements to 690.12 through the adoption of a PV Equipment Safe for Proximity Fire Fighting standard is the prudent approach. To allow adequate time for the development of this standard, it is essential that the effective date of subsection 690.12(B)(2) be deferred until January 1, 2020. Delayed enforcement is supported by a realistic assessment of the standards development process, recent experience with the 2014 NEC, and NFPA precedent on AC arc fault circuit interrupters (AFCI).

With respect to the 2014 NEC, while rapid shutdown requirements are starting to be implemented at the state-level, a rapid shutdown standard has not yet been adopted. SEIA recognizes that the necessary revisions are being made to UL 1741 to include a rapid shutdown standard consistent with the 2014 NEC but this new language will not be released until mid-2016, and this release date assumes the current standards development process remains on track. As a result, it will be the end of 2016 before products are listed to this standard and installed in the field, a full three years after the 2014 NEC was first published.

Delayed enforcement is also supported by NFPA precedent. For example, AFCI requirements were first published in the 1999 version of the NEC with a delayed enforcement date of Jan 1, 2002. Deferment will also allow for additional field testing of rapid shutdown equipment before final adoption of the 2020 NEC.

Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification

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Submittal Date: Fri Sep 25 10:22:05 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change "PV power generating equipment" to "PV system equipment" for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker
is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
### Public Comment No. 1410-NFPA 70-2015 [ Section No. 690.12 ]

**690.12 Rapid Shutdown of PV Systems on Buildings.**

PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

(A) **Controlled Conductors.**

Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) **Controlled Limits.**

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(C) **Initiation Device.**

Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device shall comply with one of the following:

(1) Where the PV system is connected in accordance with 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

(2) Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

(3) Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is "off" or "on." The initiation device shall be lockable in the "off" position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

(D) **Manually Reset.**

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

(E) **Equipment.**

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection.

(F) **Marking.**

(1) The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

**RAPID SHUTDOWN PV SYSTEM DISCONNECT**

(2) If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

*Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.*

### Statement of Problem and Substantiation for Public Comment

I support this first revision language for multiple reasons. 1) Dietz and Watson fire - this is a very strong example of a catastrophe created whereby the fire fighters could not pro-actively interact with a solar array to engage a rooftop fire using standard fire fighting practices. A very large and un-necessary property loss was the result. 2) There is no other appliance allowed to be used in and around populated areas, where there is not a clearly designated switch, plug or other de-energizing method for fully de-activing the system -
why should solar be any different? This industry inconsistency results in an even greater hazard to those untrained in solar, as the default expectation is that such that all electrical systems can be turned off and are fundamentally safe. 3) There is an increasing focus on reducing the cost of distributed energy by increasing the power and energy density of arrays. As part of increasing the rooftop power density, there is a critical need to be able to confidently and fully de-energize a solar array such that first responders can pro-actively engage directly with the PV array and roof areas as needed (such as quickly breaking out modules to increase access, roof venting, etc., and unless the array is de-energized to a safe level this is not possible).

The only remaining concern about the first revision as written, would be to dis-allow “radio frequency” or “power-line carrier” based devices or other remote based devices as an initiation device, given the inherent and un-reliable nature of these devices and the inability to confirm they operated successfully during a fire event (and were not damaged by the fire prior to being activated). There is only one thing worse than a known exposed electrical hazard to a fire fighter -and that is one where the fire fighter believes the hazard has been deactivated - when in fact they have not.

**Related Item**

Public Input No. 1008-NFPA 70-2014 [Section No. 700.12(F)(2)]

**Submitter Information Verification**

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Submittal Date: Fri Sep 25 10:31:52 EDT 2015

**Committee Statement**

Committee Action: Rejected  
Resolution: No changes were recommended by the submitter.
690.12  Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

(A)  Controlled Conductors.

Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B)  Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1)  Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2)  Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(C)  Initiation Device.

Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxilary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device shall comply with one of the following:

(1)  Where the PV system is connected in accordance with 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

(2)  Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

(3)  Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is “off” or “on.” The initiation device shall be lockable in the “off” position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

(D)  Manually Reset.

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

(E)  Equipment.

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection.

(F)  Marking.

(1)  The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

RAPID SHUTDOWN PV SYSTEM DISCONNECT

(2)  If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Informational Note: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

Statement of Problem and Substantiation for Public Comment

i support reducing the voltage within the array during an emergency

Related Item
Submitter Information Verification

Submitter Full Name: jeb eckstine
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Committee Statement

Committee Action: Rejected
Resolution: No changes were recommended by the submitter.
690.12 Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown function to reduce shock hazard for emergency responders, in accordance with 690.12(A) through (E).

(A) Controlled Conductors.

Requirements for controlled conductors shall apply only to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply outside the array boundary shall comply with 690.12(B)(1) and inside the array boundary shall comply with 690.12(B)(2).

1. Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 to 30 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

2. Controlled rapid shutdown equipment shall be installed to limit firefighter exposure to electrical hazards from the controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown and shall be listed and labeled as PV Equipment Safe for Proximity Fire Fighting.

Informational Note: The designation PV Equipment Safe for Proximity Fire Fighting identifies equipment and components that limit firefighter exposure to an electrical hazard within the array boundary after the Rapid Shutdown initiator has been activated. This designation addresses single point failures that might occur when the PV system is inadvertently damaged by firefighting operations or other mechanical damage or during a building fire. Control of electric shock hazard may be achieved by methods such as limiting access to exposed components that might become energized, reducing the potential difference between energized components, limiting the electric current that might flow in an electrical circuit involving personnel with increased resistance of the conductive circuit, or by a combination of such methods.

This requirement of 690.12(B)(2) shall become effective January 1, 2020.

(C) Initiation Device.

Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown function of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted by the PV system. The device “off” position shall indicate that the rapid shutdown function has been initiated. For one-family and two-family dwellings an initiation device(s) shall be located at a readily accessible location outside the building. The rapid shutdown initiation device shall comply with (s) shall consist of at least one of the following:

1. Where the PV system is connected in accordance with 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

2. Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is “off” or “on.” The initiation device shall be lockable in the “off” position.


4. PV system disconnecting means.

5. Readily accessible switch that plainly indicates whether the device is in the “off” or “on” position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled, that remains energized upon loss of utility voltage from the utility.
Manually Reset.

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

Equipment.

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed and labeled and identified for providing rapid shutdown protection.

Marking.

1. The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

   RAPID SHUTDOWN PV SYSTEM DISCONNECT

2. If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device. Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

   Rapid shutdown equipment not meeting the requirements of 690.12(B)(2) shall be labeled Rapid Shutdown Equipment for PV.

   Informational Note: Inverter input circuit conductors can remain energized for up to 15 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

Sunrun supports the proposed alternative code language offered by the Solar Energy Industries Association (SEIA), which takes a balanced and reasonable approach to accessing actual safety risks and developing a variety of technical solutions to improve fire fighter safety. Sunrun supports these proposed revisions to 690.12 that will allow for continued electrical protection within the array and reduce risk for fire fighters, while providing needed flexibility for a variety of technical solutions to develop. We support the Fire Service in their intent to further enhance fire safety requirements in the 2017 NEC, however we disagree with the specific proposed requirement to limit voltage to 80 volts within an array after rapid shutdown initiation. This will effectively requires module level power electronics at significant upfront cost as well as unknown long term costs associated with reliability. There are currently too few proven module level products to choose from in the market.

SEIA's proposal addresses fire service safety concerns without the negative effects of prescribing a specific product technology which has limited selection. Reliance on a specific technology would stifle innovation of potentially more effective rapid shutdown technologies, increase cost, and decrease the value of solar PV to the consumer.

Additionally, new technologies should only be incorporated into the NEC on an incremental basis, and should allow time to test new technologies in the field to ensure reliability and safety. To allow adequate time for the development of this standard, it is essential that the effective date of subsection 690.12(B)(2) be deferred until January 1, 2020. Deferment will also allow for additional field testing of rapid shutdown equipment before final adoption of the article.

Related Item

Public Input No. 1444-NFPA 70-2014 [Section No. 250.22]

Submitter Information Verification

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Committee Statement

Committee: Rejected but see related SR
Action:
Resolution:
Statement: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:
Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment” for consistency of terminology.

Section (A):
This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):
This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array to be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):
The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):
This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new
clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
690.12  Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

(A) Controlled Conductors.

Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled. Rapid shutdown equipment shall be installed to limit firefighter exposure to electrical hazards from the controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. array boundary and shall be listed and labeled as PV Equipment Safe for Proximity Fire Fighting.. This requirement shall become effective January 1, 2020.

Informational Note 1: The designation PV Equipment Safe for Proximity Fire Fighting identifies equipment and components that limit firefighter exposure to an electrical hazard within the array boundary after the Rapid Shutdown initiator has been activated. This designation addresses single point failures that might occur when the PV system is inadvertently damaged by firefighting operations or other mechanical damage or during a building fire. Control of electric shock hazard may be achieved by methods such as limiting access to exposed components that might become energized, reducing the potential difference between energized components, limiting the electric current that might flow in an electrical circuit involving personnel with increased resistance of the conductive circuit, or by a combination of such methods.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(C) Initiation Device.

Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device shall comply with one of the following:

(1) Where the PV system is connected in accordance with 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

(2) Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

(3) Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is “off” or “on.” The initiation device shall be lockable in the “off” position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

(D) Manually Reset.

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

(E) Equipment.

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection. Rapid shutdown equipment not meeting the requirements of 690.12(B)(2) shall be labeled Rapid Shutdown Equipment for PV.

(F) Marking.

(1) The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

RAPID SHUTDOWN PV SYSTEM DISCONNECT
Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Comment No. 1658-NFPA 70-2015 [Section No. 690.56(C)]</td>
<td></td>
</tr>
</tbody>
</table>
Committee Statement

Committee Action: Rejected but see related SR

Resolution: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:
Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment” for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, "PV Equipment Safe for Proximity Fire Fighting." Both the term "Rapid Shutdown PV Array" and "PV Equipment Safe for Proximity Fire Fighting" can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.
The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforced by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
**Public Comment No. 1850-NFPA 70-2015 [Section No. 690.12]**

**690.12 Rapid Shutdown of PV Systems on Buildings.**

PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

(A) Controlled Conductors.

Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(C) Initiation Device.

Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device shall comply with one of the following:

(1) Where the PV system is connected in accordance with 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

(2) Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

(3) Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is “off” or “on.” The initiation device shall be lockable in the “off” position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

(D) Manually Reset.

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

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Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection.

(F) Marking.

(1) The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

RAPID SHUTDOWN PV SYSTEM DISCONNECT

(2) If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the Panel to revise the text including the informational note to comply with the NEC Style manual.

**Related Item**

First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]
Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 11:40:52 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution:
Statement: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

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by a jurisdiction.

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dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for
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that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would
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of equipment.

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### 690.12 Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

**(A) Controlled Conductors.**

Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

**(B) Controlled Limits.**

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

1. Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

2. Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

**(C) Initiation Device.**

Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device shall comply with one of the following:

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2. Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

3. Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is “off” or “on.” The initiation device shall be lockable in the “off” position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

**(D) Manually Reset.**

When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

**(E) Equipment.**

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection.

**(F) Marking.**

1. The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

   **RAPID SHUTDOWN PV SYSTEM DISCONNECT**

2. If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

*Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.*

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**Statement of Problem and Substantiation for Public Comment**

I support the effort to reduce the voltage in a PV array under emergency conditions.

**Related Item**

First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]
Submitter Information Verification

Submitter Full Name: Corey Condren
Organization: San Jose Fire Department
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 31 17:14:33 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: No changes were recommended by the submitter.
690.12 Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

(A) Controlled Conductors.

Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

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Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

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2. Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

3. Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is “off” or “on.” The initiation device shall be lockable in the “off” position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

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RAPID SHUTDOWN PV SYSTEM DISCONNECT

2. If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

Statement of Problem and Substantiation for Public Comment

Enphase Energy supports the language proposed by CMP-4 especially the reduced voltage level within an array when initiated by emergency personnel. Rooftop PV arrays should reduce be able to shut down to safe voltage levels in the event of emergency conditions. This is particularly important when considering the life span of a system as older systems may present electrical hazards to emergency personnel.
Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification
Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Sep 09 16:00:02 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: No changes were recommended by the submitter.
690.12 Rapid Shutdown of PV Systems on Buildings.

PV system circuits installed on or in buildings shall include a rapid shutdown in accordance with 690.12 (A) through (E).

(A) Controlled Conductors.
Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

(B) Controlled Limits.
The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(C) Initiation Device.
Where multiple PV systems are installed on a single service, a single device shall initiate the rapid shutdown of all PV systems on that service. Additional auxiliary initiation devices operating in accordance with rapid shutdown equipment listings shall be permitted. The rapid shutdown initiation device shall comply with one of the following:

1) Where the PV system is connected in accordance with 705.12(D) and rapid shutdown initiates upon loss of voltage from the utility, the service disconnecting means shall be the initiation device.

2) Where the PV system is connected in accordance with 705.12(A) and rapid shutdown initiates upon loss of voltage from the utility, the PV system disconnecting means shall be the initiation device.

3) Where rapid shutdown does not initiate upon loss of voltage from the utility, the initiation device shall be readily accessible and clearly indicate whether the PV system is “off” or “on.” The initiation device shall be lockable in the “off” position.

Informational Note: 690.12(C)(3) would apply to, for example, a PV system with standby operation where conductors are not controlled upon loss of voltage from the utility.

(D) Manually Reset.
When the rapid shutdown system is manually initiated the PV system shall not reset without manual intervention.

(E) Equipment.
Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection.

(F) Marking.

1) The rapid shutdown initiation device shall have a sign complying with 690.56 located on or no more than 1 meter (3 ft) from the device that includes the following wording:

RAPID SHUTDOWN PV SYSTEM DISCONNECT

2) If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating equipment, are not required to comply with 690.12.

Statement of Problem and Substantiation for Public Comment

I am in favor of this first revision to reduce the voltage within an array during emergency operations.

Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]
Submitter Information Verification

Submitter Full Name: JOHN JUSTICE
Organization: SANTA CLARA CNTY FIRE DEPT
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 17:05:35 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: No changes were recommended by the submitter.
Public Comment No. 1338-NFPA 70-2015 [Section No. 690.12(A)]

(A) Controlled Conductors.
Requirements for controlled conductors shall apply to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

Statement of Problem and Substantiation for Public Comment

The second sentence "PV inverter output circuits shall only be required to be controlled from the PV source" is unclear as to its intent. If intended for module integrated inverters, it is implying that a disconnect device is required on the dc side of the inverter (so that the ac inverter output is de-energized). I think it is meant to apply to roof-mounted string inverters that are more than 3 ft from the array.

Related Item
First Revision No. 3659-NFPA 70-2015 [Section No. 708.10(C)(1)]

Submitter Information Verification

Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 21:09:40 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution:
Statement: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change "PV power generating equipment" to "PV system equipment" for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):
This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, "PV Equipment Safe for Proximity Fire Fighting." Both the term "Rapid Shutdown PV Array" and "PV Equipment Safe for Proximity Fire Fighting" can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforced by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the "off" position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an "on" or "off" position. The new clarified wording requires that an initiator in the "off" position requires that the PV system be in the rapid shutdown mode. If not initiators are turned "off" and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the "off" position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
Controlled Conductors.

Requirements for controlled conductors shall apply only to PV system dc circuits and inverter output circuits supplied by the PV system. PV system dc circuits shall be controlled from all sources of supply, including energy storage or other dc power sources, as applicable. PV inverter output circuits shall only be required to be controlled from the PV source.

Statement of Problem and Substantiation for Public Comment

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off.

Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification
Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 10:36:52 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution:
Statement: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment” for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):
This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2).

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

80 V seems an arbitrary limit, not determined by the shock hazard. Household voltage exceeds 220 Vac; the electrocution hazard is considered acceptable for residents, etc. The hazardous voltage threshold for DC is higher than for AC and firefighters wear gloves that offer at least some additional protection.

Raising the voltage to 220-240 V, or similar, would bring the code more in line with existing standards.

The problem with this requirement from the firefighter's perspective is it creates a false sense of security. The module-level electronics required to achieve the 80-V limit are certain to fail over time, in ways that may not be predictable. Hidden behind the solar modules on a roof, they will be difficult to check. If the electronics doesn't "fail safe", firefighters that trust the rapid shutdown system may not take adequate precautions. In this case, it would be better, for example, to throw fire blankets over the array to assure low voltage within the array boundary. Dry leather gloves might also be better protection than electronics that may or may not be working as promised.

Related Item

Public Input No. 3681-NFPA 70-2014 [Global Input]

Submitter Information Verification

Submitter Full Name: Geoffrey Kinsey
Organization: Mantech International
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 18:30:45 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: No changes were recommended by the submitter.
Public Comment No. 1224-NFPA 70-2015 [Section No. 690.12(B)]

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to outside the array boundary shall comply with 690.12(B) (1) and inside the array boundary shall comply with 690.12(B) (2).

1. Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

2. Controlled Rapid shutdown equipment shall be installed to limit firefighter exposure to electrical hazards from the controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.\n
Informational Note: The designation PV Equipment Safe for Proximity Fire Fighting identifies equipment and components that limit firefighter exposure to an electrical hazard within the array boundary after the Rapid Shutdown initiator has been activated. This designation addresses single point failures that might occur when the PV system is inadvertently damaged by firefighting operations or other mechanical damage or during a building fire. Control of electric shock hazard may be achieved by methods such as limiting access to exposed components that might become energized, reducing the potential difference between energized components, limiting the electric current that might flow in an electrical circuit involving personnel with increased resistance of the conductive circuit, or by a combination of such methods.

This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

The proposed language of 690.12(B)(2), which effectively mandates the use of module-level electronics to comply, cannot be practically enforced and field verified by the authority having jurisdiction (AHJ). This is a concern for several reasons:

1. Volume - This places the burden of verifying the presence and effectiveness of over 10 million devices projected to be installed on buildings annually by the year 2018, squarely on the shoulders of local AHJs. (Source: Citi Research)

2. Liability - The associated liability from the failure of these electronics to perform as anticipated could fall with the AHJ. This liability concern is best avoided by the application of the provisions found in Article 90.7 of the NEC, Examination of Equipment for Safety, which places the task of verifying suitability of specific electrical components in the hands of a nationally recognized testing laboratory.

3. Physical location – Arrays installed on pitched roofs may be inaccessible to AHJs tasked with verifying compliance.

4. Verification - The lack of adequate test points in a typical photovoltaic array would make the 80V and 10 second limitations impossible to verify without the dis-assembly of a completed installation. The proper training, tools, and personal protective equipment needed for such field testing is not widely available to all AHJs.

Given these concerns, it is unlikely the provisions of the proposal will be adequately enforced.

Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: CHARLES PICARD
Organization: SolarCity
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 13:58:30 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: 
Statement: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment” for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.
Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
Public Comment No. 1342-NFPA 70-2015 [ Section No. 690.12(B) ]

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>SMA-NEC2017_WhitePaper_FINAL.pdf</td>
<td>White Paper on the value of module-level rapid shutdown from SMA (largest PV inverter manufacturer in the world)</td>
<td></td>
</tr>
<tr>
<td>Fronius_Reliability.pdf</td>
<td>Fronius paper on inverter reliability</td>
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</table>

Statement of Problem and Substantiation for Public Comment

A Risk Analysis related to the PV Rapid Shutdown Proposal, 690.12(B)(2).

690.12(B)(2) essentially mandates module-level electronics in every PV module for rooftop solar. While perhaps a well-intentioned proposal to improve safety for fire fighters, it in fact is likely to both increase the number of accidents on rooftops (especially amongst electrical workers), and also increase the likelihood of rooftop fires. This proposed requirement will put thousands of IBEW and independent electrical contractors at risk, every year.

The 2014 NEC required in 690.4(C) “The installation of equipment and all associated wiring and interconnections shall be performed only by qualified persons.” – this means, in most cases, electrical contractors.

The submitters did not provide technical justification for this new requirement. In fact, PV systems have been installed on roofs now for more than 35 years. In this time, I understand that there has not been a single reported incidence of electric shock to fire fighters. This view is supported by the attached white paper from SMA, the world’s largest PV inverter manufacturer.

This proposal was promoted by manufacturers such as Enphase and Solar-edge who claim that their reliability numbers make maintenance a non-issue, and stand to profit enormously from this requirement. Enphase, for example claims a Mean Time Between Failure (MTBF) of > 300 years. This is a theoretical number, and it does not take into account beginning and end of life effects. It is also about 10 x higher than the MTBF numbers quoted by string inverter manufacturers (i.e., 30 years) which operate typically in a far less demanding thermal regime. The literature (e.g., the paper by Fronius, attached, suggests that a 100 year MTBF is more likely. I use 200 years in the analysis below).

Estimate of residential roof fires where a PV array is present (2022):
- NFPA reported 368,000 residential structure fires in 2014
- Assume roughly half of these resulted in a need for firefighter roof access (200,000)
- There will be about 1 million PV systems on residential roofs by 2022. That’s 0.75% of the total US housing stock of 133 million.
- Estimate of residential roof fires with PV on the roof (2022): 1500 per year.

Estimating rooftop inverter or converter failures (2022):
- Estimated new PV systems installed 2017 – 2022: 500,000 (source – SEIA – similar to current installation rate)
- Average system size: 10 kW
- Module/inverter rating: 250 W
- Module-inverters per system: 40
- Total inverters installed over 5 years: 20 million
- Estimated MTBF: 200 years (0.5% failures per year)
- Annual failures: 100,000 – which need to be repaired

In summary, a well-intentioned effort to protect firefighters from 1500 fire instances per year could put 100,000 electricians working on roofs every year. This is clearly an unreasonable risk and burden to the electrical worker community.

Further, as inverter failures per year would continue to grow as more systems are installed, and as inverter components age, things would get worse in later years.
The additional fire risk related to installing 20 million power electronics devices on rooftops is hard to quantify – but it probably more than 1500 per year. In other words, a measure designed to protect fire fighters could subject them to maybe twice as many fires with PV on the roof than without module-level rapid shutdown.

690.12(B)(2) mandates an UNPRECEDENTED installation of electrical apparatus on residential rooftops without full analysis of its personnel and fire-safety impact.

It is important to point out that replacing a micro-inverter or junction box converter in the middle of a PV array may involve disassembly of a significant portion of the array – it’s a complicated process that exposes the installer to fall hazards, and often several hours of rooftop work to replace a $200 component.

Finally, the proposal related to 690.12(B)(2) has not been developed in accordance with NFPA and ANSI regulations. The NFPA's Guide For The Conduct of Participants in the NFPA Standards Development Process states:

… all participants in the NFPA Standards Development Process should adhere to the following general principles:

(b) To maintain a process that is open, honest, and fair to all participants
(c) To promote the development of codes and standards that are scientifically and technically sound, that promote creativity and innovation in the development of new methods and technologies, and that set reasonable standards intended to minimize the possibility and effects of fire and related hazards
(d) To promote the development of consensus through the broad and balanced participation of a variety of interests and through the full airing and discussion of all points of view

690.12(B)(2), as proposed, fails to meet (b), (c), or (d). Rather than “minimizing the possibility and effects of fire and related hazards”, it increases them.

The representative for the solar industry on CMP4 (SEIA) voted negative (as did I – a former SEIA alternate) on the first draft of 690.12 revisions. The present 690.12 working group has little representation from the PV industry in general (i.e. module manufacturers, inverter manufacturers and installers). It appears to be a partisan group.

I urge CMP4 to remove 690.12(B)(2) as proposed, and give this topic to a balanced working group who can develop a consensus, technically sound proposal on this topic for the 2020 NEC.

Related Item
Public Input No. 3003-NFPA 70-2014 [Section No. 690.12]

Submitter Information Verification
Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
Street Address:
City:
State:
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Submittal Date: Thu Sep 24 21:31:00 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution:
Statement: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock
hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment” for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):
The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
Public Comment No. 1382-NFPA 70-2015 [Section No. 690.12(B)]

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2).

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) DC or 15 volts ac within 30 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(3) This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

Including conductors under the PV array as controlled conductors will mandate PV Module level electronics. This will result in significantly increased maintenance activities and reduced system reliability. The increase in risk of injury to service personnel will be an unacceptable unintended consequence.

The national fire code already includes requirements for roof access areas for firefighters. These access areas allow firefighters to perform their job in a reasonable manner with no risk of electrical injury. It would be reasonable to reduce the 1 Foot requirement to zero feet. This would allow firefighters to quickly and easily determine those areas that contain controlled conductors.

It is clear that those within the PV industry who are supporting the Module Level requirement stand to benefit from implementation as written. If we took this same approach to transportation vehicles, we would require that all petroleum products in the vehicle become non-flammable in the event of an accident.

If implemented as currently written, this will be a train wreck.

Related Item
Public Input No. 3003-NFPA 70-2014 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: Marv Dargatz
Organization: Kaylaco Enterprises, LLC
Affiliation: PV industry consultant
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Submittal Date: Fri Sep 25 07:04:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)2(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPV) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.
A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment’ for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforced by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):
The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 30 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled conductors located inside the array boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement, the PV system shall comply with either (a) or (b):

(a) Building-integrated PV power sources listed as a complete assembly, having no grounded components, and having ungrounded PV power source circuits shall be listed and labeled or field labeled as a building-integrated rapid shutdown PV array.

(b) PV system DC circuit components shall be listed and labeled as rapid shutdown PV equipment.

The requirement of 690.12(B)(2) shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

Dow Chemical is a manufacturer of BIPV shingles that do not have accessible wiring. Field inspection to the 690.12(B)(2) requirement is impossible without damaging the product. Dow Chemical strongly supports the development of a test standard so that compliance can be verified through listing/labeling. It is Dow’s preference that compliance to a listing/labeling requirement be mandated in the code for all industry participants, but as a minimum it should be allowed as a method of compliance. Options (a) and (b) are added to address this.

Option (a) is for products expected to function as part of the building envelope long after the power production lifetime has expired. These products can remain installed for 50 years or more, far longer than the life of the electronics inside of them. When listed as a PV array rather than as a sum of listed components, manufacturers can eliminate shock hazards without the use of electronics. The Dow Chemical BIPV shingle achieves this objective by eliminating conduction paths, even when wet and damaged. It does not use a metal frame or racking system. The product listing restricts applications to pitched, wooden roof decks. There is no grounded metal on the roof, and when used in combination with an ungrounded inverter, there is no possible conduction path to ground even if the PV circuit is exposed. These types of inherent safety improvements for BIPV products should not be discouraged through prescriptive code language. BIPV products should instead be subject to a different listing requirement that enables an equivalent or greater level of shock hazard protection using methods that consider the longevity of the products.

Option (b) is for non-BIPV component manufacturers that want to comply through listing/labeling much like they do today for other code requirements.

30V (725.41) and 50V (200.7) are industry-standard voltage cutoffs already defined within the Code. The arbitrary 80V language in 690.12(B)(2) is uniquely tailored to allow microinverter companies a method of compliance without meeting a listing/labeling requirement. This favors a particular industry technology designed for traditional PV modules. No equivalent technology exists for many types of building integrated PV. Dow has reached out to over 30 electronics firms that serve the PV market. None of those firms have or will have technology by 2018 that would enable BIPV firms to comply with the 690.12(B)(2) requirement. Even with an option for compliance through listing/labeling, if a test standard is not finalized by January 2018, Dow and other BIPV manufacturers will be unable to meet the code requirement. If this happens, the listing exemption will give microinverters an unfair market advantage. There is no technical reason to treat microinverters differently in the code.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
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<tbody>
<tr>
<td>Public Comment No. 1388-NFPA 70-2015 [Section No. 690.12(B)]</td>
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<tr>
<td>First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]</td>
<td></td>
</tr>
</tbody>
</table>
Submitter Information Verification

Submitter Full Name: Stephen Pisklak
Organization: Dow Chemical
Street Address:
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Submittal Date: Fri Sep 25 08:22:08 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:
Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change "PV power generating equipment" to "PV system equipment" for consistency of terminology.

Section (A):
This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):
This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, "PV Equipment Safe for Proximity Fire Fighting." Both the term "Rapid Shutdown PV Array" and "PV Equipment Safe for Proximity Fire Fighting" can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the...
area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the "off" position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

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This section was removed since the three initiator options are all switches that have an "on" or "off" position. The new clarified wording requires that an initiator in the "off" position requires that the PV system be in the rapid shutdown mode. If not initiators are turned "off" and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the "off" position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to "labeled" since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

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(2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Exception: Building-integrated photovoltaics with no grounded components except as required by 690.31(G).

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

30V (725.41) and 50V (200.7) are industry-standard voltage cutoffs already defined within the Code. The 80V value is not derived from any safety testing; it is designed to allow compliance through the use of microinverters and traditional panels. No equivalent technology exists for many types of building integrated PV (BIPV). The 80V requirement therefore favors a particular industry technology, and non-traditional PV products should be allowed time to develop similar solutions. Industry experts, including those representing microinverter companies, have publically estimated this development cycle to be about 5 years. An exception for one code cycle is therefore warranted for what is a relatively small segment of the overall rooftop PV market.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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</thead>
<tbody>
<tr>
<td>Public Comment No. 1386-NFPA 70-2015 [Section No. 690.12(B)]</td>
<td>Alternate acceptable revision.</td>
</tr>
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<td>First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]</td>
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Submitter Information Verification

Submitter Full Name: Stephen Pisklak
Organization: Dow Chemical
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 08:39:19 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

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The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):
The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
Statement of Problem and Substantiation for Public Comment

Worker safety exposure due to the PV Rapid Shutdown Proposal 690.12(B)(2)

690.12(B)(2), as proposed, is not the most effective path to increase firefighter safety, but increases risk and hazard exposure to electricians, thereby leading to an overall increase in risk for injury and fatality and an overall reduction in safety.

SEIA estimates that over 645,000 homes and businesses have installed solar power systems as of 2014. The only fatalities related to PV have involved falls from rooftops, falls through skylights or workers accidentally contacting overhead service lines while preparing scaffolding to work on roofs (http://www.cdph.ca.gov/programs/ohb-face/Pages/Solar.aspx). According to OSHA, in 2013 falls were the leading cause of worker deaths on construction sites, accounting for 36.5% of deaths in construction-related injuries and fatalities (https://www.osha.gov/oshsstats/commonstats.html). There are no recorded instances of firefighters being killed or injured due to hazards from PV systems.

All power electronics fail and will require service and troubleshooting. 690.12(B)(2) effectively mandates module-level power electronics at every module for rooftop solar. The greatest threat to worker safety is having to work on the roof, and every piece of power electronics placed on the roof is another exposure to worker risk. We must make sure that the risks we ask electrical workers to take on are balanced and fair, and present a reasonable risk in minimizing the possibility and effects of fire and related hazards.

Representatives of the fire service tell us that they need to quickly ventilate a structure that is on fire, and as a ten year veteran of the fire service and Chief of a rural fire department, I can tell you that they are right. However, the position that vertical ventilation is the best and only way to ventilate, and that the fire service therefore needs full and unlimited access to the roof, does not align with modern fire science. Some firefighters joke that the fire service has a hundred years of tradition unimpeded by progress, but there is new information available that many fire services are embracing as it offers a safer, more effective way of ventilation than rooftop operations.

The majority of homes and structures built today are dramatically different than those of our grandparents. Construction is lightweight trusses and engineered lumber, not beams and timbers. According to a study by UL comparing the effects of fire on modern versus legacy homes, today's larger homes, open layout, increased fuel loads and lightweight construction materials result in faster fire propagation, shorter time to flashover, shorter escape times and shorter time to structural collapse (UL, Analysis of Changing Residential Fire Dynamics and Its Implications on Firefighter Operational Timeframes, p3, http://newsScience.unl.com/wp-content/uploads/2014/04/Analysis_of_Changing_Residential_Fire_Dynamics_and_Its_Implications_on_Firefighter_Operational_Timeframes.pdf). Under these conditions, fast and effective ventilation becomes increasingly important. However, studies performed by NIST and others have shown that Positive Pressure Ventilation (PPV) is a more effective method than traditional vertical ventilation. In tests representative of a residential fire, PPV “lowered the temperatures in the room, forced all of the combustion products to flow out of the room without affecting the corridor and improved the visibility leading up to and in the room itself. In this experimental configuration a fire fighting team would likely have been able to attack the PPV ventilated fire more easily than the naturally ventilated fire” (NISTIR 7213, Effect of Positive Pressure Ventilation on a Room Fire p16, http://www.nist.gov/customcf/get_pdf.cfm?pub_id=861347).

In a similar test evaluating the effectiveness of PPV in large structures, “the pressure was increased sufficiently to: reduce temperatures, giving potential occupants a more survivable environment and increase fire fighter safety, limit smoke spread, keeping additional parts of the structure safe for occupants and undamaged and reducing the scale of the emergency for the fire fighters, and increase visibility, allowing occupants a better chance to self evacuate and providing fire fighters with an easier atmosphere to operate in. Positive pressure ventilation is a tool the fire service can utilize to make their job safer and more efficient” (NIST Technical Note 1498, Evaluating Positive Pressure Ventilation In Large Structures: School Pressure and Fire Experiments, p187, http://www.nist.gov/customcf/get_pdf.cfm?pub_id=861537).

According to this research, vertical rooftop ventilation can no longer be considered the golden standard for effective fireground operations. 690.12 should ensure that a local source of electricity (i.e. the PV array) can be easily disconnected from a building electrical system in
the event of a fire, and 690.12(B)(1) achieves that goal. Requiring conductors within the array zone to be controlled to 80 volts does not provide a touch-safe environment, and there are thousands of legacy PV installations currently installed which are not controlled within the array zone; therefore, 690.12(B)(2) creates a false sense of security for the fire service. Fire operations should not be in the array zone when there are better options.

The current proposal for 690.12(B)(1) ensures the control of conductors leaving the array field, and significantly limits the zone around a PV array where conductors are not controlled. This is a reasonable and workable level of safety, as it will allow a significant reduction in rooftop power electronics devices versus the module-level required by 690.12(B)(2). In addition, those components on the roof will be located at or under the edge of the array, leading to corresponding reductions in time-on-roof for service and maintenance versus having to pull every module, which directly relates to risk of fall hazard exposure to electrical workers.

The safety of PV systems has increased substantially in the past few code cycles, based on reasoned analysis of incidents in the field, lab tests, and a consensus process involving broad stakeholder participation. This led to the implementation of improvements such as arc fault protection and improvements in ground fault detection and protection. Recent studies indicate additional improvements can be made in terms of arc fault detection, and that process is underway. These improvements have significantly increased the safety of a PV system through the broad and balanced participation of a variety of interests promoting the development of codes and standards. That can not be said for 690.12(B)(2).

Mandating new requirements in the NEC for the power electronics required to achieve 80v module-level of control is premature, not scientifically or technically sound, and will only expose electrical workers to higher levels of risk, to the benefit of a few companies. I urge CMP4 to remove 690.12(B)(2).

Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]
Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
Public Comment No. 1433-NFPA 70-2015 [Section No. 690.12(B)]

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

690.12(B.2) as written would in effect mandate the installation of electronics on every single PV module installed. Although this change may have been advanced in the interest of life safety, we believe it is unnecessary and will in fact have the opposite effect.

While PV modules themselves are extremely reliable (warranted to last 25 years in most cases), module electronics is a very new industry - the leading providers of this equipment were founded less than 10 years ago, and early models suffered from significant reliability issues. If module electronics are mandated by NEC and even a few widely-deployed makes or models of module electronics are found to be unreliable in the field, it will result in hundreds of thousands of otherwise un-necessary roof accesses, each one of which carries risk of accident to electrical personnel. Because of the nature of module electronics, in many cases a large number of modules may need to be removed to access the faulty module electronics component - this is awkward work that multiplies the level of risk.

It is also not at all clear that module-level electronics reduces the risk of fire, because by its nature it increases the number of electronic components on the roof by 1-2 orders of magnitude, and while the available commercial units are in theory designed for a 25 year life, virtually none of the models being deployed today have been in service for even 5 years.

Besides the significant safety issues, failures related to newly-mandated module-level rapid shutdown equipment could have a catastrophic effect on the solar industry. Even in the absence of widespread failures, module-level electronics significantly increases the cost and complexity of solar installations.

Module electronics also adds significant cost and complexity for a questionable (and quite possibly negative) safety benefit. Array- and subarray-level solutions are available that provide ample safety as demonstrated by millions of installations in the US and Europe. We propose that 690.12(B.2) be struck from the 2017 code, and module-level electronics technology be allowed to mature further, and an open, honest, fair, and scientifically sound process be employed before such an unprecedented mandate is imposed.

Related Item
Public Input No. 3003-NFPA 70-2014 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: Ben Polito
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Submittal Date: Fri Sep 25 11:13:05 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety
A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment” for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would...
reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
Controlled Limits.
The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

Controlled conductors located inside or not more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

Deleted information note on 690.12 B.2 shouldn't define any option for non listed rapid shutdown components/systems to activate rapid shutdown.

Related Item

Public Input No. 1003-NFPA 70-2014 [Definition: Electrical Circuit Protective System]

Submitter Information Verification

Submitter Full Name: BIJAY SHRESTHA  
Organization: TIGO ENERGY INC.
Street Address:  
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Submittal Date: Fri Sep 25 13:17:37 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV power generating equipment”.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

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A section-by-section summary of the changes are described below.
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Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

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Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
Public Comment No. 1569-NFPA 70-2015 [Section No. 690.12(B)]

(B) Controlled Limits.
The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2).

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Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

It appears technical innovations to reduce I^2R losses could be inhibited by this rule. This rule could impede module efficiency improvements and hence slow cost reductions for clean energy.

Related Item

First Revision No. 18-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: Gene Choi
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Submittal Date: Fri Sep 25 14:26:37 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)2(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

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The informational note about capacitors in inverters was moved to the equipment section where it is more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2).

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

(3) Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

Bosch is concerned with the safety of everyone working with or around PV systems, and especially with the safety of those working on rooftops such as firefighters and personnel installing or maintaining the PV systems. Modern PV systems have achieved a level of elegant simplicity in terms of the amount of required rooftop equipment, resulting in very high reliability systems that may be installed on rooftops quickly and efficiently with little or no maintenance required over the lifetime, reducing the amount of time installers, electricians, and other service personnel need to spend on the rooftop. The rapid-shutdown requirements added in NEC 2014 also help to assure firefighters that any voltages generated by the PV array exist only near the array itself after a rapid shutdown is initiated, allowing the firefighters to work confidently on other areas of the rooftop or in other areas of the building nearby the PV array if needed during an emergency.

Bosch is very experienced in producing high reliability electronics for harsh environments through our automotive, industrial, and other activities. The 80V requirement essentially requires sophisticated electronics to be installed on the rooftop at or near every PV module, drastically increasing the complexity of the PV array, especially in large commercial rooftop installations which may contain thousands of PV modules. Even with the most reliable electronics, this increase in complexity will result in increased installation time and especially increased maintenance over the lifetime, resulting in more personnel working on rooftops with the associated risks involved.

Bosch believes the rapid shutdown requirement introduced with NEC 2014 already provides a high level of protection to firefighters, in the rare case they need to work nearby PV arrays on rooftops or in buildings due to an emergency situation. The added complexity of adding potentially thousands of disconnection circuits between the PV modules within a single PV array itself as proposed for NEC 2017 would add an unnecessary level of complexity, decreasing reliability and increasing the occurrence of rooftop maintenance work. Maintaining a potentially large number of electronic components distributed within a PV array as would be required by this 2017 NEC rapid shutdown proposal is also a much more complex and time-consuming task as compared to maintaining a much smaller amount of electronic components around the periphery of a PV array, as required by the NEC 2014 rapid shutdown requirement. Therefore, the time workers will need to spend on the rooftop is increased both by the quantity of additional electronics needed and by the relatively inaccessible location of the electronics within the array, especially for large commercial arrays. Although the proposal is well intentioned, Bosch does not believe the 80V requirement would result in a safer system overall when considering all potential for accidents to personnel working on the rooftop over the lifetime of the system.

Related Item

Public Input No. 3003-NFPA 70-2014 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: John Saussele
Organization: Robert Bosch LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 16:00:57 EDT 2015

Committee Statement

Committee Rejected but see related SR
A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment” for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):
This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
Public Comment No. 1696-NFPA 70-2015 [ Section No. 690.12(B) ]

(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to outside the array boundary shall comply with 690.12(B) (1) and inside the array boundary shall comply with (B)(2).

1. Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds, 30 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

2. Controlled rapid shutdown equipment shall be installed to limit firefighter exposure to electrical hazards from the controlled conductors located inside the array boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 90 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. array boundary and shall be listed and labeled as PV Equipment Safe for Proximity Fire Fighting.

Informational Note: The designation PV Equipment Safe for Proximity Fire Fighting identifies equipment and components that limit firefighter exposure to an electrical hazard within the array boundary after the Rapid Shutdown initiator has been activated. This designation addresses single point failures that might occur when the PV system is inadvertently damaged by firefighting operations or other mechanical damage or during a building fire. Control of electric shock hazard may be achieved by methods such as limiting access to exposed components that might become energized, reducing the potential difference between energized components, limiting the electric current that might flow in an electrical circuit involving personnel with increased resistance of the conductive circuit, or by a combination of such methods.

This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

(1) 2020

Statement of Problem and Substantiation for Public Comment

The proposed revisions to 690.12(B)(2) are intended to increase electrical safety to unqualified personnel, including firefighters, working on damaged equipment within the array boundary. While SolarCity supports the fire service in their intent to increase safety within the boundary of the array, the First Draft of Article 690.12(B)(2) has been written in such a way that effectively prescribes a specific type of electronic solution currently available in the marketplace. These devices are typically referred to as Module Level Power Electronics (MLPE) and include products like microinverters and optimizers. They are complicated devices, with a wide array of functions, but they were never designed for the sole purpose of “turning off” solar modules. The use of these complex devices as the means to accomplish rapid shutdown is a concern for several reasons.

HOW RELIABLE ARE MODULE LEVEL POWER ELECTRONICS (MLPE)?

• Prominent manufacturers of MLPEs often point to their “Mean-Time-Between-Failure” models (MTBF) to support their claims of reliability. According to Lusser’s Law, the chance that a system will fail is calculated by multiplying the Mean-Time-Between-Failures (MTBF) for each part by the number of parts. So if a MLPE has 500 parts in series, and each part is 99.9% reliable, the reliability of the entire MLPE device drops to 60%. Translation: the many features and functions of MLPEs = more failure points.
• Modeling the lifetime of these complex devices is hard. Models that translate to real-life field performance don’t exist yet. This was painfully exposed when an industry-leading maker of Module Level Power Electronics had to admit that their MTBF models, which had been advertised as sophisticated and reliable, had significantly underestimated true failure rates in the field. This manufacturer had to correct their financial statements about warranty claims on their failed devices to the tune of tens of millions of dollars. [1]
• Nonetheless, MLPE manufacturers claim that devices should last up to 25 years even though conventional inverters, with comparable parts and functions, are rated to last only 12-15 years. But their models do not realistically predict the reliability of the individual parts inside them. Even for the most trusted and experienced manufacturers, bad batches make it through to final production. MTBF calculations do not consider the impact of manufacturing quality issues.
• Dr. Jack Flicker of Sandia National Laboratories says the failures are caused, in part, by “more extreme diurnal temperature cycling [with] increased stress on componentry [resulting in] more difficult thermal management.” With “one MLPE unit for every module [equal to] 5,000 units per megaWatt of PV [it is] difficult-to-impossible to track and repair/replace units as they fail.” [2]
• Bottomline: These devices have not been built for the sole purpose of “turning off” solar modules. Because of their complexity, these devices cannot last as long as solar panels and even the best manufacturers, with established track records, have had to back track on their reliability claims. If the existing manufacturers are having a hard time, what will that mean when new companies rush to market with new rapid shutdown devices that are supposed to protect firefighters?
SAFETY FOR FIRST RESPONDERS & SOLAR WORKERS

- While the effort to enhance safety for first responders is laudable, it is important to remember that not a single firefighter has been killed while on a building with solar, suggesting that existing safety provisions for PV have been largely effective.
- While the solar industry aggressively promotes worker safety, falls remain the number one cause of death among all construction workers.[3] If MLPEs are mandated as rapid shutdown devices, solar construction workers will be the ones replacing them during the life of the system. Mandating one device beneath every solar module will directly increase the time solar construction workers will have to spend on the roof to replace them. More time on roof = higher risk of falling.
- The best way to mitigate this increased danger to American solar workers, is to place rapid shutdown devices in accessible locations that can be reached quickly and safely for testing and service, not beneath each solar module.
- There is another danger to using MLPEs to accomplish rapid shutdown. Even when these devices work “as advertised,” the system is never truly “shutdown.” A solar module producing 80V is not the same as “Off.” UL confirmed as recently as June, in their evaluation of firefighter PPE, that voltages *below* 80V still pose a risk. This was disclosed at the NFPA conference, which several members of this panel attended. A reduction in voltage does not eliminate the hazard, giving unsuspecting firefighters a false sense of security that only puts them at risk.
- Captain John Green, of the Los Angeles Fire Department (2nd largest in the US) echoed this when he said, “We don’t want our firefighters messing with the array, no matter what. Our protocol is a proven operating process, and adding layers of guess work complicates the job. Some systems might have panel level shutdown, some will not. Some of those that do will be operative, some will not. So we do not want that option to even exist; in a situation, there is no time to try to figure out what might work or not on a solar system. There is enough uncertainty in what we do. For us, the rule is ‘Do not engage’, period.”[4]
- Bottomline: Requiring the Module Level Power Electronics to accomplish rapid shutdown poses hazards to firefighters and solar construction workers alike. Even prominent members of the fire service do not support, and will not rely on, Module Level Power Electronics to protect them.

The First Draft of Article 690.12 effectively prescribes an immature technology, not expressly designed to accomplish rapid shutdown. It has the unintended effect of putting firefighters and solar workers in harm’s way. We urge this panel to vote against it and instead support the proposal put forth by SEIA’s representatives as the best path to develop safety solutions that achieve the intent of 690.12 without prescribing a single technology that closes the door on innovation.

References:

Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: Duncan Cleminshaw
Organization: SolarCity

Committee Statement

Rejected but see related SR

This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for.
For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change "PV power generating equipment" to "PV system equipment" for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
(B) Controlled Limits.

The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to 690.12(B) (1) and (2)

(1) Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 12.5 \( \times \) 30 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

(2) Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 12.5 \( \times \) 30 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

It's become clear through discussions while incorporating RSS into the UL Standard that provision for low voltage ride through that is being required of new smart inverter technology is at odds with the RSS requirements when the initiation is by loss of utility power. To reduce the possibility of interference between RSS and low voltage ride though it is recommended that the shed down time be extended to 30 seconds.

Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
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Submittal Date: Thu Sep 03 14:59:12 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution:
Statement: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment’ for consistency of terminology.
Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

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The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

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The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

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The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

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This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

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Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
Controlled Limits.
The use of the term, array boundary, in this section is defined as 30 cm (1 ft) from the array in all directions. Controlled conductors shall apply to \[690.12(B)\] (1) and (2).

1. Controlled conductors located outside the boundary or more than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 30 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.

2. Controlled conductors located inside the boundary or less than 1 m (3 ft) from the point of entry inside a building shall be limited to not more than 80 volts within 10 seconds of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground. This requirement shall become effective January 1, 2018.

Informational Note: Inverter input circuit conductors can remain energized for up to 5 minutes with inverters not listed for rapid shutdown.

Statement of Problem and Substantiation for Public Comment

There are devices available today that can implement the RSS functionality so there is no need to delay the requirement farther out than the adoption date of the 2017 NEC. Considering that other provisions are put in the NEC that have no effective way to implement them at the time of code adoption it seems to be unusual that this particular provision would be delayed. Even if no means is available when the 2017 NEC is adopted 90.4 can be used to waive the requirement as it is done in many other cases.

Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
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Submittal Date: Thu Sep 03 15:04:19 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: 
Statement: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment” for consistency of terminology.
Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to "labeled" since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
Public Comment No. 1693-NFPA 70-2015 [Section No. 690.12(E)]

(E) Equipment.

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed, labeled, and identified for providing rapid shutdown protection.

Statement of Problem and Substantiation for Public Comment

Listing and verification requirement shouldn't be defines as part of NEC guideline

Related Item

Public Input No. 1003-NFPA 70-2014 [Definition: Electrical Circuit Protective System]

Submitter Information Verification

Submitter Full Name: BIJAY SHRESTHA
Organization: TIGO ENERGY INC.
Street Address:
City: State: Zip:
Submittal Date: Fri Sep 25 16:31:18 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution:
Statement: This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbrered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment’ for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the 2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.
The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list. The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to "labeled" since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
TITLE OF NEW CONTENT

Type your content here ...

"Both significant weather-related, and seismic events can leave a PV system in an electrically hazardous condition, affecting fire service response. I am in full support of the IAFF First Revision #1008 to shutdown a rooftop PV array to the lowest degree possible utilizing current available products."

Statement of Problem and Substantiation for Public Comment

Statement of Problem
This submission reflects the incremental code change to lower the available PV system voltage after the initiation of a Rapid Shutdown. Eliminating areas of hazardous voltage within the array after shutdown, has been identified by both the fire service and insurance industry as a key gap and concern. This was the original recommendation of the NFPA Fire Task Group from the 2014 cycle with the 690.12 proposal for module level control. The UL 1741 standards body is expected to have an updated standard addressing module level control devices in place prior to implementation of the 2017 code.

There is no requirement in the NEC that there be a way to deenergize the electrical circuits connected to PV modules mounted on buildings. These circuits remain energized anytime the modules are illuminated and up to the maximum system voltage which can be up to 1,000Vdc. This results in increased level of danger to first responders when the structure has been damaged. Historically this has been accepted since there was no practical way to isolate a PV module from the PV source circuit that would operate remotely and on all PV modules in an array simultaneously. Module level systems were not developed to the point where products were readily available on the market to provide this functionality. Today this is no longer true, many reliable products are available that can be either incorporated into a PV module or added to a PV module in the field to provide PV module isolation by remote control. The reliability concerns from 2014 are no longer relevant today, and market data estimates that up to 10 million units capable of module level isolation are now in service.

Under normal fault response conditions, the inverter is taken offline due to the first fault. A risk of re-ignition remains with string and central inverters due to the discontinuation of fault detection, interruption, and annunciation when inverters are offline due to a fault, or maintenance. Module level electronics provide for continued array monitoring in the event one fault occurs within the system due to the series nature of the devices monitoring each module.

There is no longer any reasonable justification to not address the additional hazard that having energized conductors represents in a structure mounted PV array. Reducing the voltage only in conductors outside the array, leaves very large areas of a structure with hazardous voltages, and should be considered "off limits" to firefighters. Additionally this leaves no options for first or second responders to safely deenergize in the event of an emergency.

Related Item
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: James Penn
Organization: Compton Fire Department
Street Address: 
City: 
State: 
Zip:
Submittal Date: Mon Sep 21 18:03:45 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: No changes were recommended by the submitter.
If a rapid shutdown initiation device is not located near the service disconnecting means, a sign shall be installed at the service disconnecting means location, identifying the location of the initiation device.

Exception: Ground mounted PV system circuits that enter buildings or structures, of which the sole purpose is to house PV power generating system equipment, are not required to comply with 690.12.

Statement of Problem and Substantiation for Public Comment

Harmonizes wording with exception in 690.11. Consistency counts.

Related Item

First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 02 18:14:55 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: Statement:

This SR represents the revised text of 690.12 as developed by CMP4 in reviewing the 35 PCs received on this one section. Many of the PCs were in support of one of three main concepts, and the majority of the PCs were focused on 690.12(B)(2)(b). In an effort to formulate the final version for ballot, PC 1332 was produced by the NFPA Fire Fighter Safety and PV Systems (FFSPVS) Task Group and was used as the basis for SR. Changes from the First Draft language are reflected in this statement. Where specific PCs edited the language of PC 1332, those changes are specifically called out. All other changes were either part of the original PC or added by CMP4.

A section-by-section summary of the changes are described below.

Main paragraph:

Renumbered list since two of the sections were removed. Also, the prime reason for rapid shutdown is clearly stated in the main paragraph as relating to the reduced shock hazard for emergency responders. The benefit of this reduced shock hazard to other personnel is not the purpose of this requirement or the standards that will support this requirement. This is an important distinction since some may try to use this equipment for purposes other than what they were intended for. For instance, 690.12 is not intended to provide electrical isolation for electrical worker safety. That electrical isolation is covered by the disconnecting means requirements in Part III, Disconnecting Means, of Article 690.

The exception in the main paragraph was edited based on PC 502 to change “PV power generating equipment” to “PV system equipment’ for consistency of terminology.

Section (A):

This section was greatly simplified since the definition of a PV system has also been greatly simplified in the 2017 NEC cycle. The PV system can only control the ac output of PV inverters on the PV supply side of the circuit. If that circuit is connected to a utility-connected circuit breaker, only the PV end of the circuit can be deenergized since the circuit breaker is connected to a utility source that may need to be separately turned off. This also addresses several PCs requesting similar simplification and clarification.

Section (B):

This section saw the most significant debate as it is the key difference between the 2014 NEC and the first draft of the
2017 NEC. The heading was changed to further clarify which section refers to outside versus inside the array boundary. Each subsection was given a heading for even further clarification.

The subsection related to within the array boundary [690.12(B)(2)] now provides for two methods of compliance. The first method is a performance requirement that requires the PV array be evaluated as a rapid shutdown PV array. Currently, there is no standard for this option, but it is key that this option be made available so that the standards process will see the need to develop a standard to which this equipment will be evaluated. It is expected that, once a standard is developed, many PV arrays will be listed and labeled for this function. However, some configurations may require field labeling which is why this option is also provided. PC 1408, the PC produced by the Solar Energy Industries Association (SEIA) recommended slightly different terminology, “PV Equipment Safe for Proximity Fire Fighting.” Both the term “Rapid Shutdown PV Array” and “PV Equipment Safe for Proximity Fire Fighting” can mean the same thing since the standard is yet to be written.

The fire service has expressed concern that the lack of a rapid shutdown PV array standard may result in lesser safety than the 80 volts required in 690.12(B)(2)(b). To further clarify that the intent of this listing process is for fire fighter safety, the informational note clarifies the intent that a listed product will equivalent or lesser hazard than a system built in accordance with 690.12(B)(2)(b). This clearly signals to the relevant standards committees, what the code intent is for this new standard. Option (c) is included to address PV arrays that present reduced shock hazard, other than 80 V arrays.

The informational note about capacitors in inverters was moved to the equipment section where it more relevant. Lastly, the wording of the start date of the requirements inside the array boundary were clarified to specifically only apply to the area inside the array boundary. All other requirements in 690.12 are intended to be enforced when this version is enforce by a jurisdiction.

Section (C):

The initiation device section was reorganized, simplified, and clarified for better enforcement. The list of devices is the same, but all the additional language about initiation on loss of utility voltage is removed since it is not relevant. The standard, which is already under development, addresses these different scenarios. The NEC only needs a simple list.

The main paragraph has been added to clarify that the function of the initiation device is to initiate rapid shutdown. It further clarifies that an initiation device in the “off” position puts the PV system in the rapid shutdown mode. Lastly, the first paragraph requires that the rapid shutdown initiator be located on the outside of the building for one- and two-family dwellings. This was requested by the fire service as many service disconnects may be internal to a building and difficult for fire fighters to access.

Section (D):

This section was removed since the three initiator options are all switches that have an “on” or “off” position. The new clarified wording requires that an initiator in the “off” position requires that the PV system be in the rapid shutdown mode. If not initiators are turned “off” and the rapid shutdown system initiates on a loss of utility voltage, the fire fighter must know that they are unprotected until the initiator is moved to the “off” position since the power could be restored, which would reenergize the PV system (and potentially other ac wiring in the building).

Section (E):

The word identified was changed to “labeled” since that is consistent with numerous changes in the first draft. The informational note was moved to this section as it is more relevant to equipment since inverters are one prominent piece of equipment.

Section (F):

The marking section has been completely moved to the marking section of 690.56(C) and the intent of 690.12(F) has been captured in that new, much longer and detailed section.
690.13 Photovoltaic System Disconnecting Means.

Means shall be provided to disconnect the PV system from all wiring systems including power systems, energy storage systems, and utilization equipment and its associated premises wiring.

(A) Location.

The PV system disconnecting means shall be installed at a readily accessible location.

Informational Note: PV systems installed in accordance with 690.12 address the concerns related to live conductors entering a building.

(B) Marking.

Each PV system disconnecting means shall be permanently marked to identify it as a PV system disconnect and shall indicate whether in the open or closed position. For PV system disconnecting means where the line and load terminals may be energized in the open position, the device shall be marked with the following words or equivalent:

WARNING

ELECTRIC SHOCK HAZARD

TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

The warning sign(s) or label(s) shall comply with 110.21(B).

(C) Suitable for Use.

If the PV system is connected to the supply side of the service disconnecting means as permitted in 230.82(6), the PV system disconnecting means shall be listed as suitable for use as service equipment.

(D) Maximum Number of Disconnects.

Each PV system disconnecting means shall consist of not more than six switches or six sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, or in a group of separate enclosures. A single PV system disconnecting means shall be permitted for the combined ac output of one or more inverters or ac modules in an interactive system.

Informational Note: This requirement does not limit the number of PV systems connected to a service as permitted in 230.82(6), the PV system disconnecting means shall be listed as suitable for use as service equipment.

(E) Interrupting Rating.

The PV system disconnecting means shall have an interrupting rating sufficient for the maximum available short circuit current and voltage that is available at the terminals of the PV system disconnect.

(F) Type of Disconnect.

The PV system disconnecting means shall simultaneously disconnect the PV system conductors of the circuit from all conductors of other wiring systems. The PV system disconnecting means shall be an externally operable general-use switch or circuit breaker, or other approved means. A dc PV system disconnecting means shall be marked for use in PV systems or be suitable for backfeed operation.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1014.

Related Item

First Revision No. 1014-NFPA 70-2015 [Section No. 690.13]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: City:
State: Zip:
Submittal Date: Tue Sep 29 11:41:34 EDT 2015
Committee Statement

Committee Action: Rejected

Resolution: The correlating committee makes no specific changes in this PC. The CC requests that the comments to FR1014 be reviewed again which was done by the panel. The informational note on 690.13(F) was restored as shown in the comments. The ballot comment on FR1014 by Matthew Paiss is addressed in the SR for 690.12. The remaining comments were discussed with no additional changes in the SRs.
Public Comment No. 1000-NFPA 70-2015 [Section No. 690.13(A)]

(A) Location.
The PV system disconnecting means shall be installed at a readily accessible location.
Informational Note: PV systems installed in accordance with 690.12 address the concerns related to live, energized conductors entering a building.

Statement of Problem and Substantiation for Public Comment

This simply changes "live" to "energized" as directed by the correlating committee comments.

Related Item
First Revision No. 1014-NFPA 70-2015 [Section No. 690.13]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 23:25:29 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-946-NFPA 70-2015
Statement: The panel makes the editorial change as requested by the correlating committee and this PC.
(B) Marking.

Each PV system disconnecting means shall be permanently marked to identify it as a PV system disconnect and shall indicate whether in the open or closed position. The marking should indicate that it is a PV system disconnect or equivalent, but may provide additional information as warranted by the system configuration. The marking minimum shall be:

PV SYSTEM DISCONNECT

For PV system disconnecting means where the line and load terminals may be energized in the open position, the device shall be marked with the following words or equivalent:

WARNING
ELECTRIC SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

The warning sign(s) or label(s) shall comply with 110.21(B).

Statement of Problem and Substantiation for Public Comment

According to the current language, "Eacy PV System disconnecting means shall be permanently marked to identify it as a PV System disconnect" Some guidance should be provided in 690.13 for the marking. A suggestion is simply "PV System Disconnect" but it should be permitted to provide additional information depending on the system topology.

Related Item

First Revision No. 1014-NFPA 70-2015 [Section No. 690.13]

Submitter Information Verification

Submitter Full Name: Todd Fries
Organization: HellermannTyton
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 12:04:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-947-NFPA 70-2015
Statement: The panel adds specific language for marking of the PV system disconnecting means and adds a sentence to address markings for other system configurations. The words "(off)" and "(on)" were added to be consistent with the Code.
Public Comment No. 653-NFPA 70-2015 [Section No. 690.13(C)]

(C) Suitable for Use.
If the PV system is connected to the supply side of the service disconnecting means as permitted in 230.82(6), the PV system
disconnecting means shall be listed as suitable for use as service equipment.

Informational Note: DC-rated enclosed switches, open-type switches and low-voltage power circuit breakers are suitable for
use.

Statement of Problem and Substantiation for Public Comment
The informational note appears to have been deleted in the first revision. Retaining the informational note adds clarity to the purpose
of the section.

Related Item
First Revision No. 1014-NFPA 70-2015 [Section No. 690.13]

Submitter Information Verification
Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 14 18:40:00 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-948-NFPA 70-2015
Statement: The panel changes the title of this section to “Ratings” rather than “Interrupting Rating” since disconnecting means do not
include interrupting ratings unless they have overcurrent protection as well. This will help reduce the confusion created
by original title. The short circuit current rating of an unfused disconnect is a function of the upstream overcurrent device
as covered in the listing of the disconnect.
(E) Interrupting Rating.

The PV system disconnecting means shall comply with one of the following interrupt rating requirements.

1. A PV system disconnecting means that uses a circuit breaker shall have an interrupting rating sufficient for the maximum available short circuit current and voltage that is available at the terminals of the PV system disconnect.

2. A PV system disconnecting means that does NOT provide overcurrent protection shall have an interrupting rating sufficient for the maximum operating current and voltage that is available at the terminals of the PV system disconnect. The disconnecting means shall have the bracing required to conduct the maximum available short circuit current.

Statement of Problem and Substantiation for Public Comment

SunPower would like to thank CMP 4 for making these much needed revisions to 690.13. Unfortunately, the interrupt rating requirement for the PV System Disconnect (PSD) was revised in such a way that a listed switch that does not provide overcurrent protection could not be used as a PSD. Switches without overcurrent protection would not be designed to be opened under fault conditions, only under normal operating loads. Thus, their design and their listing would only allow them to conduct the short circuit current during a fault condition, but not interrupt the fault. The overcurrent protection device would be designed to provide the fault interruption capability. It would be undesirable to prevent the use of standard switches as the PSD when upstream devices provide the required overcurrent protection.

In some system designs, a circuit breaker would be used for the PSD and it would provide both the disconnecting means and the overcurrent protection required to protect the circuit. For these systems, the interrupting rating of the PSD should include the maximum available short circuit current from the service/utility. These disconnects would need to comply with the requirement in 690.13(E)(1) that we have proposed here.

In other system designs, a separate fuse or circuit breaker would provide the overcurrent protection for the circuit. In this case, the PSD would not be used to interrupt the fault, only to disconnect the equipment under normal operating conditions. Thus, the interrupt rating of these switches would only need to deal with the maximum operating current available at the terminals of the switch. The switch does need to be capable of having fault current pass through it though should the fault be on the PV system side of the PSD, hence the bracing requirement. The PSD used for these system designs would need to comply with the requirement in 690.13(E)(2) that we have proposed here.

Related Item

Public Input No. 4394-NFPA 70-2014 [Section No. 690.13]

Submitter Information Verification

Submitter Full Name: MARK ALBERS
Organization: SUNPOWER
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 16:31:00 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-948-NFPA 70-2015
Statement: The panel changes the title of this section to “Ratings” rather than “Interrupting Rating” since disconnecting means do not include interrupting ratings unless they have overcurrent protection as well. This will help reduce the confusion created by original title. The short circuit current rating of an unfused disconnect is a function of the upstream overcurrent device as covered in the listing of the disconnect.
(F) Type of Disconnect.

The PV system disconnecting means shall simultaneously disconnect the PV system conductors of the circuit from all conductors of other wiring systems. The PV system disconnecting means shall be an externally operable general-use switch or circuit breaker, or other approved means. A dc PV system disconnecting means shall be marked for use in PV systems or be suitable for backfeed operation.

Informational Note: Dc-rated enclosed switches, open-type switches, and low-voltage power circuit breakers are suitable for backfeed operation.

Statement of Problem and Substantiation for Public Comment

The first draft mistakenly omitted the informational note that was in the FR.

Related Item
First Revision No. 1014-NFPA 70-2015 [Section No. 690.13]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 23:28:22 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-949-NFPA 70-2015
Statement: The first draft mistakenly omitted the informational note that was in the FR. A sentence was added to the informational note to identify which devices are not suitable for backfeed operation.
Isolating devices shall be provided to isolate PV modules, ac PV modules, fuses, dc-to-dc converters inverters, and charge controllers from all conductors that are not solidly grounded. An equipment disconnecting means or a PV system disconnecting means shall be permitted in place of an isolating device. Where the maximum circuit current is greater than 30 amperes for the output circuit of a dc combiner or the input circuit of a charge controller or inverter, an equipment disconnecting means shall be provided for isolation. Where a charge controller or inverter has multiple input circuits, a single equipment disconnecting means shall be permitted to isolate the equipment from the input circuits.

Informational Note: The purpose of these isolating devices are for the safe and convenient replacement or service of specific PV system equipment without exposure to energized conductors.

Statement of Problem and Substantiation for Public Comment

Problem: The proposed 30 Amperes limit is arbitrarily chosen. Typically available state of the art PV connectors are listed for a rated current of up to 35 Amperes (see UL file QIJQ2.E343590 - Amphenol, QIJQ2.E339277 - Huber+Suhner). Today's typical system designs rely on the availability of these connectors as isolating device (according to (C )1) up to this maximum limit.

Solution: We suggest to set the limit to 35 Amperes because there is a large number of listed standard PV connectors with a rated current of up to 35 Amperes. From a safety point of view there is no difference between a listed connector being used as isolating device in a circuit with a maximum current of 30 Amperes compared to a circuit with a maximum current of 35 Amperes. In either case the connector will be considered an isolating device according to (C )1 not to be disconnected under load and labeled accordingly.

Related Item
First Revision No. 1013-NFPA 70-2015 [Section No. 690.15]
Public Input No. 3738-NFPA 70-2014 [Section No. 690.15]

Submitter Information Verification

Submitter Full Name: Michael Mendik
Organization: SMA America
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 17:26:34 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The 30-amp limit was not chosen based upon the current-carrying capability of any device. The current was chosen based on the likelihood of injury if personnel were to ignore warnings not to disconnect under load. Choosing 35 amps simply opens the door for other manufacturers with 50 amp connectors to argue that the value should be 50 amps.
Isolating devices shall be provided to isolate PV modules, ac PV modules, fuses, dc-to-dc converters inverters, and charge controllers from all conductors that are not solidly grounded. An equipment disconnecting means or a PV system disconnecting means shall be permitted in place of an isolating device. Where the maximum circuit current is greater than 30 amperes for the output circuit of a dc combiner or the input circuit of a charge controller or inverter, an equipment disconnecting means shall be provided for isolation. Where a charge controller or inverter has multiple input circuits, a single equipment disconnecting means shall be permitted to isolate the equipment from the input circuits.

Informational Note: The purpose of these isolating devices are for the safe and convenient replacement or service of specific PV system equipment without exposure to energized conductors.

<table>
<thead>
<tr>
<th>Statement of Problem and Substantiation for Public Comment</th>
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<tbody>
<tr>
<td>The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1013. The Correlating Committee directs that the panel rewrite the Exception to comply with the NEC Style Manual.</td>
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<tr>
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<tr>
<td>Submitter Full Name: CC on NEC-AAC</td>
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<tr>
<td>Organization: NFPA</td>
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<tr>
<td>Committee Action: Rejected but see related SR</td>
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<tr>
<td>Resolution: SR-952-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement: The revision adds &quot;lockable&quot; to equipment disconnecting means to comply with 110.25. &quot;Live&quot; was changed to &quot;energized&quot; for consistency. The words &quot;,(off)&quot; and &quot;(on)&quot; were added for consistency. The reference to the warning in 690.13(B) makes repeating the warning unnecessary. The informational note is removed and the content is captured in 690.13(F).</td>
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Isolating devices shall be provided to isolate PV modules, ac PV modules, fuses, dc-to-dc converters inverters, and charge controllers from all conductors that are not solidly grounded. An equipment disconnecting means or a PV system disconnecting means shall be permitted in place of an isolating device. Where the maximum circuit current is greater than 30 amperes for the output circuit of a dc combiner or the input circuit of a charge controller or inverter, an equipment disconnecting means complying with 690.13(B) shall be provided for isolation. Where a charge controller or inverter has multiple input circuits, a single equipment disconnecting means shall be permitted to isolate the equipment from the input circuits.

Informational Note: The purpose of these isolating devices are for the safe and convenient replacement or service of specific PV system equipment without exposure to energized conductors.

Statement of Problem and Substantiation for Public Comment

This is simply providing the requirements of disconnect device vs. isolation device but with the word complying with 690.13(B) clarifies the marking confusion.

Related Item
First Revision No. 1013-NFPA 70-2015 [Section No. 690.15]

Submitter Information Verification

Submitter Full Name: Todd Fries
Organization: HellermannTyton
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 11:50:29 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The reference to 690.13(B) will not clarify, but it will confuse the distinction between 690.13 and 690.15.
**Public Comment No. 1727-NFPA 70-2015 [Section No. 690.15(B)]**

*(B) Interrupting Rating.*

An equipment disconnecting means shall have an interrupting rating sufficient for the maximum voltage and dc short-circuit or ac load current and voltage that is available at the terminals of the equipment. An isolating device shall not be required to have an interrupting rating.

**Statement of Problem and Substantiation for Public Comment**

The dc PV circuits are current limited and therefore define the disrupting current. For ac circuits, such as inverter output circuits, the conductors and disconnect switch are protected by an ODCP that carries proper interrupt current ratings for the fault current of the source. It is not necessary for the disconnect device to interrupt the full fault current, only the load current.

**Related Item**

First Revision No. 1013-NFPA 70-2015 [Section No. 690.15]

**Submitter Information Verification**

Submitter Full Name: MARK BALDASSARI  
Organization: ENPHASE ENERGY  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Fri Sep 25 18:48:46 EDT 2015

**Committee Statement**

Committee Action: Rejected  
Resolution: The PC does not add clarity to this requirement. The basic requirement for the equipment disconnect is to open whatever current is flowing.
Public Comment No. 1225-NFPA 70-2015 [Section No. 690.15(C)]

(C) Isolating Device.
An isolating device shall not be required to simultaneously disconnect all current carrying conductors of a circuit. The isolating device shall be one of the following:

(1) A connector meeting the requirements of 690.33, and listed and identified for use with specific equipment.
(2) A finger safe fuse holder
(3) An isolating switch that requires a tool to open
(4) An isolating device listed for the intended application

An isolating device shall be marked “Do Not Disconnect Under Load” or “Not for Current Interrupting”.

Statement of Problem and Substantiation for Public Comment

This statement implies that connectors should be listed for use with the equipment that they are intended to isolate. This would be true if connectors are listed as part of the equipment being used under the “within the equipment” clause. However, if the isolating device is “within sight and within 10 feet of” they would not need to be listed to work specifically with that equipment - they would just be listed connectors. It is a general requirement that listed equipment be used in accordance with its listing, so this statement is unnecessary and misleading as written.

Related Item
First Revision No. 1013-NFPA 70-2015 [Section No. 690.15]

Submitter Information Verification

Submitter Full Name: BRIAN LYDIC
Organization: FRONIUS USA
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 14:09:44 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Most connectors on the market today do not carry a listing unless provided as part of a listed assembly. This clause was added in the 2014 NEC to clarify that connectors are not listed, but can be listed with equipment.
Public Comment No. 1728-NFPA 70-2015 [Section No. 690.15(C)]

(C) Isolating Device.

An isolating device shall not be required to simultaneously disconnect all current carrying conductors of a circuit. The isolating device shall be one of the following:

1. A connector meeting the requirements of 690.33 and listed and identified for use with specific equipment
2. A finger safe fuse holder
3. An isolating switch that requires a tool to open
4. An isolating device listed for the intended application

As: If an isolating device does not have an interrupting rating, it shall be marked “Do Not Disconnect Under Load” or “Not for Current Interrupting”.

Statement of Problem and Substantiation for Public Comment

690.15 states an Isolation device shall be permitted to have an interrupting rating. If so, then it is not necessary to mark it as “do not disconnect under load.”

Related Item
First Revision No. 1013-NFPA 70-2015 [Section No. 690.15]

Submitter Information Verification

Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 18:55:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-950-NFPA 70-2015
Statement: The revision clarifies that only devices not rated to break the maximum circuit current under load are required to be marked.
Public Comment No. 1002-NFPA 70-2015 [Section No. 690.15(D)]

(D) Equipment Disconnecting Means.

An equipment disconnecting means shall simultaneously disconnect all current carrying conductors that are not solidly grounded of the circuit to which it is connected. An equipment disconnecting means shall be externally operable without exposing the operator to contact with live parts and shall indicate whether in the open or closed position. An equipment disconnecting means shall be one of the following devices:

1. A manually operable switch or circuit breaker
2. A connector meeting the requirements of 690.33(E) (1)
3. A load break fused pull out switch
4. A remote controlled circuit breaker, contactor, or relay that is operable locally and opens automatically when control power is interrupted

Informational Note: Devices marked with “line” and “load” are not suitable for backfeed or reverse current. Dc-rated enclosed switches, open-type switches, and low-voltage power circuit breakers are suitable for backfeed operation.

For equipment disconnecting means where the line and load terminals may be energized in the open position, the device shall be marked with the following words or equivalent:

WARNING
ELECTRIC SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

The warning sign(s) or label(s) shall comply with 110.21(B).

Exception: Connectors that meet 690.33 are shall be exempt from this marking requirement.

Statement of Problem and Substantiation for Public Comment

At the direction of the correlating committee, this comment changes "are" to "shall be".

Related Item
First Revision No. 1013-NFPA 70-2015 [Section No. 690.15]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 23:31:40 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-952-NFPA 70-2015
Statement: The revision adds “lockable” to equipment disconnecting means to comply with 110.25.

"Live" was changed to "energized" for consistency.

The words "(off)" and "(on)" were added for consistency.

The reference to the warning in 690.13(B) makes repeating the warning unnecessary.

The informational note is removed and the content is captured in 690.13(F).
(D) Equipment Disconnecting Means.

An equipment disconnecting means shall simultaneously disconnect all current carrying conductors that are not solidly grounded of the circuit to which it is connected. An equipment disconnecting means shall be externally operable without exposing the operator to contact with live parts and shall indicate whether in the open or closed position. An equipment disconnecting means shall be one of the following devices:

1. A manually operable switch or circuit breaker
2. A connector meeting the requirements of 690.33(E) (1)
3. A load break fused pull out switch
4. A remote controlled circuit breaker, contactor, or relay that, or other Listed isolating means that is operable locally and opens automatically when control power is interrupted

Informational Note: Devices marked with “line” and “load” are not suitable for backfeed or reverse current. Dc-rated enclosed switches, open-type switches, and low-voltage power circuit breakers are suitable for backfeed operation.

For equipment disconnecting means where the line and load terminals may be energized in the open position, the device shall be marked with the following words or equivalent:

WARNING
ELECTRIC SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

The warning sign(s) or label(s) shall comply with 110.21(B).

Exception: Connectors that meet 690.33 are exempt from this marking requirement.

Statement of Problem and Substantiation for Public Comment

The requirements as written require either an isolating means or a disconnecting means, and allow a contactor or relay to act as a disconnecting means. It must be noted that contactors and relays may provide a disconnecting function, but generally do not provide adequate air gaps to be considered an isolating means. Additionally the contacts of contactors and relays are allowed to weld during short circuit testing, whereas Listed isolating devices are not allowed to weld. As the FR is presently written, there is an implication that relays and contactors can be used in place of an isolating means, which could result in a possible shock hazard. Since the purpose of allowing a remote disconnecting means is to provide the isolation needed to work safely on the equipment, the use of contactors or relays should not be allowed.

Suggest revising item (4) to read as follows: A remote controlled circuit breaker or other Listed isolating means, that is operable locally and opens automatically when control power is interrupted.

Related Item
First Revision No. 1013-NFPA 70-2015 [Section No. 690.15]

Submitter Information Verification

Submitter Full Name: Timothy Zgonena
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:01:58 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-951-NFPA 70-2015
Statement: The wording added to 690.15(A) addresses the concern of isolation for circuits connected to relays or contactors.
(D) Equipment Disconnecting Means.

An equipment disconnecting means shall simultaneously disconnect all current carrying conductors that are not solidly grounded of the circuit to which it is connected. An equipment disconnecting means shall be externally operable without exposing the operator to contact with live parts and shall indicate whether in the open or closed position. An equipment disconnecting means shall be one of the following devices:

1. A manually operable switch or circuit breaker
2. A connector meeting the requirements of 690.33(E) (1)
3. A load break fused pull out switch
4. A remote controlled circuit breaker, contactor, or relay that is operable locally and opens automatically when control power is interrupted

Informational Note: Devices marked with “line” and “load” are not suitable for backfeed or reverse current. Dc-rated enclosed switches, open-type switches, and low-voltage power circuit breakers are suitable for backfeed operation.

For equipment disconnecting means where the line and load terminals may be energized in the open position, the device shall be marked with the following words or equivalent:

WARNING

ELECTRIC SHOCK HAZARD

TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

The warning sign(s) or label(s) shall comply with 110.21(B).

Exception: Connectors that meet 690.33 are exempt from this marking requirement.

Statement of Problem and Substantiation for Public Comment

The use of a relay for a disconnection means appears too lenient. Relays are known to stick or mis-operate.

Related Item

First Revision No. 1013-NFPA 70-2015 [Section No. 690.15]

Submitter Information Verification

Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 18:48:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-951-NFPA 70-2015
Statement: The wording added to 690.15(A) addresses the concern of isolation for circuits connected to relays or contactors.
(D) Equipment Disconnecting Means.

An equipment disconnecting means shall simultaneously disconnect all current carrying conductors that are not solidly grounded of the circuit to which it is connected. An equipment disconnecting means shall be externally operable without exposing the operator to contact with live parts and shall indicate whether in the open or closed position. An equipment disconnecting means shall be one of the following devices:

1. A manually operable switch or circuit breaker
2. A connector meeting the requirements of 690.33(E) (1)
3. A load break fused pull out switch
4. A remote controlled circuit breaker, contactor, or relay that is operable locally and opens automatically when control power is interrupted

Informational Note: Devices marked with “line” and “load” are not suitable for backfeed or reverse current. Dc-rated enclosed switches, open-type switches, and low-voltage power circuit breakers are suitable for backfeed operation.

For equipment disconnecting means where the line and load terminals may be energized in the open position, the device shall be marked with the following words or equivalent:

WARNING
ELECTRIC SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

The warning sign(s) or label(s) shall comply with 110.21(B).

Exception: Connectors that meet 690.33 are exempt from this marking requirement.

Statement of Problem and Substantiation for Public Comment

This is redundant to 690.13. All marking requirements should be in 690.13.

Related Item

First Revision No. 1013-NFPA 70-2015 [Section No. 690.15]

Submitter Information Verification

Submitter Full Name: Todd Fries
Organization: HellermannTyton
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 12:12:58 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-952-NFPA 70-2015
Statement: The revision adds “lockable” to equipment disconnecting means to comply with 110.25.

“Live” was changed to “energized” for consistency.

The words “(off)” and “(on)” were added for consistency.

The reference to the warning in 690.13(B) makes repeating the warning unnecessary.

The informational note is removed and the content is captured in 690.13(F).
(A) Wiring Systems.

All raceway and cable wiring methods included in this Code, other wiring systems and fittings specifically listed for use on PV arrays, and wiring as part of a listed system shall be permitted. Where wiring devices with integral enclosures are used, sufficient length of cable shall be provided to facilitate replacement.

Where PV source and output circuits operating at voltages greater than 30 volts are installed in readily accessible locations, circuit conductors shall be guarded or installed in Type MC cable or in a raceway.

Statement of Problem and Substantiation for Public Comment

Just a style change. "a raceway" is a particular singular raceway where "raceway" indicates a type of enclosure.

Related Item
First Revision No. 974-NFPA 70-2015 [Section No. 690.31(A)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 02 18:39:31 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-953-NFPA 70-2015 See also SR 957, Section 690.31(E).
Statement: The panel removes the word “a” before “raceway.” The panel moves the general temperature correction factor table from 690.31(E) to 690.31(A) since it is relevant to all PV systems and not just flexible cords and cables. Moving this table makes it clearer as a new Table 690.31(E) is being added that directly relates to flexible cords and cables.
Identification.

PV system circuit conductors shall be identified at all accessible points of termination, connection, and splices. The means of identification shall be permitted by separate color coding, marking tape, tagging, or other approved means. Only solidly grounded PV system circuit conductors shall be marked in accordance with 200.6. PV system circuit conductors that are not solidly grounded shall not be marked white unless part of a multiconductor cable assembly.

Exception: Where the identification of the conductors is evident by spacing or arrangement, further identification shall not be required.

Statement of Problem and Substantiation for Public Comment

The sentence removed is redundant and not completely accurate. The revised and accepted text states that only solidly grounded conductors shall be marked as indicated in 200.6. Based on this not solidly grounded conductors can't be marked as white. The deleted sentence only references white as a marking for solidly grounded conductors, ignoring all the other types of marking called out in 200.6.

Related Item

First Revision No. 975-NFPA 70-2015 [Section No. 690.31(B)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 03 11:22:39 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-954-NFPA 70-2015
Statement: The panel removes the last sentence as it is redundant. Additional reference to 690.41(A)(5) is provided to make it clear how restrictive this marking is in PV systems.
Public Comment No. 1003-NFPA 70-2015 [Section No. 690.31(C)]

(C) Single-Conductor Cable.

(1) **General.** Single-conductor cable listed and labeled as photovoltaic (PV) wire shall be permitted in exposed outdoor locations in PV source circuits. PV wire shall be installed in accordance with 338.10(B)(4) (b) and 334.30.

*Exception: Single-conductor cable Type USE-2 shall be permitted in solidly grounded PV systems.*

(2) **Cable Tray.** PV source circuits and PV output circuits using single-conductor cable listed and labeled as photovoltaic (PV) wire of all sizes, with or without a cable tray marking/rating, shall be permitted in cable trays installed in outdoor locations, provided that the cables are supported at intervals not to exceed 300 mm (12 in.) and secured at intervals not to exceed 1.4 m (4 ½ ft).

Informational Note: Photovoltaic wire and PV cable have a nonstandard outer diameter. See Table 1 of Chapter 9 for conduit fill calculations. The warning sign(s) or label(s) shall comply with 110.2(B), contains the allowable percent of cross section of conduit and tubing for conductors and cables.

**Statement of Problem and Substantiation for Public Comment**

This comment fixes a mistaken reference to 110.21(B) and addresses a comment by the correlating committee to properly reference Table 1 in Chapter 9.

**Related Item**

First Revision No. 976-NFPA 70-2015 [Section No. 690.31(C)]

**Submitter Information Verification**

Submitter Full Name: Bill Brooks  
Organization: Brooks Engineering  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Tue Sep 22 23:36:12 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR  
Resolution: SR-955-NFPA 70-2015  
Statement: This SR returns Type USE-2 as an allowable single conductor cable as the double-insulated nature of PV Wire is not required in functionally grounded or ungrounded systems as was previously thought. The functionally grounded and ungrounded PV systems, as shown in 690.41(A) are similar to Class I systems in Europe since they include equipment grounding conductors. The previous understanding that ungrounded PV systems needed to be similar to European Class II wiring systems has been found to be false.

The term “identified” replaces “labeled” since cables are identified with the marking on the cable. The cable reel will have the listing label, but this may not be available during an inspection whereas the marking is visible at 40” intervals for the AHU. The phrase, “within the PV array” was lost from the first revision language and reinstated in this SR. The rewording of the informational note was at the request of the correlating committee.
Public Comment No. 1163-NFPA 70-2015 [Section No. 690.31(C)]

(C) Single-Conductor Cable.

(1) General. Single-conductor cable listed and labeled as photovoltaic (PV) wire shall be permitted in exposed outdoor locations in PV source circuits. PV wire shall be installed in accordance with 338.10(B)(4) (b) and 334.30.

Exception: Single-conductor cable Type USE-2 shall be permitted in solidly grounded PV systems.

(2) Cable Tray. PV source circuits and PV output circuits using single-conductor cable listed and labeled as photovoltaic (PV) wire of all sizes, with or without a cable tray marking/rating, shall be permitted in cable trays installed in outdoor locations where the cable tray and/or conductors are not in contact with a building, provided that the cables are supported at intervals not to exceed 300 mm (12 in.) and secured at intervals not to exceed 1.4 m (4 1/2 ft). Where cable trays are in contact with a building, a cable tray marking/rating shall be required for single conductor PV wire contained in the cable tray.

Informational Note: Photovoltaic wire and PV cable have a nonstandard outer diameter. See Table 1 of Chapter 9 for conduit fill calculations. The warning sign(s) or label(s) shall comply with 110.21(B).

Statement of Problem and Substantiation for Public Comment

The committee statement in the Public Input phase expressed concern that the original proposed changes "... would remove the use of cable tray on buildings which was one of the intentions for the addition of 690.31(C)(2) in the 2014 Code. Cable tray must be installed in accordance with the manufacturer’s instructions, so unless there is a clearer way of distinguishing the concern of the submitter, the panel does not recommend the addition." The revised language submitted in this Comment addresses that concern by clearly allowing the use of cable tray in contact with a building when the PV wire inside the cable tray is listed for use in cable tray. The cable tray rating on single conductors means that they must pass a vertical-tray flame test that will ensure the conductors will not propagate flame. This is an important safety consideration for any conductors installed in cable tray where in or on a building to prevent the rapid transmission of flame along the wire.

Related Item

Public Input No. 4771-NFPA 70-2014 [Section No. 690.31(C)]

Submitter Information Verification

Submitter Full Name: Christel Hunter
Organization: General Cable

Committee Statement

Committee Action: Rejected
Resolution: The testing requirements of PV Wire contain the fire rating requirements of concern by the submitter. Since this provision is limited to PV wire, the submitter’s concern is already covered in the existing language.
Additional Proposed Changes

<table>
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<th>Description</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

The term identified was added as UL 4703 require PV wire to be marked with the words "Photovoltaic Wire", or "PV Wire" at intervals not exceeding 40 inches (1 meter).

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed);
other NRTL's have similar requirements.

**Related Item**

Public Input No. 940-NFPA 70-2014 [Section No. 690.35(D)]
First Revision No. 982-NFPA 70-2015 [Section No. 690.35]

**Submitter Information Verification**

<table>
<thead>
<tr>
<th><strong>Submitter Full Name</strong></th>
<th>JEFFREY FECTEAU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td>UNDERWRITERS LABORATORIES LLC</td>
</tr>
<tr>
<td><strong>Affiliation</strong></td>
<td>UL</td>
</tr>
<tr>
<td><strong>Street Address</strong></td>
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**Committee Statement**

<table>
<thead>
<tr>
<th><strong>Committee Action</strong></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Resolution</strong></td>
<td>SR-955-NFPA 70-2015</td>
</tr>
<tr>
<td><strong>Statement</strong></td>
<td>This SR returns Type USE-2 as an allowable single conductor cable as the double-insulated nature of PV Wire is not required in functionally grounded or ungrounded systems as was previously thought. The functionally grounded and ungrounded PV systems, as shown in 690.41(A) are similar to Class I systems in Europe since they include equipment grounding conductors. The previous understanding that ungrounded PV systems needed to be similar to European Class II wiring systems has been found to be false. The term “identified” replaces “labeled” since cables are identified with the marking on the cable. The cable reel will have the listing label, but this may not be available during an inspection whereas the marking is visible at 40” intervals for the AHJ. The phrase, “within the PV array” was lost from the first revision language and reinstated in this SR. The rewording of the informational note was at the request of the correlating committee.</td>
</tr>
</tbody>
</table>

|  |  |
|  |  |
Public Comment No. 1853-NFPA 70-2015 [Section No. 690.31(C)]

(C) Single-Conductor Cable.

(1) General. Single-conductor cable listed and labeled as photovoltaic (PV) wire shall be permitted in exposed outdoor locations in PV source circuits. PV wire shall be installed in accordance with 338.10(B)(4)(b) and 334.30.

Exception: Single-conductor cable Type USE-2 shall be permitted in solidly grounded PV systems.

(2) Cable Tray. PV source circuits and PV output circuits using single-conductor cable listed and labeled as photovoltaic (PV) wire of all sizes, with or without a cable tray marking/rating, shall be permitted in cable trays installed in outdoor locations, provided that the cables are supported at intervals not to exceed 300 mm (12 in.) and secured at intervals not to exceed 1.4 m (4 1/2 ft).

Informational Note: Photovoltaic wire and PV cable have a nonstandard outer diameter. See Table 1 of Chapter 9 for conduit fill calculations. The warning sign(s) or label(s) shall comply with 110.21(B).

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to consider rewrite the Informational Note so that it does not contain a requirement, to comply with 3.1.3 of the NEC Style Manual. The Correlating Committee also directs the panel to clarify the measurement at the end of (C)(2).

Related Item
First Revision No. 976-NFPA 70-2015 [Section No. 690.31(C)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 11:44:18 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-955-NFPA 70-2015
Statement: This SR returns Type USE-2 as an allowable single conductor cable as the double-insulated nature of PV Wire is not required in functionally grounded or ungrounded systems as was previously thought. The functionally grounded and ungrounded PV systems, as shown in 690.41(A) are similar to Class I systems in Europe since they include equipment grounding conductors. The previous understanding that ungrounded PV systems needed to be similar to European Class II wiring systems has been found to be false.

The term “identified” replaces “labeled” since cables are identified with the marking on the cable. The cable reel will have the listing label, but this may not be available during an inspection whereas the marking is visible at 40” intervals for the AHU. The phrase, “within the PV array” was lost from the first revision language and reinstated in this SR. The rewording of the informational note was at the request of the correlating committee.
Public Comment No. 478-NFPA 70-2015 [Section No. 690.31(C)]

(C) Single-Conductor Cable.

(1) General. Single-conductor cable listed and labeled as photovoltaic (PV) wire shall be permitted in exposed outdoor locations within the array locations for PV source circuits. PV wire shall be installed in accordance with 338.10(B)(4)(b) and 334.30.

Exception: Single-conductor cable Type USE-2 shall be permitted in solidly grounded PV systems.

(2) Cable Tray. PV source circuits and PV output circuits using single-conductor cable listed and labeled as photovoltaic (PV) wire of all sizes, with or without a cable tray marking/rating, shall be permitted in cable trays installed in outdoor locations, provided that the cables are supported at intervals not to exceed 300 mm (12 in.) and secured at intervals not to exceed 1.4 m (4 1/2 ft).

Informational Note: Photovoltaic wire and PV cable have a nonstandard outer diameter. See Table 1 of Chapter 9 for conduit fill calculations. The warning sign(s) or label(s) shall comply with 110.21(B).

Statement of Problem and Substantiation for Public Comment

My revision is to continue to limit exposed conductors within the array footprint per the 2014 NEC.

Related Item
First Revision No. 976-NFPA 70-2015 [Section No. 690.31(C)]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 16:40:04 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-955-NFPA 70-2015
Statement: This SR returns Type USE-2 as an allowable single conductor cable as the double-insulated nature of PV Wire is not required in functionally grounded or ungrounded systems as was previously thought. The functionally grounded and ungrounded PV systems, as shown in 690.41(A) are similar to Class I systems in Europe since they include equipment grounding conductors. The previous understanding that ungrounded PV systems needed to be similar to European Class II wiring systems has been found to be false.

The term “identified” replaces “labeled” since cables are identified with the marking on the cable. The cable reel will have the listing label, but this may not be available during an inspection whereas the marking is visible at 40” intervals for the AHU. The phrase, “within the PV array” was lost from the first revision language and reinstated in this SR. The rewording of the informational note was at the request of the correlating committee.
Public Comment No. 479-NFPA 70-2015 [Section No. 690.31(C)]

<table>
<thead>
<tr>
<th>(C)</th>
<th>Single-Conductor Cable.</th>
</tr>
</thead>
</table>
| (1) | **General.** Single-conductor cable listed and labeled as photovoltaic (PV) wire shall be permitted in exposed outdoor locations in PV source circuits. PV wire shall be installed in accordance with 338.10(B)(4) (b) and 334.30.  
   **Exception:** Single-conductor cable Type USE-2 shall be permitted in solidly grounded PV systems. |
| (2) | **Cable Tray.** PV source circuits and PV output circuits using single-conductor cable listed and labeled as photovoltaic (PV) wire of all sizes, with or without a cable tray marking/rating, shall be permitted in cable trays installed in outdoor locations, provided that the cables are supported at intervals not to exceed 300 mm (12 in.) and secured at intervals not to exceed 1.4 m (4 1/4 ft).  
   Informational Note: Photovoltaic wire and PV cable have a nonstandard outer diameter. See Table 1 of Chapter 9 for conduit fill calculations. The warning sign(s) or label(s) shall comply with 110.21(B). |

Statement of Problem and Substantiation for Public Comment

The panel needs to do a search and replace for 'solidly grounded' and replace with 'reference grounded' where applicable.

**Related Item**

First Revision No. 976-NFPA 70-2015 [Section No. 690.31(C)]

Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name:</th>
<th>MIKE HOLT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization:</td>
<td>MIKE HOLT ENTERPRISES INC</td>
</tr>
<tr>
<td>Street Address:</td>
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Committee Statement

<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
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</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>The concepts of &quot;reference grounded&quot; and &quot;solid grounded&quot; are not interchangeable. The term &quot;reference grounded&quot; has been changed to &quot;functional grounded&quot; at the request of the correlating committee.</td>
</tr>
</tbody>
</table>
Multiconductor Cable.

Jacketed multiconductor cable assemblies listed, labeled and identified for the application shall be permitted in outdoor locations. The cable shall be secured at intervals not exceeding 1.8 m (6 ft).

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

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Related Item
First Revision No. 977-NFPA 70-2015 [Section No. 690.31(D)]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 4804 Northfield Rd., Northbrook, IL 60062

11/19/2015 12:04 PM
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-956-NFPA 70-2015
Statement: The term “identified” is correct in the context of cable and wire.
Flexible cords and cables, where connected to moving parts of tracking PV arrays, shall comply with Article 400 and shall be of a type identified as a hard service cord or portable power cable; they shall be suitable for extra-hard usage, listed for outdoor use, water resistant, and sunlight resistant. Flexible PV wire.

For ambient temperatures exceeding 30°C (86°F), the ampacities shall be derated by the appropriate factors given in Table 690.31(E). Stranded copper PV Wire shall also be permitted to be connected to moving parts of tracking PV arrays provided it has the minimum number of strands specified in table 690.31(X).

New Table 690.31(X).

<table>
<thead>
<tr>
<th>PV wire AWG</th>
<th>Min PV wire Strands</th>
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<tbody>
<tr>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>16-10</td>
<td>19</td>
</tr>
<tr>
<td>8 - 4</td>
<td>49</td>
</tr>
<tr>
<td>2</td>
<td>130</td>
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<tr>
<td>1 AWG - 1000MCM</td>
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Table 690.31(E) Correction Factors

<table>
<thead>
<tr>
<th>Ambient Temperature (°C)</th>
<th>Temperature Rating of Conductor</th>
<th>Ambient Temperature (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>1.00</td>
<td>86</td>
</tr>
<tr>
<td>31–35</td>
<td>0.91 – 0.97</td>
<td>87–95</td>
</tr>
<tr>
<td>36–40</td>
<td>0.82 – 0.91</td>
<td>96–104</td>
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<tr>
<td>41–45</td>
<td>0.71 – 0.82</td>
<td>105–113</td>
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<td>46–50</td>
<td>0.58 – 0.82</td>
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<tr>
<td>51–55</td>
<td>0.41 – 0.76</td>
<td>123–131</td>
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<td>56–60</td>
<td>0.58 – 0.82</td>
<td>132–140</td>
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<td>61–70</td>
<td>0.33 – 0.58</td>
<td>141–158</td>
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<tr>
<td>71–80</td>
<td>0.41 – 0.58</td>
<td>159–176</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

Not all PV wire is suitable for connection to moving parts since the number of strands can vary from PV wire to PV wire. The proposed table below matches the minimum number of strands required for other wires allowed in the NEC for connection to moving parts. The following revised text is intended to replace the FR998. PV wire may include aluminum conductors which are not suitable for flexing as work hardening of aluminum causes strand breakage. Additionally the reference to the derating table 690.31(E) and the Table 690.31(E) should be maintained.

Related Item
First Revision No. 998-NFPA 70-2015 [Section No. 690.31(E)]

Submitter Information Verification

Submitter Full Name: Timothy Zgonena
Organization: UL LLC
Street Address:
City:
State:
Committee Statement

<table>
<thead>
<tr>
<th>Committee Action:</th>
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<tbody>
<tr>
<td>Resolution:</td>
<td>SR-953-NFPA 70-2015 See also SR 957, Section 690.31(E).</td>
</tr>
<tr>
<td>Statement:</td>
<td>The panel removes the word “a” before “raceway.” The panel moves the general temperature correction factor table from 690.31(E) to 690.31(A) since it is relevant to all PV systems and not just flexible cords and cables. Moving this table makes it clearer as a new Table 690.31(E) is being added that directly relates to flexible cords and cables.</td>
</tr>
</tbody>
</table>
Flexible Cords and Cables Connected to Tracking PV Arrays.

Flexible cords and flexible cables, where connected to moving parts of tracking PV arrays, shall comply with Article 400 and shall be of a type identified as a hard service cord or portable power cable; they shall be suitable for extra-hard usage, listed for outdoor use, water resistant, and sunlight resistant. Flexible PV wire shall also be permitted to be connected to moving parts of tracking PV arrays.

Table 690.31(E) Correction Factors

<table>
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<tr>
<th>Ambient Temperature (°C)</th>
<th>Temperature Rating of Conductor</th>
<th>Ambient Temperature (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60°C (140°F)</td>
<td>75°C (167°F)</td>
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<tr>
<td>30</td>
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<td>31–35</td>
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<td>71–80</td>
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Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 998.

Related Item

First Revision No. 998-NFPA 70-2015 [Section No. 690.31(E)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 11:45:35 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-953-NFPA 70-2015 See also SR 957, Section 690.31(E).
Statement: The panel removes the word “a” before “raceway.” The panel moves the general temperature correction factor table from 690.31(E) to 690.31(A) since it is relevant to all PV systems and not just flexible cords and cables. Moving this table makes it clearer as a new Table 690.31(E) is being added that directly relates to flexible cords and cables.
(E) Flexible Cords and Cables Connected to Tracking PV Arrays.

Flexible cords and flexible cables, where connected to moving parts of tracking PV arrays, shall comply with Article 400 and shall be of a type identified as a hard service cord or portable power cable; they shall be suitable for extra-hard usage, listed for outdoor use, water resistant, and sunlight resistant. Flexible PV wire shall also be permitted to be connected to moving parts of tracking PV arrays. For ambient temperatures exceeding 30°C (86°F), the ampacities shall be derated by the appropriate factors given in Table 690.31(E).

Table 690.31(E) Correction Factors

<table>
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<tr>
<th>Ambient Temperature (°C)</th>
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<td>—</td>
</tr>
<tr>
<td>71–80</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

The sentence "For ambient temperatures exceeding 30°C (86°F), the ampacities shall be derated by the appropriate factors given in Table 690.31(E)." was deleted from the PI transfer to the FR. Section 31(E) now has a table with nothing referring to it.

Related Item

First Revision No. 998-NFPA 70-2015 [Section No. 690.31(E)]

Submitter Information Verification

Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 15 16:08:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-953-NFPA 70-2015 See also SR 957, Section 690.31(E).
Statement: The panel removes the word "a" before "raceway." The panel moves the general temperature correction factor table from 690.31(E) to 690.31(A) since it is relevant to all PV systems and not just flexible cords and cables. Moving this table makes it clearer as a new Table 690.31(E) is being added that directly relates to flexible cords and cables.
Public Comment No. 1004-NFPA 70-2015 [Section No. 690.31(G)]

(G) Direct-Current Photovoltaic Source and System Direct-Current Output. Circuits on or Inside a Building.

Where dc PV source or system dc PV output circuits are run inside a building or structure, they shall be contained in metal raceways, Type MC metal-clad cable that complies with 250.118(10), or metal enclosures from the point of penetration of the surface of the building or structure to the first readily accessible disconnecting means. The disconnecting means shall comply with 690.13(B) and (C) and 690.15(A) and (B). The wiring methods shall comply with the additional installation requirements in 690.31(G)(1) through (4).

(1) Embedded in Building Surfaces.

Where circuits are embedded in built-up, laminate, or membrane roofing materials in roof areas not covered by PV modules and associated equipment, the location of circuits shall be clearly marked using a marking protocol that is approved as being suitable for continuous exposure to sunlight and weather.

(2) Flexible Wiring Methods.

Where flexible metal conduit (FMC) smaller than metric designator 21 (trade size \(\frac{3}{4}\) in.) or Type MC cable smaller than 25 mm (1 in.) in diameter containing PV power circuit conductors is installed across ceilings or floor joists, the raceway or cable shall be protected by substantial guard strips that are at least as high as the raceway or cable. Where run exposed, other than within 1.8 m (6 ft) of their connection to equipment, these wiring methods shall closely follow the building surface or be protected from physical damage by an approved means.

(3) Marking and Labeling Required.

The following wiring methods and enclosures that contain PV power source conductors shall be marked with the wording WARNING: PHOTOVOLTAIC POWER SOURCE by means of permanently affixed labels or other approved permanent marking:

(1) Exposed raceways, cable trays, and other wiring methods
(2) Covers or enclosures of pull boxes and junction boxes
(3) Conduit bodies in which any of the available conduit openings are unused
(4) Marking and Labeling Methods and Locations.

The labels or markings shall be visible after installation. The labels shall be reflective, and all letters shall be capitalized and shall be a minimum height of 9.5 mm (3/8 in.) in white on a red background. PV power circuit labels shall appear on every section of the wiring system that is separated by enclosures, walls, partitions, ceilings, or floors. Spacing between labels or markings, or between a label and a marking, shall not be more than 3 m (10 ft). Labels required by this section shall be suitable for the environment where they are installed.

Statement of Problem and Substantiation for Public Comment

The advent of the new definition for PV system dc circuit requires the editing of this section title and first sentence for clarity and consistency.

Related Item
First Revision No. 990-NFPA 70-2015 [Section No. 690.31(G) (Excluding any Sub-Sections)]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 23:41:48 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-959-NFPA 70-2015
Statement: This revision uses the newly defined term “PV system dc circuits” to simplify the language. The SR also removes the incorrect phrase “or structure” in two places since that term could be interpreted to require metal wiring methods in all PV systems, when this section is only intended to address PV systems in or on buildings.
(3) Marking and Labeling Required.
The following wiring methods and enclosures that contain PV power source System DC Circuit conductors shall be marked with the wording WARNING: PHOTOVOLTAIC POWER SOURCE by means of permanently affixed labels or other approved permanent marking:

(1) Exposed raceways, cable trays, and other wiring methods
(2) Covers or enclosures of pull boxes and junction boxes
(3) Conduit bodies in which any of the available conduit openings are unused

Statement of Problem and Substantiation for Public Comment

“PV power source” is an undifined term and should be replaced with Photovoltaic System DC Circuit which is defined.

Related Item
First Revision No. 990-NFPA 70-2015 [Section No. 690.31(G) [Excluding any Sub-Sections]]

Submitter Information Verification
Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 18:41:45 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-961-NFPA 70-2015
Statement: The revision replaces "PV power source" with "PV system dc circuit" which is a newly defined term.
Marking and Labeling Methods and Locations.

The labels or markings shall be visible after installation. The labels shall be reflective, and all letters shall be capitalized and shall be a minimum height of 9.5 mm (⅜ in.) in white on a red background. PV power System DC circuit labels shall appear on every section of the wiring system that is separated by enclosures, walls, partitions, ceilings, or floors. Spacing between labels or markings, or between a label and a marking, shall not be more than 3 m (10 ft). Labels required by this section shall be suitable for the environment where they are installed.

Statement of Problem and Substantiation for Public Comment

PV System DC Circuit is a defined term and should be used in place of "PV power circuit."

Related Item

First Revision No. 990-NFPA 70-2015 [Section No. 690.31(G) [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: MARK BALDASSARI  
Organization: ENPHASE ENERGY  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Mon Sep 21 18:46:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR  
Resolution: SR-962-NFPA 70-2015  
Statement: "PV power circuit" is replaced with "PV system dc circuit," which is a newly defined term.
**Public Comment No. 519-NFPA 70-2015 [Section No. 690.31(J)]**

| (J) Module Connection Arrangement. | For solidly grounded PV systems, the connection to a module or panel shall be arranged so that removal of a module or panel from a PV source circuit does not interrupt a grounded conductor connection to other PV source circuits. |

**Statement of Problem and Substantiation for Public Comment**

The PI this change is based on incorrectly concludes that this section would only apply to solidly grounded PV systems. Even in systems that are reference grounded removal of a PV module should not isolate the grounded conductor of any other PV module in the system from the reference ground.

**Related Item**

Public Input No. 3813-NFPA 70-2014 [Section No. 690.31(J)]

**Submitter Information Verification**

- **Submitter Full Name:** MARVIN HAMON
- **Organization:** HAMON ENGINEERING INC
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Thu Sep 03 15:12:05 EDT 2015

**Committee Statement**

- **Committee Action:** Rejected but see related SR
- **Resolution:** SR-963-NFPA 70-2015
- **Statement:** This SR removes this antiquated language from Article 690 as the original intent was to make sure that the equipment grounding conductor not be interrupted rather than the grounded conductor of the circuit. There is no scenario addressed by this requirement since it is impossible to have a circuit if the grounded conductor were removed from a grounded source circuit.
Connectors other than those allowed by 690.32 shall comply with 690.33(A) through (E).

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that FR 980 be rewritten to clarify which connectors are required to comply with 690.33 and revise to comply with the NEC Style Manual.

Related Item

First Revision No. 980-NFPA 70-2015 [Section No. 690.33 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:02:15 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-964-NFPA 70-2015
Statement: This revision addresses concerns regarding style and application of this section in relationship to 690.32 by means of commas to separate the clause "other than those covered by."
Section 690.33(C) Type.
The connectors shall be of the latching or locking type. Connectors that are readily accessible and that are used in circuits operating at over 30 volts **dc or 15 volts ac**, shall require a tool for opening.

Statement of Problem and Substantiation for Public Comment
The proposed text conflicts with the existing wet location shock hazard voltage limits within the NEC and most safety standards which are different between AC and DC circuits.

Related Item
First Revision No. 981-NFPA 70-2015 [Section No. 690.33(C)]

Submitter Information Verification
Submitter Full Name: Timothy Zgonena
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:12:47 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-965-NFPA 70-2015
Statement: The proposed text conflicts with the existing wet location shock hazard voltage limits within the NEC and most safety standards, which are different between AC and DC circuits.
690.34_ Access to Boxes.

Junction, pull, and outlet boxes located behind modules or panels shall be so installed that the wiring contained in them can be rendered accessible directly or by displacement of a module(s) or panel(s) secured by removable fasteners and connected by a flexible wiring system.

Exception: Where devices are used to provide grounding of the module frames as permitted in 690.43(D), and identified as a single-use bonding/grounding device, displacement of a module(s) or panel(s) shall not be permitted for junction, pull or outlet box access.

Informational Note: ANSI/UL 2703-2015, UL Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels requires the installation instructions for single-use bonding/grounding devices to include the statement "For single-use only", or the equivalent.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
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<tr>
<td>Weeb_9.5NL_Single_Use_Only.pdf</td>
<td>SunPower Installation instructions in part that identify &quot;Single Use Only&quot; PV grounding clip.</td>
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<tr>
<td>Weeb_PMC_Single_Use_Only.pdf</td>
<td>SnapRack Installation instructions in part that identify &quot;Single Use Only&quot; PV grounding clamp.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

Devices used to ground module frames as permitted in section 690.43(D) are tested in combination with specific PV modules, specific PV module frames, or specific mounting-system rails as identified in the individual certifications. When these devices are Certified (Listed) as a single-use bonding/grounding device, UL 2703 requires that the installation instructions shall include the statement "For single-use only" or the equivalent.

Therefore, if a module is displaced for access to a junction box, this would require the grounding device to be replaced, 110.3(B). Since these devices are specific to PV modules and mounting systems, it is highly unlikely that the person removing the module would have the correct replacement device to maintain the tested ground path of the Certified (Listed) system. Also, the way these devices are installed, typically a single device will ground multiple PV modules to the mounting-system. The removal of a single module will have a domino effect on other modules, thereby causing the replacement of numerous devices.

If these devices are not replaced, the grounding of the modules as required by 690.43(A) will be compromised and create a potentially hazardous installation. The following are typical notes found within the installation instructions for these types of devices;

Intended for SINGLE USE ONLY! Functionality will not be guaranteed if reused.

SINGLE USE ONLY! Do not torque fasteners down if position of solar modules is not finalized. Only slightly tighten fasteners to keep modules in place.

When replacing a single faulty module, also remove the adjacent module that connects to the same grounding device as the faulty module. This will ensure that there are never ungrounded modules in the array.

Related Item

Public Input No. 878-NFPA 70-2014 [Section No. 690.34]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 03 14:17:33 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>Single-use devices, such as those referenced in this PC, must be replaced as per the installation instructions. The proposed exception would make a common installation technique disallowed even when the installation instructions have a proper method for removal and reinstallation of PV modules. This is an issue of education of installers if installers are not properly following installation instructions.</td>
</tr>
</tbody>
</table>
690.41 System Grounding.

(A) PV System Grounding Configurations.

One or more of the following system grounding configurations shall be employed:

Reference grounded 2-wire

(1) Ungrounded PV systems with one conductor referenced to ground

(2) Reference grounded bipolar PV systems with the reference (center tap) conductor referenced to ground and meets the requirements of 690.7(C)

(3) PV systems not isolated from the inverter output circuit

(4) Ungrounded PV systems

(5) a ground detector in accordance with 690.41(B)

(6) Solidly grounded PV systems as permitted in 690.41(B) Exception

(7) PV systems that use other methods that accomplish equivalent system protection in accordance with 250.4(A), with equipment listed and identified for the use.

Informational Note: The ground detector in ungrounded PV systems may include a ground-sensing circuit using a fuse, circuit breaker, resistance device, non-isolated grounded ac circuit, or electronic means that is part of a listed ground-fault protection system. Some conductors in these systems may normally be at ground potential but have voltage to ground during fault conditions.

(B) Ground Fault Protection Detector.

DC: DC PV arrays shall be provided with dc ground fault protection detector meeting the requirements of 690.41(B)(1) and (2) to reduce fire hazards.

Exception: Ground-mounted or pole-mounted PV arrays with not more than two paralleled source circuits and with all dc source and dc output circuits isolated from buildings shall be permitted without ground-fault protection. PV systems with no ground-fault protection shall be solidly grounded.

(1) Ground-Fault Detection and Interruption.

The ground fault protection device or system detector shall detect ground fault(s) in the PV array dc current–carrying conductors and components, including any intentionally grounded conductors, and be listed for providing PV ground-fault protection.

(2) Isolating Faulted Circuits.

The faulted circuits shall be isolated by one of the following two methods:

(1) The current-carrying conductors of the faulted circuit shall be automatically disconnected.

(2) The inverter or charge controller fed by the faulted circuit shall automatically cease to supply power to output circuits.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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<tr>
<td>690-41.docx</td>
<td>Readable version to show what it looks like without TerraView mixing up the numbering.</td>
<td></td>
</tr>
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</table>

Statement of Problem and Substantiation for Public Comment

The correlating committee had serious concerns about the terminology recommended in FR 991. This language was drafted to address the correlating committee concerns and to be more consistent with Article 250.21 provisions for ungrounded ac systems. The new definition for reference grounded PV systems was also removed to further address the correlating committee's concerns with the language and all references to reference grounded systems revised it 690.7 and 690.41.

Related Item

First Revision No. 991-NFPA 70-2015 [Section No. 690.41]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-966-NFPA 70-2015
Statement: The revision changes “reference grounded PV system” to “functional grounded PV system” to be similar to the terminology used in the IEC and different from the reference ground terms in Article 517. The list in 690.41(A) is reworded for simplicity and understanding.

The SR adds the phrase “and isolate the PV system dc circuits from the ground reference in a functional grounded system” to the second option for isolating faulted circuits which addresses the need to interrupt the flow of fault current.
(A) PV System Grounding Configurations.

One or more of the following system grounding configurations shall be employed:

1. Reference grounded 2-wire PV systems with one conductor referenced to ground
2. Reference grounded bipolar PV systems with the reference (center tap) conductor referenced to ground and meets the requirements of 690.7(C)
3. Reference grounded PV systems not isolated from the and referenced to the, inverter output circuit ground
4. Ungrounded PV systems
5. Solidly grounded PV systems as permitted in 690.41(B) Exception
6. PV systems that use other methods that accomplish equivalent system protection in accordance with 250.4(A) with equipment listed and identified for the use

Statement of Problem and Substantiation for Public Comment

The full language from the PI for this change was not adopted leaving option (3) poorly defined. Revised wording better describes that non-isolated inverters can use the ground on the output side referenced to the input side to reference ground the dc circuits.

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-966-NFPA 70-2015
Statement: The revision changes “reference grounded PV system” to “functional grounded PV system” to be similar to the terminology used in the IEC and different from the reference ground terms in Article 517. The list in 690.41(A) is reworded for simplicity and understanding.

The SR adds the phrase “and isolate the PV system dc circuits from the ground reference in a functional grounded system” to the second option for isolating faulted circuits which addresses the need to interrupt the flow of fault current.

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 03 15:21:13 EDT 2015
Public Comment No. 1562-NFPA 70-2015 [Section No. 690.41(B)(1)]

(1) Ground-Fault Detection and Interruption.
The ground fault protection device or system shall
- detect
- be listed for providing PV ground-fault protection
- protection in the PV array dc current-carrying conductors and components, including any reference grounded conductors
- and be listed for providing PV ground-fault protection.
- Indication of the fault shall be provided.
- Automatically isolating from the ground reference for measurement purposes shall be permitted.

Statement of Problem and Substantiation for Public Comment

SunPower would like to thank the Panel 4 for making these very important changes to the ground fault protection (GFP) requirements for PV systems. There are a couple edits that were introduced in the new version that will produce some unintended consequences. Hence, SunPower requests that you make a few small revisions to the requirement in 690.41(B)(1). As it is written right now, it only requires that the GFP device detect the ground fault, not interrupt the fault. The interruption requirement previously existed in the 2014 version of 690.5. The indication requirement was also likely inadvertently lost in the new version of the language. Thus, SunPower requests that the panel revise the language to read “… shall be listed for providing PV ground-fault protection ...”. The requirement to provide "protection" will include both the need to detect the fault and interrupt it. We also included the requirement for providing an indication of the fault. As a coordinator of the UL Task Group revising the ground fault protection requirements in the US PV standards, it is critical that the STP be given clear direction on these requirements so that they can be included in the standard.

Another provision that was lost in the migration of the requirements from 690.5 was the allowance for automatically opening the ground reference for measurement purposes. The UL 62109-2 working group will require the use of insulation resistance measurement in grounded systems before the system starts to produce power. This measurement has the required sensitivity to detect low level ground faults that when left undetected have caused fires in PV systems. To implement this measurement, the system must temporarily disconnect from ground while it is performing the measurement. Prior to including the automatically opening provision in the 2014 version of 690.5, this approach was unnecessarily interpreted as a code violation. It is critical that the provision for opening the ground reference for automatic measurement purposes be retained to allow for implementation of this essential improvement in GFP.

Related Item
First Revision No. 991-NFPA 70-2015 [Section No. 690.41]

Submitter Information Verification
Submitter Full Name: MARK ALBERS
Organization: SUNPOWER
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:20:15 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-966-NFPA 70-2015
Statement: The revision changes “reference grounded PV system” to “functional grounded PV system” to be similar to the terminology used in the IEC and different from the reference ground terms in Article 517. The list in 690.41(A) is reworded for simplicity and understanding.

The SR adds the phrase “and isolate the PV system dc circuits from the ground reference in a functional grounded system” to the second option for isolating faulted circuits which addresses the need to interrupt the flow of fault current.
(2) Isolating Faulted Circuits.

The faulted circuits shall be isolated by one of the following two methods:

(a) The current-carrying conductors of the faulted circuit shall be automatically disconnected.

(b) The inverter or charge controller fed by the faulted circuit shall automatically cease to supply power to output circuits, and isolate the system from the ground reference if it is a reference grounded system.

Statement of Problem and Substantiation for Public Comment

For some reason, TerraView is highlighting all of 690.41(B)(2) as a revision. I am only proposing to add "and isolate the system from the ground reference if it is a reference grounded system" to the end of 690.41(B)(2)(b).

As I mentioned in my comment on 690.41(B)(1), SunPower is grateful to CMP 4 for making these very important changes to the ground fault protection (GFP) requirements for PV systems. The addition of the isolation requirement for grounded systems is critical for effective implementation of GFP in grounded systems. Turning off the inverter in these systems does not provide the isolation required to stop the fault current. The connection to ground must also be opened. The inclusion of the requested revision will address this gap.

Related Item

First Revision No. 991-NFPA 70-2015 [Section No. 690.41]

Submitter Information Verification

Submitter Full Name: MARK ALBERS
Organization: SUNPOWER
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:36:44 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-966-NFPA 70-2015
Statement: The revision changes "reference grounded PV system" to "functional grounded PV system" to be similar to the terminology used in the IEC and different from the reference ground terms in Article 517. The list in 690.41(A) is reworded for simplicity and understanding.

The SR adds the phrase "and isolate the PV system dc circuits from the ground reference in a functional grounded system" to the second option for isolating faulted circuits which addresses the need to interrupt the flow of fault current.
(2) Isolating Faulted Circuits.
The faulted circuits shall be isolated by one of the following two methods:
(1) The current-carrying conductors of the faulted circuit shall be automatically disconnected.
(2) The inverter or charge controller fed by the faulted circuit shall automatically cease to supply power to output circuits.

Statement of Problem and Substantiation for Public Comment
The word two is not necessary. This is an editorial comment

Related Item
First Revision No. 991-NFPA 70-2015 [Section No. 690.41]

Submitter Information Verification

Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 15 16:30:26 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-966-NFPA 70-2015
Statement: The revision changes “reference grounded PV system” to “functional grounded PV system” to be similar to the terminology used in the IEC and different from the reference ground terms in Article 517. The list in 690.41(A) is reworded for simplicity and understanding.

The SR adds the phrase “and isolate the PV system dc circuits from the ground reference in a functional grounded system” to the second option for isolating faulted circuits which addresses the need to interrupt the flow of fault current.
Isolating Faulted Circuits.

The faulted circuits shall be isolated by one of the following two methods:

1. The current-carrying conductors of the faulted circuit shall be automatically disconnected, or
2. The inverter or charge controller fed by the faulted circuit shall automatically cease to supply power to output circuits.

Statement of Problem and Substantiation for Public Comment

The requirement refers to optional list items. The word "or" should be added to clarify that requirements can be met with item 1 or 2.

Related Item
First Revision No. 991-NFPA 70-2015 [Section No. 690.41]

Submitter Information Verification

Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 18:54:03 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The "or" is unnecessary for clarity.
690.42 Point of System Grounding Connection.

Systems with a ground-fault protection device in accordance with 690.41(B) shall have any required grounded conductor-to-ground bond made by the ground-fault protection device. This bond, where internal to the ground-fault equipment, shall not be duplicated with an external connection. For solidly grounded PV systems, the dc circuit grounding connection shall be made at any single point on the PV output circuit.

Statement of Problem and Substantiation for Public Comment

The addition of "PV" clarifies that this relates to PV systems and not other systems.

Related Item
First Revision No. 1048-NFPA 70-2015 [Section No. 690.42]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 23:49:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-967-NFPA 70-2015
Statement: This revision changes protection to protective to be more consistent with the rest of this Code. This SR also clarifies the section by removing wording that was initially written to clarify the confusion caused by an informational note that was removed in the First Draft.
690.45 Size of Equipment Grounding Conductors.

Equipment grounding conductors for PV source and PV output circuits shall be sized in accordance with 250.122. Where no overcurrent protective device is used in the circuit, an assumed overcurrent device in rating sized in accordance with 690.9(B) shall be used when applying Table 250.122. Increases in equipment grounding conductor size to address voltage drop considerations shall not be required. An equipment grounding conductor shall not be smaller than 14 AWG.

Statement of Problem and Substantiation for Public Comment

simply adds the word "sized" to correctly apply to 690.9 as directed by the correlating committee comment.

Related Item
First Revision No. 984-NFPA 70-2015 [Section No. 690.45]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 23:52:25 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-968-NFPA 70-2015
Statement: This revision is editorial.
690.45 Size of Equipment Grounding Conductors.

Equipment grounding conductors for PV source and PV output circuits shall be sized in accordance with 250.122. Where no overcurrent protective device is used in the circuit, an assumed overcurrent device rated in accordance with 690.9(B) shall be used when applying Table 250.122. Increases in equipment grounding conductor size to address voltage drop considerations shall not be required. An equipment grounding conductor shall not be smaller than 14 AWG.

Statement of Problem and Substantiation for Public Comment

Editorial Revision

Related Item

First Revision No. 984-NFPA 70-2015 [Section No. 690.45]

Submitter Information Verification

Submitter Full Name: Timothy Zgonena
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submit Date: Fri Sep 25 15:18:17 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-968-NFPA 70-2015
Statement: This revision is editorial.
690.45 Size of Equipment Grounding Conductors.

Equipment grounding conductors for PV source and PV output circuits shall be sized in accordance with 250.122. Where no overcurrent protective device is used in the circuit, an assumed overcurrent device in rating in accordance with 690.9(B) shall be used when applying Table 250.122. Increases in equipment grounding conductor size to address voltage drop considerations shall not be required. An equipment grounding conductor shall not be smaller than 14 AWG.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 984.

Related Item
First Revision No. 984-NFPA 70-2015 [Section No. 690.45]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:03:03 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-968-NFPA 70-2015
Statement: This revision is editorial.
690.45 Size of Equipment Grounding Conductors.

Equipment grounding conductors for PV source and PV output circuits shall be sized in accordance with 250.122. Where no overcurrent protective device is used in the circuit, an assumed overcurrent device rated in accordance with 690.9(B) shall be used when applying Table 250.122. Increases in equipment grounding conductor size to address voltage drop considerations shall not be required. An equipment grounding conductor shall not be smaller than 14 AWG.

Statement of Problem and Substantiation for Public Comment

Just a change in the wording to make the sentence flow better.

Related Item

First Revision No. 984-NFPA 70-2015 [Section No. 690.45]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 03 15:33:38 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-968-NFPA 70-2015
Statement: This revision is editorial.
Public Comment No. 672-NFPA 70-2015 [Section No. 690.45]

690.45 Size of Equipment Grounding Conductors.
Equipment grounding conductors for PV source and PV output circuits shall be sized in accordance with 250.122. Where no overcurrent protective device is used in the circuit, an assumed overcurrent device rated in accordance with 690.9(B) shall be used when applying Table 250.122. Increases in equipment grounding conductor size to address voltage drop considerations shall not be required. An equipment grounding conductor shall not be smaller than 14 AWG.

Statement of Problem and Substantiation for Public Comment

The first revision grammar and sentence organization was confusing if not incorrect. This is an editorial comment

Related Item
First Revision No. 984-NFPA 70-2015 [Section No. 690.45]

Submitter Information Verification

Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 15 16:33:00 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-968-NFPA 70-2015
Statement: This revision is editorial.
(A) Buildings or Structures Supporting a PV System.

A building or structure supporting a PV system shall have a grounding electrode system installed in accordance with Part III of Article 250.

The PV system equipment grounding conductors shall be connected to the grounding electrode system of the building or structure supporting the PV system by means of the grounding electrode conductor, or the grounding bus of associated equipment connected to the grounding electrode conductor. This connection shall be in addition to any other equipment grounding conductor requirements in 690.43(C). The PV system equipment grounding conductors shall be sized in accordance with 690.45.

For solidly grounded PV systems, as permitted in 690.41(A)(5), the grounded conductor shall be connected to a grounding electrode system with a grounding electrode conductor sized in accordance with 250.166.

Informational Note: Previous versions of this Code treated all grounded PV systems as solidly grounded systems and therefore required that grounded PV systems have a dc grounding electrode conductor connected to the grounded PV system dc circuits. Since most PV systems installed in the past decade are not solidly grounded, this Code narrows the requirement for a dc grounding electrode conductor to only those that are actually solidly grounded in accordance with 690.41(A)(5). All other PV system grounding configurations listed in 690.41(A) do not require a dc grounding electrode conductor.

Statement of Problem and Substantiation for Public Comment

The language in the first draft caused some objections in the correlating committee. Much of the concern comes from wording in the informational note about grounded PV systems. With the rewriting of 690.41(A), it is more appropriate to explain that most PV systems are actually functional grounded systems with ground-fault detection systems. These systems must still have a connection to the grounding electrode conductor, but this connection typically occurs at the PV system disconnecting means on the output of the interactive inverter. That disconnecting means is often in service or distribution equipment that already has an established connection to the grounding electrode conductor. This provides the appropriate point to connect the equipment grounding conductor and ground-fault detector to ground.

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-969-NFPA 70-2015
Statement: The language in the first draft caused concerns over wording in the informational note about grounded PV systems. With the rewriting of 690.41(A), it is more appropriate to explain that most PV systems are actually functional grounded systems with ground-fault detection systems. These systems must still have a connection to the grounding electrode conductor, but this connection typically occurs at the associated equipment connected to the output of an interactive inverter or dc charge controller. That equipment already has an established connection to the grounding electrode conductor. This provides the appropriate point to connect the equipment grounding conductor and ground-fault detector to ground.
Public Comment No. 936-NFPA 70-2015 [ Section No. 690.47(A) ]

(A) Buildings or Structures Supporting a PV System.

A building or structure supporting a PV system shall have a grounding electrode system installed in accordance with Part III of Article 250.

The PV system equipment grounding conductors shall be connected to the grounding electrode system of the building or structure supporting the PV system. The equipment grounding conductor, or the grounding bus of associated equipment connected to the grounding electrode conductor. This connection shall be in addition to any other equipment grounding conductor requirements in 690.43(C). The PV system equipment grounding conductors shall be sized in accordance with 690.45.

For solidly grounded PV systems, as permitted in 690.41(A)(5), the grounded conductor shall be connected to a grounding electrode system with a grounding electrode conductor sized in accordance with 250.166.

Informational Note: Previous versions of this Code treated all grounded PV systems as solidly grounded systems and therefore required a dc grounding electrode conductor to be connected to grounded PV system dc circuits. Since most PV systems installed in the past decade are not solidly grounded, this Code narrows the requirement for a dc grounding electrode to only those that are actually solidly grounded in accordance with 690.41(A)(5). All other PV system grounding configurations listed in 690.41(A) do not require a dc grounding electrode conductor.

Statement of Problem and Substantiation for Public Comment

The changes proposed clarify that the array equipment (module frames, racking, etc.) can be connected to the grounding system through an equipment ground. The current wording seems to imply the equipment is connected through a GEC, when only an EGC is required.

Related Item

First Revision No. 995-NFPA 70-2015 [Section No. 690.47]

Submitter Information Verification

Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 13:43:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-969-NFPA 70-2015
Statement: The language in the first draft caused concerns over wording in the informational note about grounded PV systems. With the rewriting of 690.41(A), it is more appropriate to explain that most PV systems are actually functional grounded systems with ground-fault detection systems. These systems must still have a connection to the grounding electrode conductor, but this connection typically occurs at the associated equipment connected to the output of an interactive inverter or dc charge controller. That equipment already has an established connection to the grounding electrode conductor. This provides the appropriate point to connect the equipment grounding conductor and ground-fault detector to ground.
Public Comment No. 1179-NFPA 70-2015 [Section No. 690.47(B)]

(B) Additional Auxiliary Electrodes for Array Grounding.

Grounding electrodes

A grounding electrode shall be permitted to be installed in accordance with 250.52 and 250.54, at the location of all ground- and pole-mounted PV arrays and as close as practicable to the location of roof-mounted PV arrays. The electrodes shall be permitted to be connected directly to the array frame(s) or structure. The dc grounding electrode conductor shall be sized according to 250.66. Additional electrodes are not permitted to be used as a substitute for equipment bonding or equipment grounding conductor requirements. The structure of a ground- or pole-mounted PV array shall be permitted to be considered a grounding electrode if it meets the requirements of 250.52. Roof-mounted PV arrays shall be permitted to use the metal frame of a building or structure if the requirements of 250.52(A)(2) are met.

Exception No. 1: An array grounding electrode(s) shall not be required where the load served by the array is integral with the array.

Exception No. 2: An additional array grounding electrode(s) shall not be required if located within 1.8 m (6 ft) of the premises wiring electrode.

Statement of Problem and Substantiation for Public Comment

This change would restore the language that is currently located in the 2014 NEC. This change was made with no technical substantiation being made one PI stated that the existing requirement was confusing, one PI attempted to relate this requirement to NFPA 780, this requirement is not intended to supersede or contradict the requirements that are used when installing a lightning protection system as covered in NFPA 780 but rather to provide some level of protection when a 780 system is not installed.

Related Item
First Revision No. 995-NFPA 70-2015 [Section No. 690.47]

Submitter Information Verification

Submitter Full Name: DAVID CLEMENTS
Organization: INTL ASSOC ELEC INSPEC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 10:05:34 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The language of 690.47(B) is permissive rather than required since the provision is related to lightning protection which the statement in PC#1179 acknowledges. Since lightning protection is not a requirement in this Code, any provisions related to lightning protection should be permissive rather than required.
690.53 Direct-Current Photovoltaic Power Source.

A permanent label for the PV power source indicating the information specified in (1) through (3) shall be provided by the installer at dc PV system disconnecting means and at each dc equipment disconnecting means required by 690.15. Where a disconnecting means has more than one dc PV power source, the values in 690.53(1) through (3) shall be specified for each source.

(1) Maximum voltage
   Informational Note to (1): See 690.7 for voltage.

(2) Maximum circuit current
   Informational Note to (2): See 690.8(A) for calculation of maximum circuit current.

(3) Maximum rated output current of the charge controller or dc-to-dc converter (if installed)

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that FR 996 be revised to comply with the NEC Style Manual, Section 2.1.5, Subdividing Sections.

Related Item
First Revision No. 996-NFPA 70-2015 [Section No. 690.53]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 12:03:53 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The existing language is a list and complies with the style manual. The numbers are part of a list rather than a subdivision.
Public Comment No. 903-NFPA 70-2015 [Section No. 690.53]

**690.53 Direct-Current Photovoltaic Power Source.**

A permanent label for the **dc PV power source** indicating the information specified in (1) through (3) shall be provided by the installer at dc PV system disconnecting means and at each dc equipment disconnecting means required by 690.15. Where a disconnecting means has more than one dc PV power source, the values in 690.53(1) through (3) shall be specified for each source.

(1) Maximum voltage

  Informational Note to (1): See 690.7 for voltage.

(2) Maximum circuit current

  Informational Note to (2): See 690.8(A) for calculation of maximum circuit current.

(3) Maximum rated output current of the charge controller or dc-to-dc converter (if installed)

**Statement of Problem and Substantiation for Public Comment**

Add the word "dc" in front of the first instance of "PV power source". The term "PV power source" is undefined, while "dc PV power source" is being described in the requirement.

**Related Item**

First Revision No. 996-NFPA 70-2015 [Section No. 690.53]

**Submitter Information Verification**

Submitter Full Name: MARK BALDASSARI  
Organization: ENPHASE ENERGY  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Mon Sep 21 19:19:07 EDT 2015

**Committee Statement**

Committee Action: Accepted  
Resolution: SR-970-NFPA 70-2015  
Statement: The word "dc" improves the clarity of the sentence.
<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td><strong>Energy storage systems shall be marked with the maximum operating voltage, including any equalization voltage. If solidly grounded, the grounded circuit conductor. The PV system output circuit conductors, shall be marked to indicate the polarity where connected to energy storage systems.</strong></td>
</tr>
</tbody>
</table>

**Statement of Problem and Substantiation for Public Comment**

The first draft language applied to requirements in the new Article 706. Article 690 should not be making requirements for Article 706. This marking requirement is focused on polarity and is only relevant to the polarity of a dc PV system that is connected to an dc energy storage system.

**Related Item**

First Revision No. 987-NFPA 70-2015 [Section No. 690.55]

**Submitter Information Verification**

**Submitter Full Name:** Bill Brooks  
**Organization:** Brooks Engineering  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Tue Sep 22 23:55:24 EDT 2015

**Committee Statement**

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-971-NFPA 70-2015  
**Statement:** The first draft language applied to requirements in the new Article 706. Article 690 should not be making requirements for Article 706. This marking requirement is focused on polarity and is only relevant to the polarity of a dc PV system that is connected to an energy storage system.
Identification of Power Sources.

(A) Facilities with Stand-Alone Systems.
Any structure or building with a PV power system that is not connected to a utility service source and is a stand-alone system shall have a permanent plaque or directory installed on the exterior of the building or structure at a readily visible location. The plaque or directory shall indicate the location of system disconnecting means and that the structure contains a stand-alone electrical power system. —

(B) Facilities with Utility Services and Photovoltaic Systems.
Plaques or directories shall be installed in accordance with 705.10.

(C) Facilities with Rapid Shutdown.
Buildings or structures with both utility service and a PV system complying with 690.12 shall have a permanent plaque or directory that includes the following wording:

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN ARRAY PARTITIONING

The plaque or directory shall be reflective, with all letters capitalized and having a minimum height of 9.5 mm (3/8 in.), in white on red background. The plaque or directory shall be located on, or no more than 1 m (3 ft) from, the service disconnecting means to which the PV systems are connected, or in accordance with 690.56(A) or (B), as applicable, and shall indicate the location of the rapid shutdown initiator if not at the same location.

Statement of Problem and Substantiation for Public Comment

The First Revision for this article was totally inadequate to provide signage that insures first responder safety. The concern for the new language is that it does not provide methods to distinguish between legacy systems with no rapid shutdown, systems installed according to the 2014 NEC with array level disconnects, and systems that may installed according to a revised NEC. I chose the word partitioning since nothing in the array is shutdown.

Related Item
First Revision No. 989-NFPA 70-2015 [Section No. 690.56(C)]

Submitter Information Verification
Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 15 16:41:32 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: These new marking requirements for Rapid Shutdown PV systems were initially developed by the NFPA Fire Fighter Safety and PV Systems Task Group that was reorganized in December of 2014. This collaborative Task Group is working on proposals for NFPA 1, NFPA 70, and other related documents. This Task Group is made up of over 20 participants from Code Making Panel 4, the solar industry, the fire service, the insurance industry, test laboratories, and other relevant stakeholders.

The Rapid Shutdown marking requirements proposed in this second revision input includes the language for these signs and greyscale figures of the color signs to print in the Code. Actual examples of these signs will exist in the handbook of the 2017 NEC Handbook for section 690.56(C) and the Annex of NFPA 1, 2018 edition. The signs are provided here so that reviewers can visualize what the signs are intended to look like.

Two different signs are required on buildings depending on what type of rapid shutdown system is on the building. Systems with multiple rapid shutdown types will be required to have a detailed directory since a simple sign will not be sufficient to clarify the levels of hazard on the roof.
Lastly, all switches that are intended to be used as rapid shutdown switches shall be labeled with the words, “RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM.”
Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 989. The Correlating Committee directs the panel to clarify “rapid shutdown initiator” and correlate with FR 1008 for use of terms.

Related Item
First Revision No. 989-NFPA 70-2015 [Section No. 690.56(C)]
First Revision No. 1008-NFPA 70-2015 [Section No. 690.12]

Committee Statement
Committee Action: Rejected but see related SR
Resolution: These new marking requirements for Rapid Shutdown PV systems were initially developed by the NFPA Fire Fighter Safety and PV Systems Task Group that was reorganized in December of 2014. This collaborative Task Group is working on proposals for NFPA 1, NFPA 70, and other related documents. This Task Group is made up of over 20 participants from Code Making Panel 4, the solar industry, the fire service, the insurance industry, test laboratories, and other relevant stakeholders.

The Rapid Shutdown marking requirements proposed in this second revision input includes the language for these signs and greyscale figures of the color signs to print in the Code. Actual examples of these signs will exist in the handbook of the 2017 NEC Handbook for section 690.56(C) and the Annex of NFPA 1, 2018 edition. The signs are provided here so that reviewers can visualize what the signs are intended to look like.

Two different signs are required on buildings depending on what type of rapid shutdown system is on the building. Systems with multiple rapid shutdown types will be required to have a detailed directory since a simple sign will not be sufficient to clarify the levels of hazard on the roof.

Lastly, all switches that are intended to be used as rapid shutdown switches shall be labeled with the words, “RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM.”
(C) **Facilities: Buildings**, with Rapid Shutdown.
Buildings

or structures with both utility service and a PV system complying with 690.12 shall have a permanent plaque or directory that includes the following wording:

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

The plaque or directory shall be reflective, with all letters capitalized and having with PV systems, shall have a permanent labels as described in (1) through (3)

(1) Rapid Shutdown Type. The type of PV system rapid shutdown shall be labeled as described in a) or b):

a) For PV systems that shutdown the array and conductors leaving the array:

   SOLAR PV SYSTEM IS EQUIPPED WITH RAPID SHUTDOWN.
   TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION
   TO SHUTDOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN ARRAY

The first two lines of the label shall be capitalized characters with a minimum height of 9.5 mm (3/8 in.) in white on green background and the remaining characters shall be capitalized with a minimum height of 4.8 mm (3/16 in.) in black on white background.

Figure 56(C)(1)(a)

b) For PV systems that only shutdown conductors leaving the array:

   EMERGENCY RESPONDER:
   SOLAR PV SYSTEM IS EQUIPPED WITH RAPID SHUTDOWN.
   TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION.

   TO SHUTDOWN CONDUCTORS OUTSIDE THE ARRAY. CONDUCTORS IN ARRAY REMAIN ENERGIZED IN SUNLIGHT.

The first two lines of the label shall be capitalized characters with a minimum height of 9.5 mm (3/8 in.) in white on red background, and the remaining characters shall be capitalized with a minimum height of 4.8 mm (3/16 in.) in black on white background.

Figure 56(C)(1)(b)
The labels in 690.56(C)(1)(a) and (b) shall include a simple diagram of a building with a roof. Diagram sections in red signify sections of the PV system that are not shutdown when the rapid shutdown switch is operated. Sections of the diagram in green signify sections of the PV system that are shutdown when the rapid shutdown switch is operated.

The rapid shutdown label in 690.56(C)(1) shall be located on or no more than 1 meter (3 ft) from the service disconnecting means to which the PV systems are connected, or in accordance with 690.56(A) or (B), as applicable, and shall indicate the location of the all identified rapid shutdown switches, if not at the same location.

(2) Buildings with More Than One Rapid Shutdown Type. For buildings that have PV systems with both rapid shutdown types or a PV system with a rapid shutdown type and a PV system with no rapid shutdown, a detailed plan view diagram of the roof shall be provided showing each different PV system and a dotted line around areas that remain energized after the rapid shutdown switch is operated.

(3) Rapid Shutdown Switch. A rapid shutdown switch shall have a label located on or no more than 1 meter (3 ft) from the switch that includes the following wording:

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

The label shall be reflective, with all letters capitalized and having a minimum height of 9.5 mm (3/8 in.), in white on red background.

Additional Proposed Changes

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<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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<td>Readable Word document in track changes mode to clearly see the graphics and changes related to 690.56(C).</td>
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Statement of Problem and Substantiation for Public Comment

These new marking requirements for Rapid Shutdown PV systems are part of a series of proposals developed by the NFPA Fire Fighter Safety and PV Systems Task Group that was reorganized in December of 2014. This collaborative Task Group is working on proposals for NFPA1, NFPA70, and other related documents. This Task Group is made up of over 20 participants from Code Making Panel 4, the solar industry, the fire service, the insurance industry, test laboratories, and other relevant stakeholders.

The Rapid Shutdown marking requirements proposed in this second draft input includes the language for these signs and greyscale figures of the color signs to print in the Code. Actual examples of these signs will exist in the handbook of the 2017 NEC Handbook for section 690.56(C) and the Annex of NFPA1, 2018 edition. The signs are provided here so that reviewers can visualize what the signs are intended to look like.

Two different signs are required on buildings depending on what type of rapid shutdown system is on the building. Systems with multiple rapid shutdown types will be required to have a detailed directory since a simple sign will not be sufficient to clarify the levels of hazard on the roof.

Lastly, all switches that are intended to be used as rapid shutdown switches shall be labeled with the words, “RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM.”
Sign for 690.56(C)(1)(a):

Sign for 690.56(C)(1)(b):

**Related Item**
First Revision No. 989-NFPA 70-2015 [Section No. 690.56(C)]

**Submitter Information Verification**

**Submitter Full Name:** Bill Brooks  
**Organization:** Brooks Engineering  
**Affiliation:** NFPA Fire Fighter Safety and PV System Task Group

**Committee Statement**

**Committee Action:** Rejected but see related SR

**Resolution:**

**Statement:** These new marking requirements for Rapid Shutdown PV systems were initially developed by the NFPA Fire Fighter Safety and PV Systems Task Group that was reorganized in December of 2014. This collaborative Task Group is working on proposals for NFPA 1, NFPA 70, and other related documents. This Task Group is made up of over 20 participants from Code Making Panel 4, the solar industry, the fire service, the insurance industry, test laboratories, and other relevant stakeholders.

The Rapid Shutdown marking requirements proposed in this second revision input includes the language for these signs and grayscale figures of the color signs to print in the Code. Actual examples of these signs will exist in the handbook of the 2017 NEC Handbook for section 690.56(C) and the Annex of NFPA 1, 2018 edition. The signs are provided here so that reviewers can visualize what the signs are intended to look like.

Two different signs are required on buildings depending on what type of rapid shutdown system is on the building. Systems with multiple rapid shutdown types will be required to have a detailed directory since a simple sign will not be sufficient to clarify the levels of hazard on the roof.

Lastly, all switches that are intended to be used as rapid shutdown switches shall be labeled with the words, “RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM.”
Public Comment No. 1658-NFPA 70-2015 [Section No. 690.56(C)]

(C) Facilities, Buildings, with Rapid Shutdown.

Buildings or structures, with both utility service and a PV system complying with 690.12 shall have a permanent plaque or directory that includes the following wording:

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

located within 1 meter (3 ft) of the service disconnecting means to which the PV systems are connected. In one and two family dwellings where the service disconnecting means is located inside of the building, the plaque shall be located on the exterior of the building near the entrance of the main service conductors. In buildings other than one and two family dwellings that are equipped with a fire alarm system, an additional plaque shall be located within 1 meter (3 ft) of the main fire alarm panel or the primary access point to the building for the fire service. The plaque(s) shall include the following wording, symbols, and diagrams:

(1) The following symbol shall be placed in the upper left corner of the plaque:

See the attached image file for PV System Symbol.

(2) The following wording shall be to the right of the above symbol:

BUILDING EQUIPPED WITH SOLAR PANELS

(3) The following wording shall be printed below (C)(1) and (C)(2):

TURN THE RAPID SHUTDOWN SWITCH TO "OFF" POSITION TO SHUT DOWN THE SOLAR SYSTEM

(4) Where the rapid shutdown initiator is located more than 1 meter (3 ft) from the plaque, a directory shall be provided below (C)(3) that illustrates the location of the rapid shutdown initiator.

(5) A directory showing the PV equipment on the roof of the building shall be provided. All areas containing components or equipment that is not touch safe shall be highlighted in red on the directory.

(6) Below the rooftop directory, the warning symbol shall be printed followed by the wording:

WARNING - CONDUCTORS AND EQUIPMENT IN RED AREAS WILL REMAIN ENERGIZED

The plaque or directory shall be reflective, with all letters capitalized and having a minimum height of 9.5 mm (\( \frac{3}{8} \) in.) in white on red background. The plaque or directory shall be located on, or no more than 1 m (3 ft) from, the service disconnecting means to which the PV systems are connected, or in accordance with . The text from 690.56(C)(2) shall be printed in black on a white background. The text from 690.56(A)(C) or (B)(A), as applicable, and shall indicate the location of the rapid shutdown initiator if not at the same location shall be printed in white on red background.

Additional Proposed Changes

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<th>Description</th>
<th>Approved</th>
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<td>PV System Symbol</td>
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<tr>
<td>Example_Rapid_Shutdown_Plaque.pdf</td>
<td>Example of a Rapid Shutdown Plaque that would result from this requirement</td>
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Statement of Problem and Substantiation for Public Comment

A recent PV system safety survey, conducted by an independent consultant with a group of 10 firefighters (3 of whom had direct experience with fires in PV Systems on commercial buildings), revealed that more firefighters want clear instructions about what equipment is energized than any other safety improvement in PV systems. This result has motivated SunPower to resubmit its request that clear and simple signage requirements be added to the 2017 NEC for systems mounted on buildings. We are delighted that CMP 4 saw value in our original proposal and requested that the Firefighter Safety Task Group (FSTG) review our proposal. While the task group did consider our proposal and incorporated elements of our proposal in their recommendation, we believe there are some very dangerous concepts also included in their proposal that should NOT be adopted. As a result, we have updated our proposal and are resubmitting it for further consideration.

The intent of this proposal is to:

• Provide a clear and standard message to a firefighter that there is a PV system installed on the building because it may not be visible to them from the ground level.

• Avoid the use of technical terms like PV and Rapid Shutdown that would only be familiar to a firefighter trained on PV systems. We need to provide instructions that an untrained firefighter can use as well.

• Clearly communicate what is safe to touch and what is not safe to touch. Anything that is not touch safe should be labeled as energized.

The proposal from the FSTG had two major flaws. First, it still uses technical terms. Second, it requires highlighting equipment that lowers the voltage to 80V in green, which would communicate to a firefighter that there is no hazard associated with this equipment and that they could do anything to it without risk of injury. This is false and will lead to firefighters getting killed. At 80V, a wet person could be exposed to 160mA, which is double the 80mA need to electrocute a person. Thus, this green labeling is more dangerous to a firefighter than a system that does NOT have rapid shutdown because it could cause him/her to unknowingly electrocute...
himself/herself. Therefore, SunPower vehemently opposes the signage proposal from FSTG.

Instead, we recommend that CMP 4 adopt the requirements in this proposal which will require the use of a sign like the example attached to this proposal. This sign only uses terms that a non-expert on PV would use, it directs the firefighter to the location of the Rapid Shutdown Initiator (switch) if they are not next to it already, and it clearly identifies what equipment is still live after the system has been shut down. This will allow a firefighter to take the proper precautions when working with the PV system.

Related Public Comments for This Document

<table>
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<th>Relationship</th>
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<tr>
<td>Public Comment No. 1536-NFPA 70-2015 [Section No. 690.12]</td>
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<tr>
<td>Public Input No. 4710-NFPA 70-2014 [Section No. 690.56(C)]</td>
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Submitter Information Verification

Submitter Full Name: MARK ALBERS  
Organization: SUNPOWER  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Fri Sep 25 15:58:55 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR  
Resolution: These new marking requirements for Rapid Shutdown PV systems were initially developed by the NFPA Fire Fighter Safety and PV Systems Task Group that was reorganized in December of 2014. This collaborative Task Group is working on proposals for NFPA 1, NFPA 70, and other related documents. This Task Group is made up of over 20 participants from Code Making Panel 4, the solar industry, the fire service, the insurance industry, test laboratories, and other relevant stakeholders.

The Rapid Shutdown marking requirements proposed in this second revision input includes the language for these signs and greyscale figures of the color signs to print in the Code. Actual examples of these signs will exist in the handbook of the 2017 NEC Handbook for section 690.56(C) and the Annex of NFPA 1, 2018 edition. The signs are provided here so that reviewers can visualize what the signs are intended to look like.

Two different signs are required on buildings depending on what type of rapid shutdown system is on the building. Systems with multiple rapid shutdown types will be required to have a detailed directory since a simple sign will not be sufficient to clarify the levels of hazard on the roof.

Lastly, all switches that are intended to be used as rapid shutdown switches shall be labeled with the words, “RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM.”
Facilities with Rapid Shutdown.

Buildings or structures with both utility service and a PV system complying with 690.12 shall have a permanent plaque or directory that includes the following wording:

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN SHUTDOWN SYSTEM AS REQUIRED BY THE 2017 NEC

The plaque or directory shall be reflective, with all letters capitalized and having a minimum height of 9.5 mm (3/8 in.), in white on red background. The plaque or directory shall be located on, or no more than 1 m (3 ft) from, the service disconnecting means to which the PV systems are connected, or in accordance with 690.56(A) or (B), as applicable, and shall indicate the location of the rapid shutdown initiator if not at the same location.

Statement of Problem and Substantiation for Public Comment

The evolution of RSS system requirements between the 2014 and 2017 NEC require first responders to treat them differently or to assume all RSS systems only comply with the limited provisions of the 2014 NEC. Adding text to the marking indicating that the RSS system was designed to comply with the 2017 NEC will allow first responders to appropriately assess the operation of the system.

Related Item

First Revision No. 989-NFPA 70-2015 [Section No. 690.56(C)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 12 16:45:28 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: Statement:

These new marking requirements for Rapid Shutdown PV systems were initially developed by the NFPA Fire Fighter Safety and PV Systems Task Group that was reorganized in December of 2014. This collaborative Task Group is working on proposals for NFPA 1, NFPA 70, and other related documents. This Task Group is made up of over 20 participants from Code Making Panel 4, the solar industry, the fire service, the insurance industry, test laboratories, and other relevant stakeholders.

The Rapid Shutdown marking requirements proposed in this second revision input includes the language for these signs and greyscale figures of the color signs to print in the Code. Actual examples of these signs will exist in the handbook of the 2017 NEC Handbook for section 690.56(C) and the Annex of NFPA 1, 2018 edition. The signs are provided here so that reviewers can visualize what the signs are intended to look like.

Two different signs are required on buildings depending on what type of rapid shutdown system is on the building. Systems with multiple rapid shutdown types will be required to have a detailed directory since a simple sign will not be sufficient to clarify the levels of hazard on the roof.

Lastly, all switches that are intended to be used as rapid shutdown switches shall be labeled with the words, "RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM."
Public Comment No. 997-NFPA 70-2015 [Section No. 690.56(C)]

(C) Facilities with Rapid Shutdown.
Buildings or structures with both utility service and a PV system complying with 690.12 shall have a permanent plaque or directory that includes the following wording:
PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN
The plaque or directory shall be reflective, with all letters capitalized and having a minimum height of 9.5 mm (3/8 in.), in white on red background. The plaque or directory shall be located on, or no more than 1 m (3 ft) from, the service disconnecting means to which the PV systems are connected, or in accordance with 690.56(A) or (B), as applicable, and shall indicate the location of the rapid shutdown initiator if not at the same location.

Statement of Problem and Substantiation for Public Comment
Not all buildings have utility service, but every building that has a rapid shutdown PV system should be marked. We should not create an inadvertent loophole where the RSD function on stand-alone homes does not need to be marked.

Related Item
Public Input No. 3728-NFPA 70-2014 [Section No. 690.56(C)]

Submitter Information Verification
Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 23:12:41 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution:
Statement: These new marking requirements for Rapid Shutdown PV systems were initially developed by the NFPA Fire Fighter Safety and PV Systems Task Group that was reorganized in December of 2014. This collaborative Task Group is working on proposals for NFPA 1, NFPA 70, and other related documents. This Task Group is made up of over 20 participants from Code Making Panel 4, the solar industry, the fire service, the insurance industry, test laboratories, and other relevant stakeholders.

The Rapid Shutdown marking requirements proposed in this second revision input includes the language for these signs and greyscale figures of the color signs to print in the Code. Actual examples of these signs will exist in the handbook of the 2017 NEC Handbook for section 690.56(C) and the Annex of NFPA 1, 2018 edition. The signs are provided here so that reviewers can visualise what the signs are intended to look like.

Two different signs are required on buildings depending on what type of rapid shutdown system is on the building. Systems with multiple rapid shutdown types will be required to have a detailed directory since a simple sign will not be sufficient to clarify the levels of hazard on the roof.

Lastly, all switches that are intended to be used as rapid shutdown switches shall be labeled with the words, “RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM.”
Public Comment No. 1337-NFPA 70-2015 [Section No. 690.60]

690.60  Identified Interactive Equipment.
Only inverters and ac modules listed, labeled and identified or field labeled and identified as interactive shall be permitted in interactive systems.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
Public Input No. 943-NFPA 70-2014 [Section No. 690.60]
First Revision No. 1003-NFPA 70-2015 [Section No. 690.60]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-972-NFPA 70-2015
Statement: The revision removes the content of Part VII and replaces it with a reference to Article 705 where all these requirements are duplicated with the exception of 690.57, Load Disconnect, which is antiquated language no longer relevant to PV systems particularly with the rewriting of Article 690 to specifically exclude the discussion of loads that are covered elsewhere in this Code. The SR removes the duplicated language with Article 705.
A normally interactive solar PV system shall be permitted to operate as a stand-alone system to supply loads that have been disconnected from electrical production and distribution network sources.

Statement of Problem and Substantiation for Public Comment

Preserve the last sentence of 690.61 from 2014 NEC which gives valuable information on stand alone systems. There are systems on the market having stand alone functionality without a battery which supply the load only with PV power. These systems are not covered by the requirements for battery systems addressed in a new chapter 7 article. Therefore, the last sentence of 690.61 is needed for clarification on the requirements for these type of systems.

Related Item

First Revision No. 1004-NFPA 70-2015 [Section No. 690.61]

Submitter Information Verification

Submitter Full Name: Michael Mendik
Organization: SMA America
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 17:54:25 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-972-NFPA 70-2015
Statement: The revision removes the content of Part VII and replaces it with a reference to Article 705 where all these requirements are duplicated with the exception of 690.57, Load Disconnect, which is antiquated language no longer relevant to PV systems particularly with the rewriting of Article 690 to specifically exclude the discussion of loads that are covered elsewhere in this Code. The SR removes the duplicated language with Article 705.
690.61 Loss of Interactive System Power.

An inverter or an ac module in an interactive, normally interactive solar PV system shall automatically de-energize its output to the connected electrical production and distribution network upon loss of voltage in that system and shall remain in that state until the be permitted to operate as a stand-alone system to supply loads that have been disconnected from electrical production and distribution network, voltage has been restored, sources.

Statement of Problem and Substantiation for Public Comment

The wrong portion of the 2014 language was deleted. Inverters will be increasingly required to provide grid supporting functions even when the grid (EPS) falters, and this functionality is better described in the listing certification instead of an installation standard. Conversely, the clarification that an inverter may be permitted to continue operation in stand-alone mode after disconnecting from the grid upon loss of interactive systems power is still useful and serves a valid purpose.

Related Item

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 22:46:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-972-NFPA 70-2015
Statement: The revision removes the content of Part VII and replaces it with a reference to Article 705 where all these requirements are duplicated with the exception of 690.57, Load Disconnect, which is antiquated language no longer relevant to PV systems particularly with the rewriting of Article 690 to specifically exclude the discussion of loads that are covered elsewhere in this Code. The SR removes the duplicated language with Article 705.
Public Comment No. 905-NFPA 70-2015 [Section No. 690.63]

690.63 Unbalanced Interconnections.
Unbalanced connections shall be in accordance with 705.100.

Statement of Problem and Substantiation for Public Comment

Remove this section as it is covered under 705.100.

Related Item
First Revision No. 1035-NFPA 70-2015 [Section No. 705.100(A)]

Submitter Information Verification

Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 19:24:26 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-972-NFPA 70-2015
Statement: The revision removes the content of Part VII and replaces it with a reference to Article 705 where all these requirements are duplicated with the exception of 690.57, Load Disconnect, which is antiquated language no longer relevant to PV systems particularly with the rewriting of Article 690 to specifically exclude the discussion of loads that are covered elsewhere in this Code. The SR removes the duplicated language with Article 705.
690.64 Point of Connection
Point of connection shall be in accordance with 705.12.

Statement of Problem and Substantiation for Public Comment
This requirement is covered under 705.12 and should be removed from Article 690.

Submitter Information Verification
Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 19:31:19 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-972-NFPA 70-2015
Statement: The revision removes the content of Part VII and replaces it with a reference to Article 705 where all these requirements are duplicated with the exception of 690.57, Load Disconnect, which is antiquated language no longer relevant to PV systems particularly with the rewriting of Article 690 to specifically exclude the discussion of loads that are covered elsewhere in this Code. The SR removes the duplicated language with Article 705.
690.71 . General

An energy storage system connected to a PV system shall be installed in accordance with Article 706.

Statement of Problem and Substantiation for Public Comment

Part VIII was supposed to be deleted according to the resolution logs. This section was erroneously retained. All energy storage language from Article 690 has been utilized in the new Article 706 - Energy Storage Systems. This deletion also includes all of 690.71, 690.72, and 690.74. Note there is an inconsistency in the online TerraView FR and the NFPA published FR.

Related Item
First Revision No. 1012-NFPA 70-2015 [Sections Part VIII., 690.71]

Submitter Information Verification

Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Mon Sep 14 16:06:57 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel decides to keep Part VIII for now and replace the content with a reference to Article 706 so that those who look to this section are properly directed to the appropriate Article.
690.72  Charge Control

(A)  General

Equipment shall be provided to control the charging process of the battery. Charge control shall not be required where the design of the photovoltaic source circuit is matched to the voltage rating and charge current requirements of the interconnected battery cells and the maximum charging current multiplied by 1 hour is less than 3 percent of the rated battery capacity expressed in ampere-hours or as recommended by the battery manufacturer.

All adjusting means for control of the charging process shall be accessible only to qualified persons.

Informational Note: Certain battery types such as valve-regulated lead acid or nickel cadmium can experience thermal failure when overcharged.

(B)  Diversion Charge Controller

(1)  Sole Means of Regulating Charging

A photovoltaic power system employing a diversion charge controller as the sole means of regulating the charging of a battery shall be equipped with a second independent means to prevent overcharging of the battery.

(2)  Circuits with Direct-Current Diversion Charge Controller and Diversion Load

Circuits containing a dc diversion charge controller and a dc diversion load shall comply with the following:

(1)  The current rating of the diversion load shall be less than or equal to the current rating of the diversion load charge controller. The voltage rating of the diversion load shall be greater than the maximum battery voltage. The power rating of the diversion load shall be at least 150 percent of the power rating of the photovoltaic array.

(2)  The conductor ampacity and the rating of the overcurrent device for this circuit shall be at least 150 percent of the maximum current rating of the diversion charge controller.

(C)  Buck/Boost Direct-Current Converters

When buck/boost charge controllers and other dc power converters that increase or decrease the output current or output voltage with respect to the input current or input voltage are installed, the requirements shall comply with 690.72(C)(1) and (C)(2).

(1)  The ampacity of the conductors in output circuits shall be based on the maximum rated continuous output current of the charge controller or converter for the selected output voltage range.

(2)  The voltage rating of the output circuits shall be based on the maximum voltage output of the charge controller or converter for the selected output voltage range.

Statement of Problem and Substantiation for Public Comment

The first draft erroneously kept this section that was deleted by the related FR.

Related Item

First Revision No. 1012-NFPA 70-2015 [Sections Part VIII., 690.71]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address:
City:
State:
<table>
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<td><strong>Committee Action:</strong></td>
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690.72 - Charge Control

(A) - General

Equipment shall be provided to control the charging process of the battery. Charge control shall not be required where the design of the photovoltaic source circuit is matched to the voltage rating and charge current requirements of the interconnected battery cells and the maximum charging current multiplied by 1 hour is less than 3 percent of the rated battery capacity expressed in amperes-hours or as recommended by the battery manufacturer.

All adjusting means for control of the charging process shall be accessible only to qualified persons.

Informational Note: Certain battery types such as valve-regulated lead acid or nickel cadmium can experience thermal failure when overcharged.

(B) - Diversion Charge Controller

(1) - Sole Means of Regulating Charging

A photovoltaic power system employing a diversion charge controller as the sole means of regulating the charging of a battery shall be equipped with a second independent means to prevent overcharging of the battery.

(2) - Circuits with Direct-Current Diversion Charge Controller and Diversion Load

Circuits containing a dc diversion charge controller and a dc diversion load shall comply with the following:

1. The current rating of the diversion load shall be less than or equal to the current rating of the diversion load charge controller. The voltage rating of the diversion load shall be greater than the maximum battery voltage. The power rating of the diversion load shall be at least 150 percent of the power rating of the photovoltaic array.

2. The conductor ampacity and the rating of the overcurrent device for this circuit shall be at least 150 percent of the maximum current rating of the diversion charge controller.

(C) - Buck/Boost Direct-Current Converters

When buck/boost charge controllers and other dc power converters that increase or decrease the output current or output voltage with respect to the input current or input voltage are installed, the requirements shall comply with 690.72(C)(1) and (C)(2).

1. The ampacity of the conductors in output circuits shall be based on the maximum rated continuous output current of the charge controller or converter for the selected output voltage range.

2. The voltage rating of the output circuits shall be based on the maximum voltage output of the charge controller or converter for the selected output voltage range.

Statement of Problem and Substantiation for Public Comment

Part VIII was supposed to be deleted according to the resolution logs. This section was erroneously retained. All energy storage language from Article 690 has been utilized in the new Article 706 - Energy Storage Systems. This deletion also includes all of 690.71, 690.72, and 690.74. Note there is an inconsistency in the on line TerraView FR and the NFPA published FR.

Related Item

First Revision No. 1012-NFPA 70-2015 [Sections Part VIII., 690.71]

Submitter Information Verification

Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:
City:  
State:  
Zip:  
Submittal Date: Mon Sep 14 16:13:05 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR  
Resolution: SR-973-NFPA 70-2015  
Statement: The deleted text should have been removed in the first draft.  
The remaining text was modified to be consistent.
Public Comment No. 1146-NFPA 70-2015 [ Sections 690.72(B), 690.72(C) ]

Sections 690.72(B), 690.72(C)

(B) · Diversion Charge Controller.

(1) · Sole Means of Regulating Charging.
A photovoltaic power system employing a diversion charge controller as the sole means of regulating the charging of a battery shall be equipped with a second independent means to prevent overcharging of the battery.

(2) · Circuits with Direct-Current Diversion Charge Controller and Diversion Load.
Circuits containing a dc diversion charge controller and a dc diversion load shall comply with the following:

(1) · The current rating of the diversion load shall be less than or equal to the current rating of the diversion load charge controller. The voltage rating of the diversion load shall be greater than the maximum battery voltage. The power rating of the diversion load shall be at least 150 percent of the power rating of the photovoltaic array.

(2) · The conductor ampacity and the rating of the overcurrent device for this circuit shall be at least 150 percent of the maximum current rating of the diversion charge controller.

(3) · PV Systems Using Utility-Interactive Inverters.
Photovoltaic power systems using utility-interactive inverters to control battery state-of-charge by diverting excess power into the utility system shall comply with (1) and (2):

(1) · These systems shall not be required to comply with 690.72(B)(2). The charge regulation circuits used shall comply with the requirements of 690.8.

(2) · These systems shall have a second, independent means of controlling the battery charging process for use when the utility is not present or when the primary charge controller fails or is disabled.

(C) · Buck/Boost Direct-Current Converters.
When buck/boost charge controllers and other dc power converters that increase or decrease the output current or output voltage with respect to the input current or input voltage are installed, the requirements shall comply with 690.72(C)(1) and (C)(2).

(1) · The ampacity of the conductors in output circuits shall be based on the maximum rated continuous output current of the charge controller or converter for the selected output voltage range.

(2) · The voltage rating of the output circuits shall be based on the maximum voltage output of the charge controller or converter for the selected output voltage range.

Statement of Problem and Substantiation for Public Comment

This comment is coordinated with the proposed new Article 706 Energy Storage Systems (FR 3662). Currently batteries are addressed in numerous places in the NEC such as Articles 480 and 690, which has been appropriate over time with the former article historically covering lead-acid batteries and the latter recently added to address the application of batteries in general, not just lead acid, to PV systems. The current state of energy storage technology, which includes batteries, and anticipated evolution of energy storage supports the need for a singular set of requirements in the NEC covering such systems. If this is not accomplished in the 2017 NEC and available to serve as a singular foundation for needed changes in the future, the provisions covering such systems will continue to reside in different places within the NEC and likely evolve to attach themselves as parts to existing criteria throughout the NEC. To foster the safe application of energy storage systems and facilitate the application and use of the NEC by technology proponents as well as those who install and inspect such systems there should be a singular article in the NEC on energy storage systems. This specific clause is replaced by 706.33.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address:
City:
State:
Zip:
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-973-NFPA 70-2015
Statement: The deleted text should have been removed in the first draft.

The remaining text was modified to be consistent.
PV Systems Using Utility-Interactive Inverters.

Photovoltaic power systems using utility-interactive inverters to control battery state-of-charge by diverting excess power into the utility system shall comply with (1) and (2):

(1) These systems shall not be required to comply with 690.72(B)(2). The charge regulation circuits used shall comply with the requirements of 690.8.

(2) These systems shall have a second, independent means of controlling the battery charging process for use when the utility is not present or when the primary charge controller fails or is disabled.

Statement of Problem and Substantiation for Public Comment

The term "utility-interactive inverter" has been replaced with "interactive inverter" as defined in section 690.2.

Related Item

Public Input No. 1083-NFPA 70-2014 [Section No. 690.72(B)(3)]

Submitter Information Verification

Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 11:27:15 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-973-NFPA 70-2015
Statement: The deleted text should have been removed in the first draft.

The remaining text was modified to be consistent.
690.74 Battery Interconnections

(A) Flexible Cables.
Flexible cables, as identified in Article 400, in sizes 2/0 AWG and larger shall be permitted within the battery enclosure from battery terminals to a nearby junction box where they shall be connected to an approved wiring method. Flexible battery cables shall also be permitted between batteries and cells within the battery enclosure. Such cables shall be listed for hard-service use and identified as moisture resistant.
Flexible, fine-stranded cables shall be terminated only with terminals, lugs, devices, or connectors in accordance with 110.14.

Statement of Problem and Substantiation for Public Comment
The first draft erroneously retained the language that was eliminated in the related FR.

Related Item
First Revision No. 1012-NFPA 70-2015 [Sections Part VIII.. 690.71]

Submitter Information Verification
Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 00:05:07 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-974-NFPA 70-2015
Statement: This language should have been removed in the first draft.
690.74 - Battery Interconnections.

(A) - Flexible Cables.

Flexible cables, as identified in Article 400, in sizes 2/0 AWG and larger shall be permitted within the battery enclosure from battery terminals to a nearby junction box where they shall be connected to an approved wiring method. Flexible battery cables shall also be permitted between batteries and cells within the battery enclosure. Such cables shall be listed for hard-service use and identified as moisture resistant.

Flexible, fine-stranded cables shall be terminated only with terminals, lugs, devices, or connectors in accordance with 110.14.

Statement of Problem and Substantiation for Public Comment

This comment is coordinated with the proposed new Article 706 Energy Storage Systems (FR 3662). Currently batteries are addressed in numerous places in the NEC such as Articles 480 and 690, which has been appropriate over time with the former article historically covering lead-acid batteries and the latter recently added to address the application of batteries in general, not just lead acid, to PV systems. The current state of energy storage technology, which includes batteries, and anticipated evolution of energy storage supports the need for a singular set of requirements in the NEC covering such systems. If this is not accomplished in the 2017 NEC and available to serve as a singular foundation for needed changes in the future, the provisions covering such systems will continue to reside in different places within the NEC and likely evolve to attach themselves as parts to existing criteria throughout the NEC. To foster the safe application of energy storage systems and facilitate the application and use of the NEC by technology proponents as well as those who install and inspect such systems there should be a singular article in the NEC on energy storage systems. This specific requirement is replaced by 706.32.

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 22:38:33 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-974-NFPA 70-2015
Statement: This language should have been removed in the first draft.
690.74 - Battery Interconnections.

(A) Flexible Cables.

Flexible cables, as identified in Article 400, in sizes 2/0 AWG and larger shall be permitted within the battery enclosure from battery terminals to a nearby junction box where they shall be connected to an approved wiring method. Flexible battery cables shall also be permitted between batteries and cells within the battery enclosure. Such cables shall be listed for hard-service use and identified as moisture resistant.

Flexible, fine stranded cables shall be terminated only with terminals, lugs, devices, or connectors in accordance with 110.14.

Statement of Problem and Substantiation for Public Comment

Part VIII was supposed to be deleted according to the resolution logs. This section was erroneously retained. All energy storage language from Article 690 has been utilized in the new Article 706 - Energy Storage Systems. This deletion also includes all of 690.71, 690.72, and 690.74. Note there is an inconsistency in the on line TerraView FR and the NFPA published FR.

Related Item
First Revision No. 1012-NFPA 70-2015 [Sections Part VIII., 690.71]
First Revision No. 1012-NFPA 70-2015 [Sections Part VIII., 690.71]
First Revision No. 1012-NFPA 70-2015 [Sections Part VIII., 690.71]

Submitter Information Verification

Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 16:15:37 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-974-NFPA 70-2015
Statement: This language should have been removed in the first draft.
Flexible Cables.

Flexible cables, as identified in Article 400, in sizes 2/0 AWG and larger shall be permitted within the battery enclosure from battery terminals to a nearby junction box where they shall be connected to an approved wiring method. Flexible battery cables shall also be permitted between batteries and cells within the battery enclosure. Such cables shall be listed for hard-service use and identified as moisture resistant.

Flexible, fine-stranded cables shall be terminated only with terminals, lugs, devices, or connectors in accordance with 110.14.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee advises that article titles and scope statements are the responsibility of the Correlating Committee. The Correlating Committee accepts the article scope. The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 7511 with regard to the Article title and text

Related Item
First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:06:25 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-974-NFPA 70-2015
Statement: This language should have been removed in the first draft.
Article 691. Large-Scale Photovoltaic (PV) Electric Supply Stations, Power Production Facility

691.1 Scope. This article covers the installation of large-scale PV electric supply stations, power production facilities operated for the sole purpose of providing electric supply to the utility transmission or distribution system with a generating capacity of no less than 5,000 kW. Electric supply stations, power production facilities, are locations containing the generating stations, solar photovoltaic power production facility, and substations, including their associated generator, storage battery, transformer, and switchgear areas. Facilities covered by this article have specific design and safety features unique to large-scale PV facilities.

Informational Note: 90.2(B)(5) includes information about utility-owned properties not covered under this Code. For additional information on electric supply stations, power production facilities, see ANSI/IEEE C2-2012, National Electrical Safety Code.

691.2 Definitions.

Engineering Supervision. Designed and approved (or certified) by a licensed professional engineer competent in the specific area under supervision.

Field Labeled (as applied to evaluated products). Equipment or materials to which has been attached a label, symbol, or other identifying mark of a field evaluation body (FEB) indicating the equipment or materials were evaluated and found to comply with requirements as described in an accompanying field evaluation report. [790, 2012]

Generating Capacity. The sum of the parallel inverter rated maximum continuous output power at 40°C in kilowatts (kW).

Generating Station, Solar Photovoltaic Power Production Facility. A plant wherein electric energy is produced by conversion from some other form of energy (e.g., chemical, nuclear, solar, wind, mechanical, or hydraulic) by means of suitable apparatus.

Utility Distribution System. An electrical system operated by a regulated utility company operating at an ac voltage greater than 1000 volts and less than 100,000 volts.

Utility Transmission System. An electrical system operated by a regulated utility company operating at a voltage equal to or greater than 100,000 volts.

691.4 Special Requirements for Large-Scale PV Electric Supply Stations, Power Production Facilities.

Large-scale PV electric supply stations, power production facilities, shall comply with the following:

1. Electrical circuits and equipment for large-scale PV electric supply stations, power production facilities, are accessible only to qualified personnel needed for the maintenance and operation of the PV electric supply station power production facility. Informational Note: Refer to NFPA 70E-2015, Standard for Electrical Safety in the Workplace, for electrical safety requirements.

2. Access to PV electric supply stations is power production facilities is restricted by fencing or other adequate means in accordance with 110.31. Field applied hazard markings shall be applied in accordance with 110.21(B).

3. The connection between the PV electric supply station power production facility and the utility transmission or distribution system is through medium- or high-voltage switch gear, substation, switch yard, or similar methods whose sole purpose is to safely and effectively interconnect the two systems.

4. The electrical loads within the supply station power production facility are only used to power auxiliary equipment for the generation of the PV power.

5. PV electric supply stations, power production facilities, shall not be installed on buildings.

691.5 Equipment Approval. All equipment used for interconnection with an electric utility shall be approved by the electric utility, and all electrical equipment shall be approved for installation by one of the following:

1. Listing and labeling

2. Field labeling

3. Where products complying with 691.5(1) or (2) are not available, by engineering review validating that the electrical equipment is tested to relevant standards or industry practice
691.6 Design Under Engineering Supervision.

Documentation of the engineered design of the electric supply station power production facility shall be provided upon request of the AHJ. An additional independent engineering report detailing compliance of the design with applicable standards and industry practice shall be provided upon request of the AHJ. This documentation shall include details of conformance of the design with Article 690, and any alternative methods to Article 690, or other articles of this Code.

691.7 Installation Under Engineering Supervision.

Documentation of the electric supply station power production facility installation shall be provided upon request of the AHJ. An additional independent engineering report detailing compliance with applicable standards and industry practice shall be provided upon request of the AHJ. This documentation shall include details of conformance of the installation with this Code, applicable standards, and industry practice. This documentation, where requested, shall be available prior to the commercial operation of the station facility.

691.8 Direct Current Operating Voltage.

For large-scale PV electric supply stations power production facilities operating at a dc voltage above 1000 volts, calculations shall be performed under engineering supervision.

691.9 Disconnection of Photovoltaic Equipment.

Isolating devices shall be permitted to be more than 1.8 m (6 ft) from the equipment where written safety procedures and conditions of maintenance and supervision ensure that only qualified persons service the equipment.

Informational Note: For information on lockout/tagout procedures, see NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Buildings whose sole purpose is to house and protect power production facility equipment shall not be required to comply with Article 690.12. Written standard operating procedures shall be available at the site detailing necessary shutdown procedures in the event of an emergency.

691.10 Arc-Fault Mitigation.

PV systems that do not comply with the requirements of Article 690.11 shall be designed under engineering supervision that includes fire mitigation plans to address dc arc-faults.

691.11 Fence Grounding.

Fence grounding requirements and details shall be provided under engineering supervision.

Statement of Problem and Substantiation for Public Comment

1.) There are several terms used in the article taken from the National Electrical Safety Code (NESC) which provides requirements for generation, transmission, distribution and metering assets of electric utilities. One such term is "Supply Station" and for this article is best replaced with "Power Production Facility" to be consistent with terminology found in the National Electrical Code (NEC) associated with premises wiring in Article 705.

2.) It is common for 2000kW large Solar PV systems to be interconnected to primary voltage utility systems.

3.) "Solar Photovoltaic Power Production Facility" is more appropriately defined and used in this article for premises wiring systems than "Generating Station" which is a utility term.

4.) The definition and use of "Utility Distribution System" and "Utility Transmission System" is not necessary for premises wiring as these systems are specific to utilities. It would be more appropriate to make references to Article 225- Outside Branch Circuits and Feeders and Article 230- Services from the NEC.

5.) Equipment used for interconnection with an electric utility shall also be approved by the electric utility.

Related Item

First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: Roger McDaniel
Organization: Georgia Power Company
Affiliation: Edison Electric Institute
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 17:20:11 EDT 2015

Committee Statement

Committee Action: Rejected
| Resolution: | The panel has specifically chosen the term “supply station” to avoid confusion with PV systems that supply power to premises wiring. Supply stations produce energy that is delivered to a system operated by a utility, not premises wiring. |
691.1 Scope.

This article covers the installation of large-scale PV electric supply stations operated for the sole purpose of providing electric supply to the utility transmission or distribution system with a generating capacity of no less than 5,000 kW. Electric supply stations are locations containing the generating stations and substations, including their associated generator, storage battery, transformer, and switchgear areas. Facilities covered by this article have specific design and safety features unique to large-scale PV facilities.

Informational Note: 90.2(B)(5) includes information about utility-owned properties not covered under this Code. For additional information on electric supply stations, see ANSI/IEEE C2-2012, National Electrical Safety Code.

Statement of Problem and Substantiation for Public Comment

Referenced correct SDO in the informational note.

Related Item

Public Input No. 4085-NFPA 70-2014 [Section No. 690.1]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address:
City:
State: 
Zip: 
Submittal Date: Wed Jul 01 23:44:55 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The reference to ANSI/IEEE C2-2012 is confirmed to be correct.
Public Comment No. 1613-NFPA 70-2015 [Section No. 691.1]

Scope.

This article covers the installation of large-scale PV electric supply stations operated by independent power producers for the sole purpose of providing electric supply to the utility transmission or distribution system with a generating capacity of no less than 5,000 kW. Electric supply stations are locations containing the generating stations and substations, including their associated generator, storage battery, transformer, and switchgear areas. Facilities covered by this article have specific design and safety features unique to large-scale PV facilities.

Informational Note: 90.2(B)(5) includes information about utility-owned properties not covered under this Code. For additional information on electric supply stations, see ANSI/IEEE C2-2012, National Electrical Safety Code.

Statement of Problem and Substantiation for Public Comment

Clarify that unless the owner is a regulated public utility they are not exempt from the requirements of this article.

Reduction of the 5000 KWh to 1000 KWh to allow for smaller ground mounted systems to make use of the reduced requirements of this article.

Related Item

First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: WENDELL WHISTLER
Organization: ALASKA JOINT ELECTRICAL APPREN
Affiliation: IBEW
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:18:54 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel has specifically chosen the term “supply station” to avoid confusion with PV systems that supply power to premises wiring. Supply stations, produce energy that is delivered to a system operated by a utility, not premises wiring. The size of large-scale electric supply stations is maintained at the 5MW threshold for this code cycle to ensure that only systems that represent a significant investment, and therefore require significant engineering resources are included in the scope.
691.1 Scope.
This article covers the installation of large-scale PV electric supply stations operated for the sole purpose of providing electric supply to the utility transmission or distribution system with a generating capacity of no less than 5,000 kW. Electric supply stations are locations containing the generating stations and substations, including their associated generator, storage battery, transformer, and switchgear areas. Facilities covered by this article have specific design and safety features unique to large-scale PV facilities.

Informational Note: 90.2(B)(5) includes information about utility-owned properties not covered under this Code. For additional information on electric supply stations, see ANSI/IEEE C2-2012, National Electrical Safety Code.

Statement of Problem and Substantiation for Public Comment
The First Draft sets the entry level for the new Article 691 at 5000 kW, which is a very large system. Furthermore, the attributes of a PV plant that really matter for application of Art. 691 are interconnection at MV or HV, restricted access, and being ground mounted, not simply power. We feel that smaller systems that satisfy these other attributes should be allowed to use the approaches in Art. 691, and frequently already do (design and installation under engineering supervision for example).

Related Item
First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification
Submitter Full Name: JIM EICHNER
Organization: SCHNEIDER ELECTRIC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 04 16:55:25 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The size of large-scale electric supply stations is maintained at the 5MW threshold for this code cycle to ensure that only systems that represent a significant investment, and therefore require significant engineering resources are included in the scope.
691.1 Scope.

This article covers the installation of large-scale PV electric supply stations operated for the sole purpose of providing electric supply to the utility transmission or distribution system, at a voltage greater than 1000V, with a generating capacity of no less than 5,000 kW. Electric supply stations are locations containing the generating stations and substations, including their associated generator, storage battery, transformer, and switchgear areas. Facilities covered by this article have specific design and safety features unique to large-scale PV facilities.

Informational Note: 90.2(B)(5) includes information about utility-owned properties not covered under this Code. For additional information on electric supply stations, see ANSI/IEEE C2-2012, National Electrical Safety Code.

Statement of Problem and Substantiation for Public Comment

The reference to transmission and distribution levels is vague in the definitions and really says that the interconnection to the utility is to be at 1000V or greater. Text is updated to state this and remove the reference to transmission and distribution. See comment on the definitions for Utility Transmission System and Utility Distribution System.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
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<tbody>
<tr>
<td>Public Comment No. 620-NFPA 70-2015 [Definition: Engineering Supervision.]</td>
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<tr>
<td>Public Comment No. 621-NFPA 70-2015 [Definition: Generating Capacity]</td>
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<td>Public Comment No. 622-NFPA 70-2015 [Definitions (691.2): Utility Dis... to Utility Tra...</td>
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<tr>
<td>Public Comment No. 625-NFPA 70-2015 [Section No. 691.4]</td>
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<td>First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]</td>
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Submitter Information Verification

| Submitter Full Name: MARVIN HAMON |
|-----------------|-----------------|
| Organization: HAMON ENGINEERING INC |  |
| Street Address:  |  |
| City:  |  |
| State:  |  |
| Zip:  |  |
| Submittal Date: Sat Sep 12 17:33:53 EDT 2015 |  |

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-975-NFPA 70-2015
Statement: The size of large-scale electric supply stations is maintained at the 5MW threshold for this code cycle to ensure that only systems that represent a significant investment, and therefore require significant engineering resources are included in the scope.

The term “transmission and distribution system” is deleted from the language in the scope and replaced with “for the transfer of electrical energy” to address concerns about the definition and use of transmission and distribution system.

Section 691.4, which articulates the distinctions between large scale PV and that covered by 690, is added to the scope so that it is clear how large-scale PV systems are distinguished from other PV systems.

The reference to ANSI/IEEE C2-2012 has been retained as it is useful to direct readers to the Code that is relevant to PV systems not covered by 690 or 691.
691.1 Scope.

This article covers the installation of large-scale PV electric supply stations operated for the sole purpose of providing electric supply to the utility transmission or distribution system with a generating capacity of no less than 5,000 kW. Electric supply stations are locations containing the generating stations and substations, including their associated generator, storage battery, transformer, and switchgear areas. Facilities covered by this article have specific design and safety features unique to large-scale PV facilities. This statement should be removed, unless the design and safety features are specifically defined which there not and if they were would be extremely limiting as all site locations are unique in nature regarding location and qualified personnel cannot be measured in a document but requires actual hands on training.

Informational Note: 90.2(B)(5) includes information about utility-owned properties not covered under this Code. For additional information on electric supply stations, see ANSI/IEEE C2-2012, National Electrical Safety Code. This IN should be removed as all these systems are privately owned property and exchange hands, sold, to different parties.

Statement of Problem and Substantiation for Public Comment

Facilities covered by this article have specific design and safety features unique to large-scale PV facilities. This statement should be removed, unless the design and safety features are specifically defined which there not and if they were would be extremely limiting as all site locations are unique in nature regarding location and qualified personnel cannot be measured in a document but requires actual hands on training.

Informational Note: 90.2(B)(5) includes information about utility-owned properties not covered under this Code. For additional information on electric supply stations, see ANSI/IEEE C2-2012, National Electrical Safety Code. This IN should be removed as all these systems are privately owned property and exchange hands, sold, to different parties.

Related Item

Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

Submitter Information Verification

Submitter Full Name: Scott Humphrey
Organization: LA County DPW
Affiliation: Building and Safety
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 21:33:28 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The informational note and reference to ANSI/IEEE C2-2012 has been retained as it is useful to direct readers to the Code that is relevant to PV systems not covered by 690 or 691. Section 691.4 is added to the scope so that it is clear how large-scale PV systems are distinguished from other PV systems.
Engineering Supervision.

Designed and approved (or certified) Supervised by a licensed professional engineer competent in the specific area under supervision.

Statement of Problem and Substantiation for Public Comment

The correlating committee has concerns about this definition. The rewording is intended to limit the definition to defining what the term means and letting the text of the requirements determine how it is used.

Related Item

First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 23:05:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-976-NFPA 70-2015
Statement: Definition of “Engineering Supervision” has been deleted and actions required of the engineer supervising certain aspects of design have been included in the appropriate sections of the code. This is consistent with other uses of the term “engineering supervision” as used throughout the code.
Engineering Supervision.

Designed and approved (or certified) by a licensed professional engineer competent engaged primarily in the specific area under supervision, design and maintenance of electrical installations under their supervision. The documents shall be wet stamped by the professional engineer. This documentation shall be made available to those authorized to design, install, inspect, maintain and operate the system.

Statement of Problem and Substantiation for Public Comment

Clarify and further refine who is can provide electrical design and engineering for these large PV systems

Related Item

First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: WENDELL WHISTLER
Organization: ALASKA JOINT ELECTRICAL APPREN
Affiliation: IBEW
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 15:37:38 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-976-NFPA 70-2015
Statement: Definition of “Engineering Supervision” has been deleted and actions required of the engineer supervising certain aspects of design have been included in the appropriate sections of the code. This is consistent with other uses of the term “engineering supervision” as used throughout the code.
Engineering Supervision.
Designed and approved (or certified), sealed by a licensed professional engineer competent in the specific area under supervision.

Statement of Problem and Substantiation for Public Comment
A licensed engineer seals documents that they have produced, or were produced under their supervision, with their state P.E. seal and signature. This is the only legal way of indicating approval or certification by a licensed engineer.

Related Public Comments for This Document

<table>
<thead>
<tr>
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<tr>
<td>Public Comment No. 624-NFPA 70-2015 [Section No. 691.1]</td>
<td>Related Item</td>
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<tr>
<td>First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]</td>
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Submitter Information Verification
Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 12 17:02:20 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-976-NFPA 70-2015
Statement: Definition of "Engineering Supervision" has been deleted and actions required of the engineer supervising certain aspects of design have been included in the appropriate sections of the code. This is consistent with other uses of the term "engineering supervision" as used throughout the code.


**Public Comment No. 713-NFPA 70-2015 [ Definition: Engineering Supervision. ]**

**Engineering Supervision.**
Designed and approved (or certified) by a licensed professional engineer competent in the specific area under supervision.

**Statement of Problem and Substantiation for Public Comment**

This definition should be removed; as stated in Article 90.1 Purpose "This code is not intended as a design specification or an instruction manual for untrained persons." The code doesn't define designed, certified and competent engineer, one could argue that a civil engineer is competent in the specific area of fault current studies or relay settings for a substation. Additionally, The term approved is already defined in Article 100

**Related Item**
Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

**Submitter Information Verification**

Submitter Full Name: Scott Humphrey
Organization: LA County DPW
Affiliation: Building and Safety
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 17 19:27:33 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR
Resolution: SR-976-NFPA 70-2015
Statement: Definition of "Engineering Supervision" has been deleted and actions required of the engineer supervising certain aspects of design have been included in the appropriate sections of the code. This is consistent with other uses of the term "engineering supervision" as used throughout the code.
Public Comment No. 626-NFPA 70-2015 [ Definition: Field Labeled (as applied to evaluated products... ]

Field Labeled, Labeling (as applied to evaluated products).
Equipment or materials to which has been attached a label, symbol, or other identifying mark of an field evaluation body (FEB) indicating the equipment or materials were evaluated and found to comply with requirements as described in an accompanying field evaluation report. [790, 2012]

Statement of Problem and Substantiation for Public Comment

Text changed to be the same as how it is referenced in the rest of the text of 691

Related Item
First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: City: State: Zip: Submittal Date: Sat Sep 12 17:43:29 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The new term does not match the past tense of the definition. CMP4 691 Task group corrected the term to “labeled” so this change is no longer needed.
Public Comment No. 715-NFPA 70-2015 [ Definition: Field Labeled (as applied to evaluated products... ]

Field Labeled (as applied to evaluated products).

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an field evaluation body (FEB) indicating the equipment or materials were evaluated and found to comply with requirements as described in an accompanying field evaluation report. [790, 2012]

Statement of Problem and Substantiation for Public Comment

This section should be removed. Field evaluations (FE) are not defined in the NEC and are subject to interpretation by both NRTL’s and non-NRTL’s (private test labs). At what level of review is the FE process? Is testing required? Is document review only required? How or who qualifies the certification body performing the evaluation? What are the certification requirements of the test lab? Is the evaluator a licensed architect or civil engineer?

Related Item

Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

Submitter Information Verification

Submitter Full Name: Scott Humphrey
Organization: LA County DPW
Affiliation: Building and Safety
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 19:38:33 EDT 2015

Committee Statement

Committee Action: Unknown Reason
Resolution: The substantiation was inadequate for removal of Field Labeling which is an important option to evaluate products in the field. NFPA 790 and 791 detail the requirements for field labeling of equipment.
Field Labeled (as applied to evaluated products).
Equipment or materials to which has been attached a label, symbol, or other identifying mark of an field evaluation body (FEB) indicating the equipment or materials were evaluated and found to comply with requirements as described in an accompanying field evaluation report. [790, 2012]

Statement of Problem and Substantiation for Public Comment
A reference to 790,2012 needs to be added. It is not clear what this refers to. Is it a NEC Code? ANSI standard? Other?

Related Item
First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification
Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 11:37:00 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-918-NFPA 70-2015
Statement: The definition is no longer extracted.
Public Comment No. 621-NFPA 70-2015 [ Definition: Generating Capacity. ]

Generating Capacity.
The sum of the parallel inverter rated maximum continuous output power at 40°C in kilowatts (kW).

Statement of Problem and Substantiation for Public Comment

The term Generating Capacity is not reference in the article and therefore does not require a definition.

Related Public Comments for This Document

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<tr>
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<tbody>
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Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 12 17:08:12 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The term “generating capacity” is used in the Scope of 691, therefore the definition should not be deleted.
Generating Station.
A plant wherein electric energy is produced by conversion from some other form of energy (e.g., chemical, nuclear, solar, wind, mechanical, or hydraulic) by means of suitable apparatus.

Statement of Problem and Substantiation for Public Comment
Generating Station is not referenced in the article and therefore does not need to be defined.

Related Item
First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification
Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 12 17:50:21 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The term “Generating Station” is used in the Scope of 691, therefore the definition should not be deleted.
**Utility Distribution System.**
An electrical system operated by a regulated utility company operating at an ac voltage greater than 1000 volts and less than 100,000 volts.

## Statement of Problem and Substantiation for Public Comment

This section should be removed. Article 90.2 Scope (B)(5) identifies installations not covered by the NEC to include installation under the exclusive control of an electric utility.

**Related Item**

Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

### Submitter Information Verification

<table>
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<tr>
<th>Submitter Full Name</th>
<th>Scott Humphrey</th>
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<tbody>
<tr>
<td>Organization</td>
<td>LA County</td>
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<tr>
<td>Affiliation</td>
<td>Building and Safety</td>
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<td>Street Address</td>
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### Committee Statement

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<th>Committee Action</th>
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<tr>
<td>Resolution</td>
<td>SR-979-NFPA 70-2015</td>
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<tr>
<td>Statement</td>
<td>The definitions of a Utility Distribution System and Utility Transmission System have been deleted since they have been removed from the scope.</td>
</tr>
</tbody>
</table>
Utility Transmission System.
An electrical system operated by a regulated utility company operating at a voltage equal to or greater than 100,000 volts.

Statement of Problem and Substantiation for Public Comment
This section should be removed. Article 90.2 Scope (B)(5) identifies installations not covered by the NEC to include installation under the exclusive control of an electric utility.

Related Item
Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

Submitter Information Verification
Submitter Full Name: Scott Humphrey
Organization: LA County
Affiliation: Building and Safety
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 20:24:40 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-979-NFPA 70-2015
Statement: The definitions of a Utility Distribution System and Utility Transmission System have been deleted since they have been removed from the scope.
Definitions (691.2): Utility Dis... to Utility Tra...

Utility Distribution System.
An electrical system operated by a regulated utility company operating at an ac voltage greater than 1000 volts and less than 100,000 volts.

Utility Transmission System.
An electrical system operated by a regulated utility company operating at a voltage equal to or greater than 100,000 volts.

Statement of Problem and Substantiation for Public Comment

Unfortunately there is no standard in the industry that supports these voltage levels to identify distribution verses transmission systems. I have seen the break between distribution and transmission set at a number of voltages between 30kV and 120kV. Distribution covers everything down to the 240/120V conductors on the pole outside a residence.

The definition is also not needed since all PV systems interconnected to a utility interconnect at some point in the utility transmission or distribution system. Perhaps a better way of defining the interconnection would be to interconnect at voltages greater than 1000V?

Related Public Comments for This Document

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<tr>
<th>Related Comment</th>
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<td>Public Comment No. 625-NFPA 70-2015 [Section No. 691.4]</td>
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<td>Public Comment No. 625-NFPA 70-2015 [Section No. 691.4]</td>
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Related Item

First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Sat Sep 12 17:26:15 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-979-NFPA 70-2015
Statement: The definitions of a Utility Distribution System and Utility Transmission System have been deleted since they have been removed from the scope.
691.4 Special Requirements for Large-Scale PV Electric Supply Stations.

Large-scale PV electric supply stations shall comply with the following:

1. Electrical circuits and equipment for large-scale PV electric supply stations are accessible only to qualified personnel needed for the maintenance and operation of the PV electric supply station. 

   Informational Note: Refer to NFPA 70E-2015, Standard for Electrical Safety in the Workplace, for electrical safety requirements.

2. Access to PV electric supply stations is restricted by fencing or other adequate means in accordance with 110.31. Field applied hazard markings shall be applied in accordance with 110.21(B).

3. The connection between the PV electric supply station and the utility transmission or distribution system is through medium- or high-voltage switch gear, substation, switch yard, or similar methods whose sole purpose is to safely and effectively interconnect the two systems.

4. The electrical loads within the supply station are only used to power auxiliary equipment for the generation of the PV power.

5. PV electric supply stations shall not be installed on buildings.

Statement of Problem and Substantiation for Public Comment

The reference to transmission and distribution removed from text. See comment on the definitions for Utility Transmission System and Utility Distribution System an comment on Scope.

Related Public Comments for This Document

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Related Item

First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 12 17:37:40 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-980-NFPA 70-2015
Statement: The SR adds language in the main paragraph to clarify that access to these sites is only available to authorized personnel. This can include guided tourists, inspectors, and qualified persons working on the station.

The panel modified language regarding the tasks of the qualified individuals.

The term "utility transmission and distribution system" is removed and the language modified to align with wording in 691.1. This eliminates the voltage sizing concerns but clarifies that the PV electric supply station is connected to a utility system that transfers electrical energy.

The term "large-scale" is added to the last item on the list to make it explicit that these systems are not installed on buildings.
Special Requirements for Large-Scale PV Electric Supply Stations.

Large-scale PV electric supply stations shall comply with the following:

1. Electrical circuits and equipment for large-scale PV electric supply stations are accessible only to qualified personnel needed for the maintenance and operation of the PV electric supply station. Informational Note: Refer to NFPA 70E-2015, Standard for Electrical Safety in the Workplace, for electrical safety requirements.

2. Access to PV electric supply stations is restricted by fencing or other adequate means in accordance with 110.31. Field applied hazard markings shall be applied in accordance with 110.21(B).

3. The connection between the PV electric supply station and the utility transmission or distribution system is through medium- or high-voltage switch gear, substation, switch yard, or similar methods whose sole purpose is to safely and effectively interconnect the two systems.

4. The electrical loads within the supply station are only used to power auxiliary equipment for the generation of the PV power.

5. PV electric supply stations shall not be installed on buildings.

Statement of Problem and Substantiation for Public Comment

I don't see any safety advantage to limiting access to something greater than qualified personnel only.

Related Item
First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 12 17:45:39 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-980-NFPA 70-2015
Statement: The SR adds language in the main paragraph to clarify that access to these sites is only available to authorized personnel. This can include guided tourists, inspectors, and qualified persons working on the station.

The panel modified language regarding the tasks of the qualified individuals.

The term “utility transmission and distribution system” is removed and the language modified to align with wording in 691.1. This eliminates the voltage sizing concerns but clarifies that the PV electric supply station is connected to a utility system that transfers electrical energy.

The term “large-scale” is added to the last item on the list to make it explicit that these systems are not installed on buildings.
691.4 Special Requirements for Large-Scale PV Electric Supply Stations.

Large-scale PV electric supply stations shall comply with the following:

1. Electrical circuits and equipment for large-scale PV electric supply stations are accessible only to qualified personnel needed for the maintenance and operation of the PV electric supply station.

   Informational Note: Refer to NFPA 70E-2015, Standard for Electrical Safety in the Workplace, for electrical safety requirements.

2. Access to PV electric supply stations is restricted by fencing or other adequate means in accordance with 110.31. Field applied hazard markings shall be applied in accordance with 110.21(B). Add language to increase the height of the fence surrounding a substation on privately owned land to 8 ft. to be in line (consistent) with OSHA requirements.

3. The connection between the PV electric supply station and the utility transmission or distribution system is through medium- or high-voltage switch gear, substation, switch yard, or similar methods whose sole purpose is to safely and effectively interconnect the two systems.

4. The electrical loads within the supply station are only used to power auxiliary equipment for the generation of the PV power.

5. PV electric supply stations shall not be installed on buildings. I'm not sure why we were referencing this as other portions of the code would limit the installation; however if a company like BOEING wanted to install several 1MW arrays on let's say 6 buildings why would we limit this installation (6MW)?

Statement of Problem and Substantiation for Public Comment

OSHA 1926.403(J)(1) & (2) says for equipment operating at over 600V “a wall screen or fence less than 8 feet in height is not considered adequate to prevent access.”

Related Item

Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

Submitter Information Verification

Submitter Full Name: Scott Humphrey
Organization: LA County
Affiliation: Building and Safety
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 20:29:12 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: PC 718 recommends adding language to increase the height of the fence surrounding a substation on privately owned land to 8 ft. to be in line (consistent) with OSHA requirements, however this would be inconsistent with the NEC requirements in 110.31. Suggest the commenter make the proposal to 110.31. PC 718 further recommends allowing systems covered by 691 to be allowed on buildings. The CMP is limiting the scope of 691 to ground mounted systems to ensure that only qualified individual have access to the systems. Limiting access on roof mounted systems is not feasible as the roof serves multiple purposes other than supporting a PV system. Regardless of size, roof mounted systems will need to comply with 690 rather than 691.
Public Comment No. 719-NFPA 70-2015 [Section No. 691.5]

691.5 Equipment Approval.
All electrical equipment shall be approved for installation by one of the following:

1. Listing and labeling
2. Field labeling
3. Where products complying with 691.5(1) or (2) are not available, by engineering review validating that the electrical equipment is tested to relevant standards or industry practice. This section should be removed. The ability to have properly listed equipment is available even for all the 230kV components and below, through the use of IEEE Standards. STP’s need to be developed.

Statement of Problem and Substantiation for Public Comment
Field evaluations and engineering review are not defined in Article 100 NFPA 70. Part 2 and 3 should be removed.

Related Item
Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

Submitter Information Verification
Submitter Full Name: Scott Humphrey
Organization: LA County DPW
Affiliation: Building and Safety
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 20:43:16 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Field Labeled is defined in Article 100. The commenter recommends removing 691.5(3) and suggests the creation of Standards Technical Panels that can work on the listing of equipment for which there is currently no standard. The purpose of allowing equipment to be selected by a competent engineer is that there is not an existing method to list all equipment that used in large scale PV systems, therefore alternative methods must be used until standards exist.
691.6 Design Under Engineering Supervision.

Documentation of the engineered design of the electric supply station shall be provided upon request of the AHJ. An additional independent engineering report detailing compliance of the design with applicable standards and industry practice shall be provided upon request of the AHJ. The independent engineer shall be a licensed professional engineer competent in the specific area under review and selected in mutual agreement between the AHJ and engineer of record. This documentation shall include details of conformance of the design with Article 690, and any alternative methods to Article 690, or other articles of this Code.

Statement of Problem and Substantiation for Public Comment

This proposed change helps to ensure that the independent engineer has experience with large scale PV and that both parties are fairly represented. We would like to avoid scenarios in which the AHJ has complete control over the selection of the independent engineer as this would not seem to meet the intent of the independent engineering report referenced within 691.6.

Related Item

First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: JASON SPOKES
Organization: SUNPOWER CORP
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:37:09 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-981-NFPA 70-2015
Statement: It is necessary to retain the statement regarding the need to document alternative methods that are used in the design of the large scale PV system.

It is the responsibility of the owner/installer to retain the independent engineer and ensure that they are competent to perform the evaluation, not the responsibility of the AHJ.
Statement of Problem and Substantiation for Public Comment

"Any alternatives" should be removed from this article as this is already defined in Article 90.2(C)

Related Item
Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

Submitter Information Verification
Submitter Full Name: Scott Humphrey
Organization: LA County DPW
Affiliation: Building and Safety
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 20:54:07 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-981-NFPA 70-2015
Statement: It is necessary to retain the statement regarding the need to document alternative methods that are used in the design of the large scale PV system.

It is the responsibility of the owner/installer to retain the independent engineer and ensure that they are competent to perform the evaluation, not the responsibility of the AHJ.
691.7 Installation Under Engineering Supervision.

Documentation of the electric supply station installation shall be provided upon request of the AHJ. An additional independent engineering report detailing compliance with applicable standards and industry practice shall be provided upon request of the AHJ. The independent engineer shall be a licensed professional engineer competent in the specific area under review and selected in mutual agreement between the AHJ and engineer of record. This documentation shall include details of conformance of the installation with this Code, applicable standards, and industry practice. This documentation, where requested, shall be available prior to the commercial operation of the station.

Statement of Problem and Substantiation for Public Comment

This proposed change helps to ensure that the independent engineer has experience with large scale PV and that both parties are fairly represented. We would like to avoid scenarios in which the AHJ has complete control over the selection of the independent engineer as this would not seem to meet the intent of the independent engineering report referenced within 691.7.

Related Item
First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: JASON SPOKES
Organization: SUNPOWER CORP
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:12:59 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-982-NFPA 70-2015
Statement: The SR modifies the language to better reflect the actions that will be taken to confirm that the PV system was built in conformance to the design.

The language has also been revised to better articulate the process for choosing an independent engineer.
691.7 . Installation Under Engineering Supervision.

Documentation of the electric supply station installation shall be provided upon request of the AHJ. An additional independent engineering report detailing compliance with applicable standards and industry practice shall be provided upon request of the AHJ. This documentation shall include details of conformance of the installation with this Code, applicable standards, and industry practice. This documentation, where requested, shall be available prior to the commercial operation of the station.

Statement of Problem and Substantiation for Public Comment

This requirement for engineering supervision of installation will create a need for a service that a reasonable engineering company or engineer will not want to provide.

Engineers traditionally do not supervise construction projects or contractors and nowhere else in the NEC is it called out that an engineer will supervise a construction project. Engineers do provide construction observation which is performing site visits at appropriate intervals to inspect the work for general conformance with the design, but that is not an inspection or supervision.

Related Item
First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Sep 12 17:58:42 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-982-NFPA 70-2015
Statement: The SR modifies the language to better reflect the actions that will be taken to confirm that the PV system was built in conformance to the design.

The language has also been revised to better articulate the process for choosing an independent engineer.
691.7  Installation Under Engineering Supervision.

Documentation of the electric supply station installation shall be provided upon request of the AHJ. An additional independent engineering report detailing compliance with applicable standards and industry practice shall be provided upon request of the AHJ. This documentation shall include details of conformance of the installation with this Code, applicable standards, and industry practice. This documentation, where requested, shall be available prior to the commercial operation of the station. This should be removed (entire section) as all systems should be subject to plan check approval. This document would be more in line with something for the owner as part of the conditions of acceptability.

Statement of Problem and Substantiation for Public Comment

This should be removed as all systems should be subject to plan check approval. This document would be more in line with something for the owner as part of the conditions of acceptability but not an NFPA 70 requirement.

Related Item

Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

Submitter Information Verification

Submitter Full Name: Scott Humphrey
Organization: LA County DPW
Affiliation: Building and Safety
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 20:57:37 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-982-NFPA 70-2015
Statement: The SR modifies the language to better reflect the actions that will be taken to confirm that the PV system was built in conformance to the design.

The language has also been revised to better articulate the process for choosing an independent engineer.
691.8 Direct Current Operating Voltage.

For large-scale PV electric supply stations operating at a dc voltage above 1000 volts, calculations shall be performed under engineering supervision. PV system dc conductors and equipment with a maximum voltage of 1500V or less do not need to comply with Article 490.

Statement of Problem and Substantiation for Public Comment

In PI#3181 it was proposed to raise the voltage limit in the scope of Art. 490 from 1000V to 2000V. The substantiation for PI#3181 pointed out that product standards for HV equipment begin at 2000V and that recent changes to product standards for low voltage equipment have raised requirements suitable for higher voltages up to 1500V or 2000V in some cases. In particular, for the PV industry there has been a lot of work done to revise product standards for switches, circuit breakers, fuses, modules, power conversion, etc. to cover PV system voltages up to at least 1500V. Such systems should not have to use the approaches in Art. 490, which are intended to address medium voltage installations at 2.4kV and higher using HV equipment. The burden such requirements place on PV systems are not justified at system voltages of 1500V or less using appropriately rated and approved equipment.

PI#3181 was resolved, but in their Resolution statement the CMP wrote "Increasing the upper limit may be practical in microenvironments such as those covered in Articles 690 or 694..." which indicates that it would be appropriate to narrow the scope of PI#3181 to just PV, and move it to Art. 690 and 691, which we are now doing with this Public Comment and a related one for a revision to 690.7.

Note that we would like to get both revisions accepted: this one to 691.8 and the related one for 690.7. However if the CMP feels that they cannot accept this 691.8 proposal, please consider the 690.7 proposal separately and on its own merit.

Related Public Comments for This Document

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<td>Public Input No. 2947-NFPA 70-2014 [Section No. 215.2(A)]</td>
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<td>Public Input No. 3112-NFPA 70-2014 [Section No. 312.11(A)(3)]</td>
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Submitter Information Verification

Submitter Full Name: JIM EICHNER
Organization: SCHNEIDER ELECTRIC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 16:06:35 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-983-NFPA 70-2015
Statement: 691.6 allows design of large scale PV systems to be performed under engineering supervision and requires documentation to be provided to the AHJ to demonstrate compliance with Article 690 or any alternative methods to Article 690. Article 690 includes information about listed equipment, rated 1500Vdc or less not being required to comply with 490.

The distinction between <=1kV and >1kV systems has been removed and replaced with a reference to 691.6.
691.8 Direct Current Operating Voltage.
For large-scale PV electric supply stations operating at a dc voltage above 1000 volts, calculations shall be performed under engineering supervision.

Statement of Problem and Substantiation for Public Comment

We support this language in principle but propose to strike/delete it because we do not believe it adds substance and may actually cause confusion for the following reasons:

1) 691.6 already allows design of large scale PV systems to be performed under engineering supervision and requires documentation to be provided to the AHJ to demonstrate compliance with Article 690 or any alternative methods to Article 690. Calling out a small subset of a large scale PV system design (i.e. max dc operating voltage calculation) and requiring that to be calculated under engineering supervision appears to be redundant.

2) Stating that DC system voltages >1kV shall be calculated under engineering supervision creates a distinction between systems <=1kV and systems >1kV and implies these two scenarios might be treated differently. We believe the intent of Article 691 is to allow maximum DC operating voltages (less than or greater than 1kV) for large scale PV systems to be calculated under engineering supervision. Therefore the distinction between <=1kV and >1kV systems should be removed.

3) 690.7 allows DC operating voltages to exceed 1kV under certain conditions, yet does not require calculation under engineering supervision for those systems that exceed 1kV.

Related Item
First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: JASON SPOKES
Organization: SUNPOWER CORP
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 14:22:32 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-983-NFPA 70-2015
Statement: 691.6 allows design of large scale PV systems to be performed under engineering supervision and requires documentation to be provided to the AHJ to demonstrate compliance with Article 690 or any alternative methods to Article 690. Article 690 includes information about listed equipment, rated 1500Vdc or less not being required to comply with 490.

The distinction between <=1kV and >1kV systems has been removed and replaced with a reference to 691.6.
Statement of Problem and Substantiation for Public Comment

This should be removed as the calculations for all aspects of the system are no different from any electrical system to include the medium voltage (just larger numbers). Seems obvious that an engineer would be involved with the design lets keep the book (NEC) to one volume and save a tree.

Related Item
Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

Submitter Information Verification

Submitter Full Name: Scott Humphrey
Organization: LA County DPW
Affiliation: Building and Safety
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 21:03:05 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-983-NFPA 70-2015
Statement: 691.6 allows design of large scale PV systems to be performed under engineering supervision and requires documentation to be provided to the AHJ to demonstrate compliance with Article 690 or any alternative methods to Article 690. Article 690 includes information about listed equipment, rated 1500Vdc or less not being required to comply with 490.

The distinction between <=1kV and >1kV systems has been removed and replaced with a reference to 691.6.
691.9 Disconnection of Photovoltaic Equipment.

Isolating devices shall be permitted to be more than 1.8 m (6 ft) from the equipment where written safety procedures and conditions of maintenance and supervision ensure that only qualified persons service the equipment.

Informational Note: For information on lockout/tagout procedures, see NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Buildings whose sole purpose is to house and protect supply station equipment shall not be required to comply with 690.12.

Written standard operating procedures shall be available at the site detailing necessary shutdown procedures in the event of an emergency.

*Written safety procedures should be replaced with a sign/plaque/directory; personal experience, no one reads the written procedures. With that said again this is more in line with a document used by O & M and presented to the owner. (Are isolating devices defined in the NEC? Are they to be listed? If so, to what standard?)*

Statement of Problem and Substantiation for Public Comment

Written safety procedures should be replaced with a sign/plaque/directory; personal experience, no one reads the written procedures. With that said again this is more in line with a document used by O & M and presented to the owner. (Are isolating devices defined in the NEC? Are they to be listed? If so, to what standard?)

It seems we are adding language with no direction and/or definition of the components we are referring to. Suggest this section be removed, very vague as to component requirements and safe operating procedures for the disconnecting means and its design and certification requirements.

Related Item

Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

Submitter Information Verification

Submitter Full Name: Scott Humphrey
Organization: LA County DPW
Affiliation: Building and Safety

Street Address:
City:
State:
Zip:

Submittal Date: Thu Sep 17 21:11:51 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: In large-scale PV electric supply stations, the AC disconnect is located at the switchgear, which can be up to a mile away from the dozens of inverters at the site. Due to the large number of inverters in a large scale PV supply station, it is not possible to have all inverters in sight of the switchgear and their associated disconnects. The existing language does not prohibit plaques or directories from being provided.
Public Comment No. 728-NFPA 70-2015 [Section No. 691.10]

691.10 Arc-Fault Mitigation.

PV systems that do not comply with the requirements of 690.11 shall be designed under engineering supervision that includes fire mitigation plans to address dc arc-faults.

Remove in its entirety as most large solar installations have an O & M Building which may or may not have PV on the roof and would be required to meet this requirement; these buildings are occupied structures covered under the Building Code and contain sleeping quarters.

Statement of Problem and Substantiation for Public Comment

Remove in its entirety as most large solar installations have an O & M Building which may or may not have PV on the roof and would be required to meet this requirement; these buildings are occupied structures covered under the Building Code and contain sleeping quarters.

Related Item

Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

Submitter Information Verification

Submitter Full Name: Scott Humphrey  
Organization: LA County DPW  
Affiliation: Building and Safety  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu Sep 17 21:22:04 EDT 2015

Committee Statement

Committee Action: Rejected  
Resolution: The scope of 691 is limited to ground mounted PV. If, within a Large Scale PV Generating Station, there were a building, such as an O&M building, which was designed for continuous human occupancy, all requirements of 690 would apply to the PV system installed on that building.
691.11 Fence Grounding.
Fence grounding requirements and details shall be provided under engineering supervision.

Statement of Problem and Substantiation for Public Comment

We support this language in principle but propose to strike/delete it because we do not believe it adds substance and may actually cause confusion for the following reasons:

1) 691.6 already allows design of large scale PV systems to be performed under engineering supervision and requires documentation to be provided to the AHJ to demonstrate compliance with Article 690 or any alternative methods to Article 690. Calling out a small subset of a large scale PV system design (i.e. fence grounding) and requiring the details to be provided under engineering supervision appears to be redundant.

2) Stating that fence grounding details must be provided under engineering supervision creates a distinction between fence grounding and other system grounding and implies these two aspects of large scale PV system grounding might be treated differently. We believe the intent of Article 691 is to allow large scale PV system grounding to be designed under engineering supervision. Therefore the distinction between fence grounding and all other large scale PV system grounding should be removed.

Related Item
First Revision No. 7511-NFPA 70-2015 [New Section after 690.74(A)]

Submitter Information Verification

Submitter Full Name: JASON SPOKES
Organization: SUNPOWER CORP
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 16:04:55 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-985-NFPA 70-2015
Statement: 691.6 allows design of large scale PV systems to be performed under engineering supervision and requires documentation to be provided to the AHJ.
**Public Comment No. 729-NFPA 70-2015 [ Section No. 691.11 ]**

691.11 Fence Grounding.

Fence grounding requirements and details shall be provided under engineering supervision.

*Limit fence grounding to only areas where conductors travel over or under a fence and use approved isolators to limit migration of fault current in the construction of the build of the fence*

**Statement of Problem and Substantiation for Public Comment**

Limit fence grounding to only areas where conductors travel over or under a fence and use approved isolators to limit migration of fault current in the construction of the build of the fence.

The danger is where the feeder conductors operating at over 600v to ground travel over or under fenced in areas. These areas should also be designed with isolators within a specified distance of the conductors. Lets not require the entire fence to be grounded which could be several square miles of fencing.

**Related Item**

Public Input No. 3289-NFPA 70-2014 [New Section after 690.91]

**Submitter Information Verification**

Submitter Full Name: Scott Humphrey  
Organization: LA County DPW  
Affiliation: Building and Safety  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu Sep 17 21:25:16 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR  
Resolution: SR-985-NFPA 70-2015  
Statement: 691.6 allows design of large scale PV systems to be performed under engineering supervision and requires documentation to be provided to the AHJ.
692.1 Scope.
This article applies to fuel cell systems. These systems may be interactive with other electrical power production sources or stand-alone or both, and may or may not be connected to electric energy storage systems such as batteries. These systems may have ac and or dc output(s) for utilization.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs that the last sentence of 692.1 be rewritten to comply with the NEC Style Manual that discourages the use of "and/or."

Related Item
First Revision No. 1007-NFPA 70-2015 [Section No. 692.1]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 12:07:40 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-919-NFPA 70-2015
Statement: The revised text clarifies that the systems may have any combination of ac and dc or a combination of these outputs for utilization.
Public Comment No. 1399-NFPA 70-2015 [Section No. 692.6]

Listing Requirement.
The fuel cell system shall be listed and labeled or field labeled for its intended application.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

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As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
- Public Input No. 946-NFPA 70-2014 [Section No. 692.6]
- First Revision No. 1015-NFPA 70-2015 [Section No. 692.6]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
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<tr>
<td>Resolution:</td>
<td>SR-920-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement:</td>
<td>Listed equipment is also required to be labeled to assist AHJs in determining whether the equipment is listed during an inspection.</td>
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Public Comment No. 1066-NFPA 70-2015 [Section No. 694.1]

694.1 Scope.

This article applies to wind (turbine) electric systems that consist of one or more wind electric generators and their related alternators, inverters, controllers, and associated equipment.

Informational Note: Some wind electric systems are interactive with other electric power sources and some are standalone systems. Some systems have ac output and some have dc output. Some systems contain electrical energy storage, such as batteries.

Figure 694.1(a) Identification of Wind Electric System Components — Interactive System.

Figure 694.1(b) Identification of Wind Electric System Components — Stand-Alone System.

Statement of Problem and Substantiation for Public Comment

The general term "generator" encompasses both the DC generator and the AC alternator. Either of these can be used in a wind system. The way the text is written it limits wind generators to AC alternators.

Figure 694.1(a) uses "Outlet" for the output of the inverter and they could be misinterpreted to mean that an electrical outlet is used. Art. 690 uses "Electric Power Production and Distribution Network" for this call out. The figure is too specific by showing only an alternator based system and there are other types of systems.

Figure 694.1(b) is too specific, it shows an AC coupled alternator based system and there are DC generator based systems and AC coupled systems.

Related Item
First Revision No. 943-NFPA 70-2015 [Section No. 694.1]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 14:49:57 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-922-NFPA 70-2015
Statement: The addition of the word “generators” to the scope clarifies the definition and allows for both alternators and generators (including ac and dc types) in the related equipment list.

The comment expressed in voting on FR 943 in regards to Figure 694.1(A). Stated: "The word to the right of the Inverter box in Figure 694.1A was changed to 'outlet'." This is incorrect. It should be changed to the NEC defined term "Electric Power Production and Distribution Network", as has also been done in the introductory figures to Article 690.
694.1 Scope.
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Informational Note: Some wind electric systems are interactive with other electric power sources and some are standalone systems. Some systems have ac output and some have dc output. Some systems contain electrical energy storage, such as batteries.

Figure 694.1(a) Identification of Wind Electric System Components — Interactive System.

Figure 694.1(b) Identification of Wind Electric System Components — Stand-Alone System.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee advises that article scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the panel action. The Correlating Committee directs that further consideration be given to the comment expressed in voting on FR 943 in regards to Figure 694.1(A).

Related Item
First Revision No. 943-NFPA 70-2015 [Section No. 694.1]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: City: State: Zip:
Submittal Date: Tue Sep 29 12:12:01 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-922-NFPA 70-2015
Statement: The addition of the word “generators” to the scope clarifies the definition and allows for both alternators and generators (including ac and dc types) in the related equipment list.

The comment expressed in voting on FR 943 in regards to Figure 694.1(A). Stated: “The word to the right of the Inverter box in Figure 694.1A was changed to ‘outlet.’” This is incorrect. It should be changed to the NEC defined term “Electric Power Production and Distribution Network”, as has also been done in the introductory figures to Article 690.
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Figure 694.1(b) Identification of Wind Electric System Components — Stand-Alone System.

Additional Proposed Changes

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<td>fig_1a.jpg</td>
<td>Revised Figure 694.1(a)</td>
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Statement of Problem and Substantiation for Public Comment

Figure shows output of interactive inverter feeding an outlet. This is incorrect. An interactive inverter feeds the utility grid, aka Electric Power Production and Distribution Network.

Related Item

First Revision No. 943-NFPA 70-2015 [Section No. 694.1]

Submitter Information Verification

Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
Affiliation: American Wind Energy Association
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 14 21:22:17 EDT 2015

Committee Statement

Rejected but see related SR
<table>
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Public Comment No. 808-NFPA 70-2015 [Definition: Guy.]

Guy (as related to wind electrical systems).
A cable that mechanically supports a wind turbine tower.

Statement of Problem and Substantiation for Public Comment

All NFPA definitions are incorporated without change or comment into the NFPA Glossary of terms which simply indicates the code or standard where the definition originates. The definition of guy in the NEC can refer to multiple occupations or products and is not unique to article 694. If the panel wants to identify it in a different way, that would still comply with the concept that "guy" is too generic a term to stay as a definition that applies solely to a wind turbine cable. I can imagine multiple other concepts to which the term "guy" applies.

Related Item
Public Input No. 2467-NFPA 70-2014 [Definition: Guy.]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 20:02:07 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-923-NFPA 70-2015
Statement: The definition is unnecessary. The term used in 694 is "tower guy," which qualifies the generic term.
Public Comment No. 809-NFPA 70-2015 [Definition: Tower.]

**Tower (as applied to wind electric systems).**
A pole or other structure that supports a wind turbine.

Statement of Problem and Substantiation for Public Comment

All NFPA definitions are incorporated without change or comment into the NFPA Glossary of terms which simply indicates the code or standard where the definition originates. The definition of tower in the NEC can refer to multiple structures and is not unique to article 694. If the panel wants to identify it in a different way, that would still comply with the concept that "tower" is too generic a term to stay as a definition that applies solely to a structure that supports a wind turbine.

**Related Item**

Public Input No. 2468-NFPA 70-2014 [Definition: Tower]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Sep 20 20:05:37 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-924-NFPA 70-2015
Statement: The definition only pertains to wind electric systems.
Public Comment No. 1371-NFPA 70-2015 [Section No. 694.7(B)]

(B) Equipment.

Wind electric systems shall be listed and or field labeled for the application. Wind electric systems under development or undergoing evaluation and testing for type certification and/or listing shall be permitted to be operated under conditions of engineering supervision in a controlled location with access limited to qualified personnel.

Statement of Problem and Substantiation for Public Comment

Field labeling is a common activity for large wind turbines, as they are often build as a batch using common components, but with some variation from batch to batch. It is impractical to type test or fully fix the design of large-scale wind turbines (this applies to listing of the overall assembly. In general, components are certified for the application). Field-labeling is sometimes also used for intermediate and small wind turbines, but they are more generally type-tested and listed. Questions regarding appropriate wording for listing and labeling were raised across the board for all articles in this code cycle. Wind turbines are a special case where either listing OR field labeling is appropriate.

The additional sentence regarding turbines under development is also important as a wind turbine cannot be listed or certified without several months of operating at a wide range of wind speeds. This certification testing is performed under engineering supervision in an access-limited environment (for example at the National Wind Test Center in Boulder, CO). Provision for such testing is necessary as the turbines still need to feed the power grid during this time, and so are subject to inspection and the NEC. Utility Interactive inverters are required to be NRTL listed to applicable ANSI standards and interconnection must comply with Article 705.

Related Item

Public Input No. 949-NFPA 70-2014 [Section No. 694.60]

Submitter Information Verification

Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
Affiliation: American Wind Energy Association
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 01:42:47 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-925-NFPA 70-2015
Statement: Field labeling is a common activity for large wind turbines, as they are often build as a batch using common components, but with some variation from batch to batch. It is impractical to type test or fully fix the design of large-scale wind turbines (this applies to listing of the overall assembly - in general, individual components are certified for the application). Field-labeling is sometimes also used for intermediate and small wind turbines, but they are more generally type-tested and listed. Questions regarding appropriate wording for listing and labeling were raised across the board for all articles in this code cycle. Wind turbines are a special case where either listing OR field labeling is appropriate and necessary.

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Public Comment No. 1403-NFPA 70-2015 [Section No. 694.7(F)]

(F) Poles or Towers Supporting Wind Turbines Used as a Raceway.
A pole or tower shall be permitted to be used as a raceway if evaluated as part of the listing for the wind turbine or otherwise shall be listed and labeled or field labeled for the purpose.

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Related Item
Public Input No. 947-NFPA 70-2014 [Section No. 694.7(F)]
Public Input No. 915-NFPA 70-2014 [Section No. 517.61(A)(2)]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
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Public Comment No. 1862-NFPA 70-2015 [ New Section after 694.15 ]

See Correlating Note below

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to reconsider and correlate the deletion of 694.18, as Code-Making Panel 13 did not approve the proposed new Article 710 (Microgrids and Stand-Alone Systems).

Related Item
First Revision No. 916-NFPA 70-2015 [Section No. 694.18]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:13:01 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The requirements of 694.18 in the 2014 NEC were moved in the first draft to Article 705. CMP4 then moved them to a new Article 710 (Stand-Alone Systems) in the second draft. The new Article makes this CC request unnecessary.
Public Comment No. 1405-NFPA 70-2015 [Section No. 694.15(C)]

(C) Direct-Current Rating.
Overcurrent devices, either fuses or circuit breakers, used in any dc portion of a wind electric system shall be listed and labeled for use in dc circuits and shall have appropriate voltage, current, and interrupting ratings.

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Related Item
Public Input No. 948-NFPA 70-2014 [Section No. 694.15(C)]
First Revision No. 1021-NFPA 70-2015 [Section No. 694.15(C)]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
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**Committee Statement**

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| Statement: | The addition of the words “and labeled” provides information to the AHJ regarding the suitability of equipment they encounter. |
(B) Connection Through Disconnecting Means and Overcurrent Device.

(1) Number of Disconnecting Means.

(a) General. A single disconnecting means and associated overcurrent protective device(s) shall be permitted to be installed between the fire pump power source(s) and one of the following: [20:9.1.2]

1. A listed fire pump controller
2. A listed fire pump power transfer switch
3. A listed combination fire pump controller and power transfer switch

(b) Feeder Sources. For systems installed under the provisions of 695.3(C) only, additional disconnecting means and the associated overcurrent protective device(s) shall be permitted.

(c) On-Site Standby Generator. Where an on-site standby generator is used to supply a fire pump, an additional disconnecting means and an associated overcurrent protective device(s) shall be permitted.

(2) Overcurrent Device Selection.

Overcurrent devices shall comply with 695.4(B)(2)(a) or (b).

(a) Individual Sources. Overcurrent protection for individual sources shall comply with 695.4(B)(2)(a)(1) or (2).

1. Overcurrent protective device(s) shall be rated to carry indefinitely the sum of the locked-rotor current of the largest fire pump motor and the pressure maintenance pump motor(s) and the full-load current of all of the other pump motors and associated fire pump accessory equipment when connected to this power supply. Where the locked-rotor current value does not correspond to a standard overcurrent device size, the next standard overcurrent device size shall be used in accordance with 240.6. The requirement to carry the locked-rotor currents indefinitely shall not apply to conductors or devices other than overcurrent devices in the fire pump motor circuit(s). The requirement to carry the locked rotor currents indefinitely shall not apply to feeder overcurrent protective devices installed in accordance with 695.3(C). [20:9.2.3.4]

(2) Overcurrent protection shall be provided by an assembly listed for fire pump service and complying with the following:

a. The overcurrent protective device shall not open within 2 minutes at 600 percent of the full-load current of the fire pump motor(s).

b. The overcurrent protective device shall not open with a re-start transient of 24 times the full-load current of the fire pump motor(s).

c. The overcurrent protective device shall not open within 10 minutes at 300 percent of the full-load current of the fire pump motor(s).

d. The trip point for circuit breakers shall not be field adjustable. [20:9.2.3.4.1]

(b) On-Site Standby Generators. Overcurrent protective devices between an on-site standby generator and a fire pump controller shall be selected and sized to allow for instantaneous pickup of the full pump room load, but shall not be larger than the value selected to comply with 430.62 to provide short-circuit protection only. [20:9.6.1.1]
Disconnecting Means.

All disconnecting devices that are unique to the fire pump loads shall comply with items (a) through (e).

(a) **Features and Location — Normal Power Source.** The disconnecting means for the normal power source shall comply with all of the following:

1. Be identified as suitable for use as service equipment.
2. Be lockable in the closed position. The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed.
3. Not be located within the same enclosure, panelboard, switchboard, switchgear, or motor control center, with or without common bus, that supplies loads other than the fire pump.
4. Be located sufficiently remote from other building or other fire pump source disconnecting means such that inadvertent operation at the same time would be unlikely.

   *Exception to 4: For a multibuilding campus-style complex(s) installed under the provisions of 695.3(C), only the requirements in 695.4(B)(3) (a)(2) shall apply for normal power source disconnects.*

(b) **Features and Location — On-Site Standby Generator.** The disconnecting means for an on-site standby generator(s) used as the alternate power source shall be installed in accordance with 700.10(B)(5) for emergency circuits and shall be lockable in the closed position. The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed.

(c) **Disconnect Marking.** The disconnecting means shall be marked “Fire Pump Disconnecting Means.” The letters shall be at least 25 mm (1 in.) in height, and they shall be visible without opening enclosure doors or covers.

(d) **Controller Marking.** A placard shall be placed adjacent to the fire pump controller, stating the location of this disconnecting means and the location of the key (if the disconnecting means is locked).

(e) **Supervision.** The disconnecting means shall be supervised in the closed position by one of the following methods:

1. Central station, proprietary, or remote station signal device
2. Local signaling service that causes the sounding of an audible signal at a constantly attended point
3. Locking the disconnecting means in the closed position

(f) Sealing of disconnecting means and approved weekly recorded inspections when the disconnecting means are located within fenced enclosures or in buildings under the control of the owner

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**Statement of Problem and Substantiation for Public Comment**

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 3653.

**Related Item**

First Revision No. 3653-NFPA 70-2015 [Section No. 695.4(B)]

**Submitter Information Verification**

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 20eri St.
City: Quincy
State: MA
Zip: 02269
Submittal Date: Tue Sep 29 12:15:42 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR
Resolution: SR-3622-NFPA 70-2015
Statement: This revision clarifies that the exception applies to all of 695.4(B)(3)(a) and not just to 695.4(B)(3)(a)(4).
Public Comment No. 1412-NFPA 70-2015 [ Section No. 695.4(B)(1) ]

(1) Number of Disconnecting Means.

   (a) General. A single disconnecting means and associated overcurrent protective device(s) shall be permitted to be installed between the fire pump power source(s) and one of the following: [20:9.1.2]

(2) A listed and labeled fire pump controller

(3) A listed and labeled fire pump power transfer switch

(4) A listed and labeled combination fire pump controller and power transfer switch

(e) Feeder Sources. For systems installed under the provisions of 695.3(C) only, additional disconnecting means and the associated overcurrent protective device(s) shall be permitted.

(f) On-Site Standby Generator. Where an on-site standby generator is used to supply a fire pump, an additional disconnecting means and an associated overcurrent protective device(s) shall be permitted.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.
Related Item

Public Input No. 950-NFPA 70-2014 [Section No. 695.4(A)]
First Revision No. 3653-NFPA 70-2015 [Section No. 695.4(B)]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 10:34:35 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel recognizes that the correlating committee reversed actions to add "listed and labeled" in all cases and a task group is reviewing this issue for the next NEC cycle.
Public Comment No. 210-NFPA 70-2015 [Section No. 695.4(B)(3)]

(3) Disconnecting Means.  
All disconnecting devices that are unique to the fire pump loads shall comply with items (a) through (e).

(a) Features and Location — Normal Power Source. The disconnecting means for the normal power source shall comply with all of the following: [20:9.2.3.1]

(2) Be identified as suitable for use as service equipment.

(3) Be lockable in the closed position. The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed.

(4) Not be located within the same enclosure, panelboard, switchboard, switchgear, or motor control center, with or without common bus, that supplies loads other than the fire pump.

(5) Be located sufficiently remote from other building or other fire pump source disconnecting means such that inadvertent operation at the same time would be unlikely.

Exception to 695.4(B)(3)(a): For a multibuilding campus-style complex(s) installed under the provisions of 695.3(C), only the requirements in 695.4(B)(3)(a)(2) shall apply for normal power source disconnects.

(f) Features and Location — On-Site Standby Generator. The disconnecting means for an on-site standby generator(s) used as the alternate power source shall be installed in accordance with 700.10(B)(5) for emergency circuits and shall be lockable in the closed position. The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed.

(g) Disconnect Marking. The disconnecting means shall be marked “Fire Pump Disconnecting Means.” The letters shall be at least 25 mm (1 in.) in height, and they shall be visible without opening enclosure doors or covers. [20:9.2.3.1(5)]

(h) Controller Marking. A placard shall be placed adjacent to the fire pump controller, stating the location of this disconnecting means and the location of the key (if the disconnecting means is locked). [20:9.2.3.2]

(i) Supervision. The disconnecting means shall be supervised in the closed position by one of the following methods:

(10) Central station, proprietary, or remote station signal device
(11) Local signaling service that causes the sounding of an audible signal at a constantly attended point
(12) Locking the disconnecting means in the closed position

(m) Sealing of disconnecting means and approved weekly recorded inspections when the disconnecting means are located within fenced enclosures or in buildings under the control of the owner [20:9.2.3.3]

Statement of Problem and Substantiation for Public Comment

The exception does not apply to 695.4(B)(3)(4). It applies to 695.4(B)(3)(a)

Related Item

First Revision No. 3653-NFPA 70-2015 [Section No. 695.4(B)]

Submitter Information Verification

Submitter Full Name: LAWRENCE FORSHNER
Organization: BARD RAO ATHANAS CONSULTING
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jul 13 10:55:28 EDT 2015

Committee Statement
<table>
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<th><strong>Committee Action:</strong></th>
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<tr>
<td><strong>Resolution:</strong></td>
<td>SR-3622-NFPA 70-2015</td>
</tr>
<tr>
<td><strong>Statement:</strong></td>
<td>This revision clarifies that the exception applies to all of 695.4(B)(3)(a) and not just to 695.4(B)(3)(a)(4).</td>
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</table>
(3) Disconnecting Means.

All disconnecting devices that are unique to the fire pump loads shall comply with items (a) through (e).

(a) Features and Location — Normal Power Source. The disconnecting means for the normal power source shall comply with all of the following: [20:9.2.3.1]

(2) Be identified as suitable for use as service equipment.

(3) Be lockable in the closed position. The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed.

(4) Not be located within the same enclosure, panelboard, switchboard, switchgear, or motor control center, with or without common bus, that supplies loads other than the fire pump.

(5) Be located sufficiently remote from other building or other fire pump source disconnecting means such that inadvertent operation at the same time would be unlikely.

Exception to

4

(1)

(a) For a multibuilding campus-style complex(s) installed under the provisions of 695.3(C), only the requirements in 695.4(B)(3)(a)(2) shall apply for normal power source disconnects.

(6) Features and Location — On-Site Standby Generator. The disconnecting means for an on-site standby generator(s) used as the alternate power source shall be installed in accordance with 700.10(B)(5) for emergency circuits and shall be lockable in the closed position. The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed.

(g) Disconnect Marking. The disconnecting means shall be marked “Fire Pump Disconnecting Means.” The letters shall be at least 25 mm (1 in.) in height, and they shall be visible without opening enclosure doors or covers. [20:9.2.3.1(5)]

(h) Controller Marking. A placard shall be placed adjacent to the fire pump controller, stating the location of this disconnecting means and the location of the key (if the disconnecting means is locked). [20:9.2.3.2]

(i) Supervision. The disconnecting means shall be supervised in the closed position by one of the following methods:

(10) Central station, proprietary, or remote station signal device

(11) Local signaling service that causes the sounding of an audible signal at a constantly attended point

(12) Locking the disconnecting means in the closed position

(m) Sealing of disconnecting means and approved weekly recorded inspections when the disconnecting means are located within fenced enclosures or in buildings under the control of the owner [20:9.2.3.3]

Statement of Problem and Substantiation for Public Comment

Note that the terra software does what it wants to the existing text.

The intent of this comment is to revise the exception following 695.4(B)(3)(a). The editors changed the scope of the exception to apply to only list item (4) when it applies to all of 695.4(B)(3)(a).

Related Item
First Revision No. 3653-NFPA 70-2015 [Section No. 695.4(B)]

Submitter Information Verification

Submitter Full Name: James Dollard
Organization: IBEW Local Union 98
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3622-NFPA 70-2015
Statement: This revision clarifies that the exception applies to all of 695.4(B)(3)(a) and not just to 695.4(B)(3)(a)(4).
Feeders.

Fire pump supply conductors on the load side of the final disconnecting means and overcurrent device(s) permitted by 695.4(B), or conductors that connect directly to an on-site standby generator, shall comply with all of the following:

(a) **Independent Routing.** The conductors shall be kept entirely independent of all other wiring.

(b) **Associated Fire Pump Loads.** The conductors shall supply only loads that are directly associated with the fire pump system.

(c) **Protection from Potential Damage.** The conductors shall be protected from potential damage by fire, structural failure, or operational accident.

(d) **Inside of a Building.** Where routed through a building, the conductors shall be protected from fire for 2 hours, shall be installed using one of the following methods:

The cable or raceway is

1. Be encased in a minimum 50mm(in) of concrete.

2. Be a listed fire resistive cable system.

   **Informational Note 1:** Fire resistive cables are tested to ANSI/UL 2196, Tests for Fire Resistive Cables.

   **Informational Note 2:** The listing organization provides information for fire resistive cable systems on proper installation requirements to maintain the fire rating.

1. Be protected by a fire rated assembly listed to achieve a minimum fire rating of 2 hours and dedicated to the fire pump circuit(s).

2. Be a listed electrical circuit protective system.

   **Informational Note 1:** Electrical circuit protective systems could include, but not be limited to, thermal barriers or a protective shaft and are tested to UL 1724, Fire Tests for Electrical Circuit Protection Systems.

   **Exception to (A)(2)(d):** The supply conductors located in the electrical equipment room where they originate and in the fire pump room shall not be required to have the minimum 2-hour fire separation or fire resistance rating, unless otherwise required by 700.10(D) of this Code.

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**Additional Proposed Changes**

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<td>695.6(A)(2)(d) document</td>
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**Statement of Problem and Substantiation for Public Comment**

See attached document for correct mark ups.

The revisions that were accepted in 695.6(A)(2)(d) changed time-proven methods of providing fire and mechanical protection to fire pump supply conductors without any substantiation of a problem with the existing requirements.

- The addition of the words “protected from fire for 2 hours” to 695.6 (A)(2)(d) is ambiguous and unenforceable for the concrete encasement allowance in (1). It could be interpreted that any amount of concrete is sufficient or it could be interpreted that the concrete assembly has to be tested to prove that it has a 2 hour fire rating. The allowance for 2” of concrete encasement has been in this section of the Code for years and has been recognized as providing both mechanical and fire protection sufficient for this application. During
the 2014 code cycle, a similar change was proposed using an International Building Code table showing fire resistive ratings of various concrete thicknesses as substantiation. It was defeated during the NFPA Technical Meetings. One of those supporting the motion to reject the change and to allow the continued use of 2” of concrete was the past chairman of the ASCE SFP Committee on Structural Fire Protection who stated that the use of that table was a “complete and total misapplication”. This time there was no substantiation at all to remove the 2” requirement.

- The additional changes made to this section do not add clarity. One removes the option for 2 hour fire-rated assemblies, which should be retained, and one adds “a listed fire resistive cable system” which is not necessary. According to the UL On-Line Certification Directory Guide Information for fire resistive cables listed to UL 2196 (Category FHJR), they must be used as part of a classified Electrical Circuit Protective System (Category FHIT) so they are already included in existing (3) “be a listed electrical circuit protective system with a minimum 2-hour fire rating”.

Related Item
First Revision No. 3654-NFPA 70-2015 [Section No. 695.6(A)(2)]
Public Input No. 4808-NFPA 70-2014 [Section No. 695.6(A)(2)]

Submitter Information Verification
Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 11:51:23 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: The permission to use 2 inches of concrete was deleted in the first revision stage and is added back in this revision. The absence of a dimension for the depth of concrete would cause serious confusion in practical applications.
Public Comment No. 211-NFPA 70-2015 [Section No. 695.6(G)]

(G) Ground-Fault Protection of Equipment.

Ground-fault protection of equipment shall not be permitted for fire pumps.

No ground fault interruption means shall be installed in any fire pump control or power circuit.

[20:9.1.8.1]

Statement of Problem and Substantiation for Public Comment

With the changes and clarifications in FR 3652 and 3653, specifically 695.4(B)(1)(b) The rewording of existing text 695.6(G) with extracted text from NFPA 20 makes it clear that there may be ground protection upstream, but is not permitted in the Fire Pump Power Circuit.

Related Item
First Revision No. 3653-NFPA 70-2015 [Section No. 695.4(B)]

Submitter Information Verification

Submitter Full Name: LAWRENCE FORSHNER
Organization: BARD RAO ATHANAS CONSULTING
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jul 13 13:08:55 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3624-NFPA 70-2015
Statement: This revision will clarify that ground-fault protection of equipment is not permitted for the fire pump power circuit.

This revision is limited to the fire pump power circuit as 695.6 is titled “Power Wiring”.

This change is necessary to clarify that multi building campus style distribution systems may include upstream ground fault protection.

See NFPA 20: 9.1.8.1 for the NFPA 20 requirement.
Public Comment No. 658-NFPA 70-2015 [Section No. 695.14(E)]

(E) Electric Fire Pump Control Wiring Methods.

All electric motor–driven fire pump control wiring shall be in rigid metal conduit, intermediate metal conduit, electrical metallic tubing (EMT), liquidtight flexible metal conduit, liquidtight flexible nonmetallic conduit, listed Type MC cable with an impervious covering, or Type MI cable.

Statement of Problem and Substantiation for Public Comment

There was an editorial mistake made to FR 3656 as EMT should have been included as an acceptable wiring method for fire pump controls. Under the committee statement for this FR they stated “Electrical Metallic Tubing (EMT) is acceptable as a fire pump control wiring method” EMT should be added under the list of acceptable wiring methods.

Related Item
First Revision No. 3656-NFPA 70-2015 [Section No. 695.14(E)]

Submitter Information Verification

Submitter Full Name: Raymond Horner
Organization: Allied Tube & Conduit
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 15 11:57:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3625-NFPA 70-2015
Statement: This revision correctly adds electrical metallic tubing in the list of approved wire methods based on actions taken in the First Draft stage.
(F) Generator Control Wiring Methods.

Control conductors installed between the fire pump power transfer switch and the standby generator supplying the fire pump during normal power loss shall be kept entirely independent of all other wiring. Breakage, disconnecting, or shorting of the wires, or loss of power to the remote start circuits control conductors shall cause immediate starting and continuous running of the generator and shall not prevent the starting of the generator(s) due to causes other than failure of these external control circuits.

Informational Note: See NFPA 20-2013, Standard for the Installation of Stationary Pumps for Fire Protection, Section 3.3.7.2, for more information on fault-tolerant external control circuits.

The control conductors shall be protected to resist potential damage by fire or structural failure. They shall be permitted to be routed through a building(s) using one of the following methods:

1. Be encased in a minimum 50 mm (2 in.) of concrete.
2. Be protected by a fire-rated assembly listed to achieve a minimum fire rating of 2 hours and dedicated to the fire pump circuits.
3. Be a listed electrical circuit protective system with a minimum 2-hour fire rating. The installation shall comply with any restrictions provided in the listing of the electrical circuit protective system used.

Informational Note: The listing organization provides information for electrical circuit protective systems on proper installation requirements to maintain the fire rating.

Statement of Problem and Substantiation for Public Comment

The generator control expects a normally open or normally closed dry contact for the remote start circuit, and uses the generator starting battery system for power. If the generator battery system power is lost, the generator cannot start.

The last part of the second sentence in paragraph 1 conflicts with the first part and is unnecessary. The first part says that the generator shall start and run under the stated conditions, and the second part says that it shall not prevent the starting of the generators due to other causes. If the generator is already running, it’s a moot point.

Related Item
First Revision No. 3657-NFPA 70-2015 [Section No. 695.14(F)]

Submitter Information Verification

Submitter Full Name: Timothy Windey
Organization: Cummins Power Generation
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 12:42:23 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3626-NFPA 70-2015
Statement: The revised text provides necessary clarity. A generator cannot start if the control conductors lose power due to failed batteries. A new last sentence is added to require visual and audible annunciation where a loss of power prevent the starting of the generator.
Luminaire, Directly Controlled.

An emergency lighting luminaire that operates on constant power, line voltage and has a control input for an integral dimming or switching function that is used to drive the luminaire to full brightness, a specified level upon loss of normal power.

Informational Note No. 1: See ANSI/UL924, Emergency Lighting and Power Equipment for information covering directly controlled luminaires.

Informational Note No. 2: Some examples of protocols used for control inputs are ANSI E1.11 - DMX512, IEC 62386 - DALI, ANSI C82.11 - Annex A (0-10V).

Statement of Problem and Substantiation for Public Comment

Emergency luminaires, whether standard or directly controlled, may not always be powered on in normal operation. Hence the change of constant power to line voltage.

The requirements for emergency illumination do not require luminaires in an emergency mode to be on at full bright, just to provide the required illumination as determined by building codes such as NFPA 101. (Reference 700.1 and the definition of Emergency Systems in 700.2). In addition, Section 700.23 - Dimmer and Relay Systems - only requires energization of branch circuits required to provide minimum emergency illumination. In some respects, Directly Controlled Luminaires are essentially 1-channel dimmers integral to the luminaire.

The addition of Informational Note 2 is to provide examples of a few of the control methods used for Directly Controlled Luminaires to aid in understanding of the concept.

Related Item

First Revision No. 3606-NFPA 70-2015 [New Definition after Definition: Emergency Systems.]

Public Input No. 746-NFPA 70-2014 [Section No. 520.68(B)]

Submitter Information Verification

Submitter Full Name: Mitchell Hefter
Organization: Philips Lighting
Affiliation: Illuminating Engineering Society
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 23:42:38 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3601-NFPA 70-2015
Statement: The panel recognizes that directly controlled luminaires may not always be powered in normal operation and revises the definition. Additional editorial revisions are made for clarity.

The panel reaffirms that “directly controlled luminaires” return to full illumination upon loss of normal power.
**Public Comment No. 666-NFPA 70-2015 [ Definition: Luminaire, Directly Controlled. ]**

**Luminaire, Directly Controlled.**

An emergency lighting luminaire that operates on constant power and has an integral dimming or switching function that drives the luminaire to full brightness upon loss of normal power.

Informational Note: See ANSI/UL924, Emergency Lighting and Power Equipment for information covering directly controlled luminaires.

**Statement of Problem and Substantiation for Public Comment**

Editorial suggestion. The ‘operates on constant power’ qualification is not necessary and would likely cause confusion.

**Related Item**
First Revision No. 3606-NFPA 70-2015 [New Definition after Definition: Emergency Systems.]

**Submitter Information Verification**

Submitter Full Name: MICHAEL SHULMAN  
Organization: UL LLC

**Committee Statement**

Committee Action: Rejected but see related SR  
Resolution: SR-3601-NFPA 70-2015  
Statement: The panel recognizes that directly controlled luminaires may not always be powered in normal operation and revises the definition. Additional editorial revisions are made for clarity.  
The panel reaffirms that “directly controlled luminaires” return to full illumination upon loss of normal power.
Public Comment No. 1666-NFPA 70-2015 [Sections 700.3(B), 700.3(C), 700.3(D)]

Sections 700.3(B), 700.3(C), 700.3(D)

(B) - Tested Periodically.
Systems shall be tested periodically on a schedule acceptable to the authority having jurisdiction to ensure the systems are maintained in proper operating condition.

(C) - Maintenance.
Emergency system equipment shall be maintained in accordance with manufacturer instructions and industry standards.

(D) - Written Record.
A written record shall be kept of such tests and maintenance.

Statement of Problem and Substantiation for Public Comment

This doesn't fall within the Scope of the NEC, as the NEC applies only to the installation of equipment [90.2(A)]. Perhaps this should be in NFPA 110.

Related Item
First Revision No. 3608-NFPA 70-2015 [Section No. 700.3(C)]

Submitter Information Verification

Submitter Full Name: RYAN JACKSON
Organization: RYAN JACKSON
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:03:17 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: 90.1(B) clearly states that compliance with the NEC and proper maintenance will result in an installation essentially free from hazard. Conditions of maintenance and the need for maintenance are within the scope of the NEC.
Public Comment No. 347-NFPA 70-2015 [Section No. 700.3(C)]

(C) Maintenance.

Emergency. The authority having jurisdiction shall require periodic maintenance. Emergency system equipment shall be maintained in accordance with manufacturer instructions and industry standards.

Statement of Problem and Substantiation for Public Comment

Making this change puts the "teeth" back into the requirement as in previous editions to allow the AHJ to require the maintenance on battery systems needed to assure proper operation of the emergency system. This particular AHJ is probably not the electrical inspector assuring proper initial installation of the equipment. Rather this AHJ is another party (possibly a third enforcement party) as described in the NEC definition in Article 100 of Authority Having Jurisdiction (AHJ). Maintenance is a variable, somewhat subjective requirement, contained in several industry standards, and is subject to the environment, use, and condition of the equipment. Only the AHJ responsible for maintenance (not initial installation) can evaluate all of the parameters of the battery installation and set up the proper/required periodic or reliability centered maintenance tasks for a battery system used in an emergency system.

Related Item
First Revision No. 3608-NFPA 70-2015 [Section No. 700.3(C)]

Submitter Information Verification

Submitter Full Name: TIMOTHY CROUSHORE
Organization: FIRSTENERGY
Affiliation: FirstEnergy
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 13:02:24 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed new first sentence is not necessary as the Authority Having Jurisdiction is required to enforce all of the requirements in the NEC.
(E) . Temporary Source of Power for Maintenance or Repair of the Alternate Source of Power.

If the emergency system relies on a single alternate source of power, which must be disabled for maintenance or repair, the emergency system shall include permanent switching means to connect a temporary alternate source of power for the duration of the maintenance or repair. The switching means shall comply with the following:

(1) Connection of the temporary alternate source of power shall not require disabling of the emergency system's normal source of power or disconnection of the emergency system's alternate source of power, other than by the switching means.

(2) Any transfer of power shall be in accordance with 700.12. It shall be permissible to utilize manual switching.

(3) The connection point for the temporary alternate source shall be marked with the phase rotation and system bonding requirements.

(4) Mechanical or electrical interlocking shall prevent inadvertent interconnection of power sources.

(5) The switching means shall include an "emergency source disabled" contact for connection to a generator remote annunciator or another facility alarm data collection point.

It shall be permissible to utilize the switching means for connection of a load bank.

Exception: A permanent switching means to temporarily connect an alternate source of power for the duration of the maintenance or repair shall not be required where one of the following conditions exists:

(1) All processes that rely on the emergency system source are capable of being disabled during maintenance or repair of the emergency source of power.

(2) The building or structure is unoccupied and fire suppression systems are fully functional and do not require an alternate power source.

(3) Other temporary means can be substituted for the emergency system.

(4) A permanent alternate emergency source, such as, but not limited to, a second on-site standby generator or separate electric utility service connection, capable of supporting the emergency system, exists.

Statement of Problem and Substantiation for Public Comment

The proposed new Section 700.3 (F) requires a means to connect a temporary generator during maintenance or repair of the prime generator. The concept for a portable, temporary source of power for generator maintenance was removed from 700.4 (B) in an effort to place the "maintenance" requirement in Section 700.3 which is titled "Tests and Maintenance", however, the requirement for portable temporary alternate source was originally required only for generators that are also used for peak load shaving. The requirement was also expanded as to how to provide the permanent means, and is far too specific.

This new Section can properly be interpreted to require all emergency generator systems, with a single generator or generators in parallel, to include a permanent docking station for a temporary portable generator, as the exceptions are vague.

Exception 1: An Inspector can correctly conclude that there are no emergency (life safety) processes that are capable of being disabled. Exception 2: Who is going to enforce or verify that the building is actually unoccupied?? (It will be occupied by the mechanic performing the maintenance)

Exception 3: It is unclear what "other temporary means" are. What about other permanent means??

Exception 4: It is unclear if generators operating in parallel meet this exception.

During the First Revision meetings, this proposed first draft revision was sent to an Ad Hoc committee, of which one of the members was this submitter, for further study/editing. This submitter believes the requirement is unnecessary, as there as only anecdotal evidence of an actual issue in the field.

If the Panel feels it should be a requirement in the NEC, this submitter recommends a motion of "Reject but Hold" to allow further study by a committee comprised individuals with appropriate expertise.

In addition, the text deleted in 700.4 (B) should remain.

Related Public Comments for This Document

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<th>Related Item</th>
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<tr>
<td>Public Comment No. 318-NFPA 70-2015 [Section No. 700.4(B)]</td>
<td>Relationship</td>
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</tbody>
</table>
Committee Statement

Committee Action: Rejected

Resolution: Where maintenance or repair is performed on an emergency generator, a portable or temporary alternate source must be available. This requirement significantly improves safety. The prescriptive requirements in new 700.3(F) are extremely feasible and can consist of an additional circuit breaker or bus to attach an alternate source. The exceptions provide relief where needed. The parent text of first level subdivision 700.3(F) is modified to require a portable or temporary alternate source to be available whenever the emergency generator is out of service for maintenance or repair.
Public Comment No. 788-NFPA 70-2015 [Section No. 700.3(F)]

(E) . Temporary Source of Power for Maintenance or Repair of the Alternate Source of Power.

If the emergency system relies on a single alternate source of power, which must be disabled for maintenance or repair, the emergency system shall include permanent switching means to connect a temporary alternate source of power for the duration of the maintenance or repair. The switching means shall comply with the following:

(1) Connection of the temporary alternate source of power shall not require disabling of the emergency system’s normal source of power or disconnection of the emergency system’s alternate source of power, other than by the switching means.

(2) Any transfer of power shall be in accordance with 700.12. It shall be permissible to utilize manual switching.

(3) The connection point for the temporary alternate source shall be marked with the phase rotation and system bonding requirements.

(4) Mechanical or electrical interlocking shall prevent inadvertent interconnection of power sources.

(5) The switching means shall include an “emergency source disabled” contact for connection to a generator remote annunciator or another facility alarm data collection point.

It shall be permissible to utilize the switching means for connection of a load bank.

Exception: A permanent switching means to temporarily connect an alternate source of power for the duration of the maintenance or repair shall not be required where one of the following conditions exists:

(1) All processes that rely on the emergency system source are capable of being disabled during maintenance or repair of the emergency source of power.

(2) The building or structure is unoccupied and fire suppression systems are fully functional and do not require an alternate power source.

(3) Other temporary means can be substituted for the emergency system.

(4) A permanent alternate emergency source, such as but not limited to, a second on-site standby generator or separate electric utility service connection, capable of supporting the emergency system, exists.

Statement of Problem and Substantiation for Public Comment

IEC’s position is to delete 700.3(F) - (FR 3616)

The proposed impact of this change is far reaching and the submitter did not provide any substantiation that the code text is needed. There are numerous ways to provide back-up power to a building in order to work on and maintain generators rather than mandating a specific requirement. Even if the requirement is placed into the code this doesn’t mean that an Owner or an Owner’s representative will follow through and rent a temporary generator. Typically when a generator is maintained a service tech is right near the generator. Should power be needed immediately the generator technician can suspend preventative maintenance work and turn on the generator in a split second.

Related Item

First Revision No. 3616-NFPA 70-2015 [New Section after 700.3(E)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Sep 20 16:21:01 EDT 2015

Committee Statement

Committee: Rejected
| Action: | Resolution: Where maintenance or repair is performed on an emergency generator, a portable or temporary alternate source must be available. This requirement significantly improves safety. The prescriptive requirements in new 700.3(F) are extremely feasible and can consist of an additional circuit breaker or bus to attach an alternate source. The exceptions provide relief where needed. The parent text of first level subdivision 700.3(F) is modified to require a portable or temporary alternate source to be available whenever the emergency generator is out of service for maintenance or repair. |
Public Comment No. 1417-NFPA 70-2015 [ New Section after 700.4 ]

**TITLE OF NEW CONTENT**
Type your content here ...

(C) Voltage Regulation. (New) If a voltage range is provided by the equipment manufacturer, feeder and branch circuit conductors shall be sized to provide voltage at the equipment within the range that is required by the manufacturer. In addition, feeder and branch-circuit conductors shall be sized so the voltage at the end of the feeder conductor is not lower than 97% of that at the service or source and for branch circuits, not lower than 95% of the voltage at the service or source at the furthest outlet. Calculations shall be based on circuit loading at 80 percent of the rating of the overcurrent device.

**Statement of Problem and Substantiation for Public Comment**

The public deserves to have equipment that will provide reasonable operation for both safety and comfort. Where manufacturers are now worldwide it is important for safe and proper operation that conductors be sized properly to provide voltage within a standard operating range. When determined by the manufacturer, most offshore manufacturers have very low standards.

**Related Item**
Public Input No. 4332-NFPA 70-2014 [New Section after 700.4(B)]

**Submitter Information Verification**

Submitter Full Name: TRAVIS LINDSEY
Organization: TLC SERVICES
Street Address:
City:
State:
Zip:

Submittal Date: Fri Sep 25 10:40:32 EDT 2015

**Committee Statement**

Committee Action: Rejected
Resolution: The intent of the submitter is met in the present text of 110.3(B). Listed and labeled equipment must be installed in accordance with their listing, labeling and manufacturers instructions.
700.4 Capacity and Voltage.
(A) Capacity and Rating.
An emergency system shall have adequate capacity and rating for all loads to be operated simultaneously. The emergency system equipment shall be suitable for the maximum available fault current at its terminals.

(B) Selective Load Pickup, Load Shedding, and Peak Load Shaving.
The alternate power source shall be permitted to supply emergency, legally required standby, and optional standby system loads where the source has adequate capacity or where automatic selective load pickup and load shedding is provided as needed to ensure adequate power to (1) the emergency circuits, (2) the legally required standby circuits, and (3) the optional standby circuits, in that order of priority. The alternate power source shall be permitted to be used for peak load shaving, provided these conditions are met.

Peak load shaving operation shall be permitted for satisfying the test requirement of 700.3(B), provided all other conditions of 700.3 are met.

(C) Voltage Regulation.
If a voltage range is provided by the equipment manufacturer, feeder and branch circuit conductors shall be sized to provide voltage at the equipment within the range that is required by the manufacturer. In addition, feeder and branch-circuit conductors shall be sized so the voltage at the end of the feeder conductor is not lower than 97% of that at the service or source and for branch circuits, not lower than 95% of the voltage at the service or source at the furthest outlet. Calculations shall be based on circuit loading at 80 percent of the rating of the overcurrent device.

Statement of Problem and Substantiation for Public Comment
It is important for safe and proper operation that conductors be sized properly to provide voltage within the operating range as determined by the manufacturer. It is very common for feeder conductors for emergency equipment to be lengthy so it is important that the conductors be sized properly so the electrical systems will perform safely and provide the purpose for which it is intended.

Related Item
Public Input No. 4331-NFPA 70-2014 [Section No. 700.4]

Submitter Information Verification
Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services

Committee Statement
Committee Action: Rejected
Resolution: The intent of the submitter is met in the present text of 110.3(B). Listed and labeled equipment must be installed in accordance with their listing, labeling and manufacturers instructions.
Public Comment No. 1424-NFPA 70-2015 [Section No. 700.4(A)]

(A) Capacity, Rating, and Rating Voltage.

An emergency system shall have adequate capacity and rating and voltage for all loads to be operated simultaneously. The emergency system equipment shall be suitable for the maximum available fault current at its terminals.

Statement of Problem and Substantiation for Public Comment

The public deserves to have equipment that will provide reasonable operation for both safety and comfort. Where manufacturers are now worldwide it is important for safe and proper operation that conductors be sized properly to provide voltage within a standard operating range. When determined by the manufacturer, many offshore manufacturers have very low standards and would not require consideration for voltage minimums. Standby systems are valuable and important to safety and protection of life.

Related Item
Public Input No. 4331-NFPA 70-2014 [Section No. 700.4]

Submitter Information Verification

Submitter Full Name: TRAVIS LINDSEY
Organization: TLC SERVICES
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 10:57:37 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The intent of the submittter is met in the present text of 110.3(B). Listed and labeled equipment must be installed in accordance with their listing, labeling and manufacturers instructions.
Selective Load Pickup, Load Shedding, and Peak Load Shaving.

The alternate power source shall be permitted to supply emergency, legally required standby, and optional standby system loads where the source has adequate capacity or where automatic selective load pickup and load shedding is provided as needed to ensure adequate power to (1) the emergency circuits, (2) the legally required standby circuits, and (3) the optional standby circuits, in that order of priority. The alternate power source shall be permitted to be used for peak load shaving, provided these conditions are met.

Peak load shaving operation shall be permitted for satisfying the test requirement of 700.3(B), provided all other conditions of 700.3 are met.

A portable or temporary alternate source shall be available whenever the emergency generator is out of service for major maintenance or repair.

Statement of Problem and Substantiation for Public Comment

See PC 317

Related Public Comments for This Document

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<th>Related Comment</th>
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<tr>
<td>Public Comment No. 317-NFPA 70-2015 [Section No. 700.3(F)]</td>
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<tr>
<td>First Revision No. 3617-NFPA 70-2015 [Section No. 700.4(B)]</td>
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</table>

Submitter Information Verification

Submitter Full Name: DANIEL CARON
Organization: BARD RAO + ATHANAS CONSULTING ENGINEERS
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Jul 29 13:56:21 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3602-NFPA 70-2015 See the Second Revision on 700.3(F) to modify the parent text of first level subdivision 700.3(F) to require a portable or temporary alternate source to be available whenever the emergency generator is out of service for maintenance or repair.
Statement: The deletion of the last sentence in 700.4(B) in first revision 3617 inadvertently removed the requirement for portable or temporary alternate sources to be available whenever the emergency generator is out of service for maintenance or repair.

This requirement is now added into the parent text of first level subdivision 700.3(F) to require a portable or temporary alternate source to be available whenever the emergency generator is out of service for maintenance or repair.

The previous requirement was incorrectly located in 700.4(B) Capacity, which limited application to standby generators used in emergency systems that were also used for selective load pickup, load shedding, and peak load shaving. The committee expands the requirement to all emergency generators where “maintenance or repair” is to be performed. Where an emergency system is required, provisions for supplementing the emergency standby generator during maintenance or repair are necessary.

Editorial revisions are made throughout the requirement to increase clarity and usability.
Public Comment No. 1416-NFPA 70-2015 [Section No. 700.5(C)]

(C) Automatic Transfer Switches.
Automatic transfer switches shall be electrically operated and mechanically held. Automatic transfer switches shall be listed, labeled and identified for emergency system use.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

The term identified was added as UL 1008 requires that a transfer switch investigated for use in emergency systems or legally-required standby systems shall be marked “automatic transfer switch for emergency systems”.

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer's attestation that the product is in compliance with the appropriate standard. NRTL's conduct factory surveillance of products, surveillance is one method to validate the manufacturer's attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL's have similar requirements.

Related Item
Public Input No. 951-NFPA 70-2014 [Section No. 700.5(C)]
First Revision No. 3609-NFPA 70-2015 [Section No. 700.5(C)]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
<table>
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<tr>
<th>Committee Action:</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>The panel recognizes that the Correlating Committee reversed actions to add &quot;listed and labeled&quot; in all cases and a task group is reviewing this issue for the next NEC cycle.</td>
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</table>
Public Comment No. 749-NFPA 70-2015 [Section No. 700.5(E)]

(E) Documentation.
The short-circuit current rating of the transfer equipment, based on the specific overcurrent protective device type and settings protecting the transfer equipment, shall be field marked on the exterior of the transfer equipment.

Statement of Problem and Substantiation for Public Comment

IEC's position is to delete 700.5 - (FR 7518)

The code already requires that equipment be installed according to available fault current, so adding this requirement is redundant. The installer/supplier already has the responsibility/liability to install the proper equipment based on the characteristics of the system. This proposal puts too much liability on the contractor/supplier because after installation various factors can change which will affect the available fault current. Feeders can be reworked, transformers can be changed with different impedance values, motor loads can be added to the existing system and similar factors that can change the available fault current. In the case of a lawsuit, the installer will have the burden of proof that the installation was done according to code and would result in unnecessary costs for defending an installation that was installed correctly, but that had variables change that are out of their control. A better proposal would be to require the owner to relabel the equipment after any alteration to the system.

Related Public Comments for This Document

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<td>Public Comment No. 750-NFPA 70-2015 [Section No. 701.5(D)]</td>
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Related Item
First Revision No. 7518-NFPA 70-2015 [New Section after 700.5(D)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 18 20:35:53 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Typically Automatic Transfer Switches have several overcurrent protection options each with different short-circuit current ratings (analogous to withstand close on ratings) which can cause confusion for AHJ during inspection or for service provider when replacing overcurrent protection after installation. This requirement requires the installer to mark the equipment exterior with the short-circuit current rating of the automatic transfer switch based upon the specific overcurrent protective device type/rating. This clarifies to the inspector and service provider the specifics of the protection scheme, which is vital for safety.
(A) Identification.

All boxes and enclosures (including transfer switches, generators, and power panels) for emergency circuits shall be permanently marked so they will be readily identified as a component of an emergency circuit or system. Where boxes or enclosures are not encountered the cable or raceway system shall be permanently marked to be identified as a component of the emergency system.

Receptacles supplied from the emergency system shall have a distinctive color or marking on the receptacle cover plates or the receptacles themselves.

Statement of Problem and Substantiation for Public Comment

The original input was rejected with the panel statement; that the intent of 700.10(A) was not to require all elements of the emergency be identified. The 2017 input was simply requesting when there were no boxes for identification that the raceway or cable system be identified in some manner. Requiring only boxes & enclosures to be identified misses the mark 50% of the time. It is common for metallic cable to daisy chain from emergency light to emergency light without installing a splice or junction box leaving the emergency system wiring method undistinguishable from the normal system. I can tell you that it is a difficult task for an inspector to try and follow a cable or raceway in a ceiling that is identical to every other cable or raceway in that same ceiling that is not distinguished. This requirement would benefit service electricians, inspectors and installers without any hardship. The method could be as simple as the spray painting the cable or conduit as installers do for grid wire identification. Please reconsider the rejection of the original input.

Related Item

Public Input No. 2656-NFPA 70-2014 [Section No. 700.10(A)]

Submitter Information Verification

Submitter Full Name: James Dorsey
Organization: Douglas County
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 20:53:33 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3603-NFPA 70-2015
Statement: The requirement for identifying emergency circuits is modified to address circuits that may not include junction boxes. The intent of 700.10(A) is to provide installers, maintainers and the AHJ with the ability to identify components of an emergency circuit or system. There are many circuits including but not limited to metal clad cable installations in lighting fixtures that use duplex connectors without junction boxes. These circuits are required to be identified. It is not intended that the entire length of raceways and cable assemblies be identified and a maximum distance between markings of 25 feet is added for clarity.
Public Comment No. 395-NFPA 70-2015 [Section No. 700.10(D) [Excluding any Sub-Sections]]

Emergency systems shall meet the additional requirements in (D)(1) through (D)(3) in assembly occupancies for not less than 1000 persons, or in buildings above 23 m (75 ft) in height, buildings classified as Use Group E with a total occupancy load of more than 300 occupants and buildings classified as Use Group I-2.

Statement of Problem and Substantiation for Public Comment

Fire protection of emergency systems should not be limited to high rise buildings or those buildings or portions of buildings with large occupancy loads. Schools (K-12) and Institutional occupancies housing people who are incapable of self-preservation should be included. Many schools and large hospitals are not high rise buildings or classed as Assembly occupancies, yet the importance and the challenges of safe evacuation in the event of fire are similar.

Panel 13 debated a proposal to include all building during the first draft meetings. The vote was a tie. Many were concerned with the financial impact on small business occupancies. This comment address the life safety importance of fire protection and the financial impact on some.

Related Item

Public Input No. 1246-NFPA 70-2014 [Section No. 700.10(D) [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: LAWRENCE FORSHNER
Organization: BARD RAO ATHANAS CONSULTING
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 11 15:31:13 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3612-NFPA 70-2015
Statement: Fire protection of emergency systems is necessary in many venues in addition to high-rise buildings and those buildings or portions of buildings with large occupancy loads. Schools (K-12) and Institutional venues housing people who are incapable of self-preservation must also be included. Many schools and large hospitals are not high-rise buildings or classed as assembly occupancies, yet should require emergency systems that are protected from fire for a minimum of 2-hours.
Public Comment No. 603-NFPA 70-2015 [Section No. 700.10(D)(1)]

(1) Feeder-Circuit Wiring. 

Feeder-circuit wiring shall be protected from fire for 2 hours using one of the following methods:

(1) The cable or raceway is installed in spaces or areas that are fully protected by an approved automatic fire suppression system.

(2) The cable or raceway is protected by a listed electrical circuit protective system with a minimum 2-hour fire rating.

   Informational Note No. 1: Electrical circuit protective systems could include but not be limited to thermal barriers, or a protective shaft and are tested to UL 1724, Fire Tests for Electrical Circuit Protection Systems.

   Informational Note No. 2: The listing organization provides information for electrical circuit protective systems on proper installation requirements to maintain the fire rating.

(3) Be a listed fire resistive cable system.

   Informational Note No. 1: Fire resistive cables are tested to ANSI/UL 2196, Tests for Fire Resistive Cables.

   Informational Note No. 2: The listing organization provides information for fire resistive cable systems on proper installation requirements to maintain the fire rating.

(4) The cable or raceway is encased in concrete 2 inches of concrete.

Statement of Problem and Substantiation for Public Comment

The draft indicates just "concrete encasement". This is very subjective and the potential risk of construction error is high. It has been shown in previous testing as noted in the 2008 NFPA Fire Protection Handbook Figure 19.2.2 that when a 6 inch slab of concrete is exposed for 2 hours in the ASTM E 119 fire test that the unexposed side of the slab at 2 inches will see a temperature of 357 C. The cable in the conduit is typically rated at 90 C so there would be a strong risk of circuit failure even at 2 inches. The more appropriate thickness would be in the area of 4 inches but that cannot be accommodated at this time of the draft. That means the 2 inch requirement at the very least should be kept in place.

Related Item
First Revision No. 3613-NFPA 70-2015 [Section No. 700.10(B)]

Submitter Information Verification

Submitter Full Name: DON TREMAGLIO
Organization: PENTAIR THERMAL MANAGEMENT
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 11 10:32:40 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: 
Statement: List item (4), for listed fire-rated assemblies with a minimum fire rating of 2 hours and contains only emergency circuits was deleted during the FR cycle and is added in this second revision. This means to achieve a 2-hour fire rating for emergency systems is time tested, and commonly used.

The permission to use 2-inches of concrete was also deleted in the first revision stage and is added back in this revision. The absence of a dimension for the depth of concrete would cause serious confusion in practical application.
Public Comment No. 786-NFPA 70-2015 [Section No. 700.10(D)(1)]

(1) Feeder-Circuit Wiring.
Feeder-circuit wiring shall be protected from fire for 2 hours using one of the following methods:

(1) The cable or raceway is installed in spaces or areas that are fully protected by an approved automatic fire suppression system

(2) The cable or raceway is protected by a listed electrical circuit protective system with a minimum 2-hour fire rating

   Informational Note No. 1: Electrical circuit protective systems could include but not be limited to thermal barriers, or a protective shaft and are tested to UL 1724, Fire Tests for Electrical Circuit Protection Systems.

   Informational Note No. 2: The listing organization provides information for electrical circuit protective systems on proper installation requirements to maintain the fire rating.

(3) Be a listed fire resistive cable system

   Informational Note No. 1: Fire resistive cables are tested to ANSI/UL 2196, Tests for Fire Resistive Cables.

   Informational Note No. 2: The listing organization provides information for fire resistive cable systems on proper installation requirements to maintain the fire rating.

(4) The cable or raceway is encased in a minimum of 50 mm (2 in.) of concrete

Statement of Problem and Substantiation for Public Comment

IEC's position is to leave the 2 inch concrete requirement in 700.10(D)(1) - (FR 3665)

IEC believes that substantiation has not been provided to eliminate the 2 inch concrete requirement when installing emergency feeders. Installing 2 inch of concrete around certain wiring methods has been in the NEC for numerous years with not one substantiated injury or death. Changing the text will reduce the overall clarity needed in the code.

Related Item
First Revision No. 3665-NFPA 70-2015 [Section No. 700.10(D)(1)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 20 16:14:18 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution:
Statement: List item (4), for listed fire-rated assemblies with a minimum fire rating of 2 hours and contains only emergency circuits was deleted during the FR cycle and is added in this second revision. This means to achieve a 2-hour fire rating for emergency systems is time tested, and commonly used.

The permission to use 2-inches of concrete was also deleted in the first revision stage and is added back in this revision. The absence of a dimension for the depth of concrete would cause serious confusion in practical application.
Public Comment No. 840-NFPA 70-2015 [Section No. 700.10(D)(1)]

(1) Feeder-Circuit Wiring.

Feeder-circuit wiring shall be protected from fire for 2 hours using one of the following methods:

1. The cable or raceway is installed in spaces or areas that are fully protected by an approved automatic fire suppression system.
2. The cable or raceway is protected by a listed electrical circuit protective system with a minimum 2-hour fire rating.

Informational Note No. 1:

- Electrical circuit protective systems could include but not be limited to thermal barriers, protective shafts, and are tested to UL 1724, Fire Tests for Electrical Circuit Protection Systems.

Informational Note No. 2:

- UL guide information for electrical circuit protective systems (FHR) contains the information on proper installation requirements to maintain the fire rating.

3. Be protected by a listed fire resistive cable system.

Informational Note No. 1:

- Fire resistive cables are tested to ANSI/UL 2196, Tests for Fire Resistive Cables.

Informational Note No. 2:

- The listing organization provides information for fire resistive cable systems on proper installation requirements to maintain the fire rating.

The cable or raceway is encased in concrete.

4. Thermal barrier system for electrical components with a minimum 2-hour fire rating.

5. Be protected by a listed fire-rated assembly that has a minimum fire rating of 2 hours and contains only emergency wiring circuits.

6. Be encased in a minimum of 50mm (2 in) of concrete.

Additional Proposed Changes

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<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>700_10_D_1_FR_3665-5rn.pdf</td>
<td>700.10(D)(1) document</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

The revisions that were accepted in 700.10(D)(1) through (5) change time-proven methods of providing fire and mechanical protection to these conductors without any substantiation of a problem with the existing requirements.

- The addition of the words “protected from fire for 2 hours” in 700.10(D)(1) is ambiguous and unenforceable for the concrete encasement allowance in new (4) which states: “the cable or raceway is encased in concrete”. It could be interpreted that any amount of concrete is sufficient or it could be interpreted that the concrete assembly has to be tested to prove that it has a 2-hour fire rating. The allowance for 2” of concrete encasement has been in this section of the Code for years and has been recognized as providing both mechanical and fire protection sufficient for this application. During the 2014 code cycle, a similar change was proposed using an International Building Code table showing fire resistive ratings of various concrete thicknesses as substantiation. It was defeated during the NFPA Technical Meetings. One of those supporting the motion to reject the change and to allow the continued use of 2” of concrete was the past chairman of the ASCE SFP Committee on Structural Fire Protection who stated that the use of that table was a “complete and total misapplication”. This time there was no substantiation at all to remove the 2” requirement.

- The additional changes made to this section do not add clarity. One removes the option for 2-hour fire-rated assemblies, which should be retained, and one adds “a listed fire resistive cable system” which is not necessary. According to the UL On-Line Certification Directory Guide Information for fire resistive cables listed to UL 2196 (Category FHRJ), they must be used as part of a classified Electrical Circuit Protective System (Category FHR) so they are already included in existing (2) “be a listed electrical circuit protective system with a minimum 2-hour fire rating”. We also question how an “approved automatic fire suppression system” is evaluated as meeting the requirement for 2-hour fire.
Committee Statement

Committee Action: Rejected but see related SR

Resolution: List item (4), for listed fire-rated assemblies with a minimum fire rating of 2 hours and contains only emergency circuits was deleted during the FR cycle and is added in this second revision. This means to achieve a 2-hour fire rating for emergency systems is time tested, and commonly used.

The permission to use 2-inches of concrete was also deleted in the first revision stage and is added back in this revision. The absence of a dimension for the depth of concrete would cause serious confusion in practical application.
Public Comment No. 1203-NFPA 70-2015 [Section No. 700.10(D)(3)]

**(3) Generator Control Wiring.**

Control conductors installed between the transfer equipment and the emergency generator shall be kept entirely independent of all other wiring and shall meet the conditions of 700.10(D)(1). Breakage, disconnecting, or shorting of the wires or loss of power to the remote start circuits control conductors shall cause immediate starting and continuous running of the generator and shall not prevent the starting of the generator(s) due to causes other than failure of these external control circuits.

**Statement of Problem and Substantiation for Public Comment**

The generator control expects a normally open or normally closed dry contact for the remote start circuit, and uses the generator starting battery system for power. If the generator battery system power is lost, the generator cannot start.

The last part of the second sentence conflicts with the first part and is unnecessary. The first part says that the generator shall start and run under the stated conditions, and the second part says that it shall not prevent the starting of the generators due to other causes. If the generator is already running, it's a moot point.

**Related Item**

First Revision No. 3614-NFPA 70-2015 [Section No. 700.10(D)(3)]

**Submitter Information Verification**

**Submitter Full Name:** Timothy Windey  
**Organization:** Cummins Power Generation  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Thu Sep 24 12:50:44 EDT 2015

**Committee Statement**

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-3611-NFPA 70-2015  
**Statement:** The revised text provides necessary clarity. A generator cannot start if the control conductors lose power due to failed batteries. A new last sentence is added to require visual and audible annunciation where a loss of power prevent the starting of the generator.
Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings
centered, emergency lighting, emergency power, or both shall be available within the time required for the application but not
to exceed 10 seconds. The supply system for emergency purposes, in addition to the normal services to the building and
meeting the general requirements of this section, shall be one or more of the types of systems described in 700.12(A) through
(E). Unit equipment in accordance with 700.12(F) shall satisfy the applicable requirements of this article.

In selecting an emergency source of power, consideration shall be given to the occupancy and the type of service to be
rendered, whether of minimum duration, as for evacuation of a theater, or longer duration, as for supplying emergency power
and lighting due to an indefinite period of current failure from trouble either inside or outside the building.

Equipment shall be designed and located so as to minimize the hazards that might cause complete failure due to flooding, fires,
icing, and vandalism.

Equipment for sources of power as described in 700.12(A) through (E) where located within assembly occupancies for greater
than 1000 persons or in buildings above 23 m (75 ft) in height with any of the following occupancy classes — assembly,
educational, residential, detention and correctional, business, and mercantile — shall be installed either in spaces fully
protected by approved automatic fire suppression systems (sprinklers, carbon dioxide systems, and so forth) or in spaces with a
1-hour fire rating shall comply with 700.10(D).

Informational Note No. 1: For the definition of Occupancy Classification, see Section 6.1 of NFPA 101-2015, Life
Safety Code. Informational Note No. 2: For further information, see ANSI/IEEE 493-2007, Recommended Practice for
the Design of Reliable Industrial and Commercial Power Systems.

Statement of Problem and Substantiation for Public Comment

This PI does not modify the number of occupants or height of the building.

All this does is coordinate this requirement with those located in section 700.10(D). Actually, 700.12 is in conflict with section 700.10(D)
as both 700.10(D) and 700.12 apply to assembly occupancies of not less than 1000 persons or in buildings above 23 m (75 ft) in height
and if not fully protected by an approved automatic fire suppression system, section 700.10(D) will require a 2 hour fire rated protection
system for the wiring or it has to be encased in a minimum of 50 mm (2 in.) of concrete.

However, as currently written, 700.12 will permit assembly occupancies with the same building height and occupant count if not fully
protected by an approved automatic fire suppression system to only have 1 hour fire rated protection.

This is confusing, does one need to comply with the two hour fire protection requirements of 700.10(D) or the one hour protection
requirements of 700.12?

Related Item

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 20:10:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3613-NFPA 70-2015
Statement: The action taken by the committee on the Second Revision to 700.10(D) to expand the fire protection requirements in
700.10(D) requires that correlation occur in section 700.12.

This revision adds “health care occupancies where persons are not capable of self preservation and educational
occupancies with more than 300 occupants” to correlate with the revisions in 700.10(D).
This revision does not represent new material. Public input 1246 sought the revisions seen in the FR to modify 700.10(D). In the first revision stage public input 1246 was resolved. If a first revision had occurred in 700.10(D) as suggested in public comment 1246, a first revision to correlate in 700.12 would have been necessary.
Public Comment No. 431-NFPA 70-2015 [Section No. 700.12(A)]

(A) Storage Battery.

Storage batteries shall be of suitable rating and capacity to supply and maintain the total load for a minimum period of 1 1/2 hours, without the voltage applied to the load falling below the load equipment manufacturer's minimum operating value 87-1/2 percent of normal. Automotive-type batteries shall not be used.

An automatic battery charging means shall be provided.

Statement of Problem and Substantiation for Public Comment

Eliminating the standardized 87.5% minimum battery retention threshold would be highly problematic for the listing of the equipment containing the storage batteries and for maintenance of the systems after installation. If the first revision is adopted as currently proposed, a marking will be required on every power source to identify (by manufacturer and model number) those loads for which it has been evaluated and found to provide the required 90 minutes of power. Additionally, field testing may be required when any of the connected emergency luminaires (the load equipment) need to be replaced, to verify that the power source has sufficient capacity. The minimum voltage requirement (in the 2014 and earlier editions) is what allows the power source and the load equipment to be independently certified and then mated in the field without the need for field testing for compatibility. The related product standard (UL 924) is benchmarked to this 87.5% threshold. This standardization should be restored and not be permitted to 'float' as suggested by the first revision. The flexibility gained does not adequately offset the unintended consequences for the majority of stakeholders.

Similar comments have been submitted in regards to the same issue under FR 3627, 3618, and 3628.

Related Item

First Revision No. 3615-NFPA 70-2015 [Section No. 700.12(A)]

Submitter Information Verification

Submitter Full Name: MICHAEL SHULMAN
Organization: UL LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Aug 24 14:50:33 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3606-NFPA 70-2015
Statement: The 87.5% minimum battery retention threshold is reinstated. The minimum voltage requirement allows the power source and the load equipment to be independently certified and then mated in the field without the need for field testing for compatibility. The related product standard (UL 924) is benchmarked to this 87.5% threshold.
Public Comment No. 433-NFPA 70-2015 [ Section No. 700.12(F)(2) ]

(2) Installation of Unit Equipment.
Unit equipment shall be installed in accordance with 700.12(F)(2)(1) through (6).

(1) The batteries shall be of suitable rating and capacity to supply and maintain the total lamp load associated with the unit in accordance with (a) or (b).

(b) For a period of at least 1 1/2 hours without the voltage falling below the equipment manufacturer's minimum operating voltage value.

The unit equipment shall supply and maintain not less than 60 percent of the initial emergency illumination for a period of at least 1 1/2 hours. Unit equipment shall be listed.

Informational note: See ANSI/UL 924, Emergency Lighting and Power Equipment, for information covering unit equipment.

(3) Unit equipment shall be permanently fixed in place (i.e., not portable) and shall have all wiring to each unit installed in accordance with the requirements of any of the wiring methods in Chapter 3. Flexible cord-and-plug connection shall be permitted, provided that the cord does not exceed 900 mm (3 ft) in length.

(4) The branch circuit feeding the unit equipment shall be the same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

Exception: In a separate and uninterrupted area supplied by a minimum of three normal lighting circuits that are not part of a multiwire branch circuit, a separate branch circuit for unit equipment shall be permitted if it originates from the same panelboard as that of the normal lighting circuits and is provided with a lock-on feature.

(5) The branch circuit that feeds unit equipment shall be clearly identified at the distribution panel.

(6) Emergency luminaires that obtain power from a unit equipment and are not part of the unit equipment shall be wired to the unit equipment as required by 700.10 and by one of the wiring methods of Chapter 3.

(7) Remote heads providing lighting for the exterior of an exit door shall be permitted to be supplied by the unit equipment serving the area immediately inside the exit door.

Statement of Problem and Substantiation for Public Comment

Because subsection 700.12(F)(2)(5) allows remote luminaires to obtain power from the unit equipment batteries, the nominal 87-1/2% battery output voltage threshold must be maintained for field-mating compatibility purposes; otherwise, an operational field test will be needed every time such a remote luminaire is added or replaced if that remote luminaire is not specifically identified as suitable for use with the unit equipment at the time the unit equipment is listed. See my similar comment submitted under FR-3615. Also see similar comment submitted for 701.12(G), under FR-3628.

The simplest and most useful revision here is just to require the unit equipment to be listed and include an informational note pointing to UL 924 which addresses these products and includes the requirements for retention of battery power, along with a minimum light output requirement, at the end of 90 minutes (or longer, if the equipment is rated for longer operation). The standard performs this testing inclusive of any remote loads for which the equipment is rated and marked.

If the CMP does not want to rely exclusively on the product safety standard, then the 87-1/2% battery voltage should be retained in 700.12(F)(2)(1). I have submitted a second (separate) comment showing this option.

Terraview created a slight formatting problem – this comment suggests revising only subclause (1) of 700.12(F)(2). The subsequent subclauses, including their numbering, are intended to be left intact.

Related Item
First Revision No. 3618-NFPA 70-2015 [Section No. 700.12(F)(2)]

Submitter Information Verification
Submitter Full Name: MICHAEL SHULMAN
Organization: UL LLC
Street Address:
City: 
State: 
Zip: 
Submittal Date: Mon Aug 24 15:18:35 EDT 2015
### Committee Statement

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<tr>
<td>Resolution:</td>
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<tr>
<td>Statement:</td>
<td>The 87.5% minimum battery retention threshold is reinstated. The minimum voltage requirement allows the power source and the load equipment to be independently certified and then mated in the field without the need for field testing for compatibility. The related product standard (UL 924) is benchmarked to this 87.5% threshold.</td>
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</table>
(2) Installation of Unit Equipment.
Unit equipment shall be installed in accordance with 700.12(F)(2)(1) through (6).

(1) The batteries shall be of suitable rating and capacity to supply and maintain the total lamp load associated with the unit in accordance with (a) or (b):

   (a) For a period of at least 1 1/2 hours without the voltage falling below the equipment manufacturer's minimum operating voltage value 87-1/2 percent of normal battery voltage.

   (a) The unit equipment shall supply and maintain not less than 60 percent of the initial emergency illumination for a period of at least 1 1/2 hours.

(2) Unit equipment shall be permanently fixed in place (i.e., not portable) and shall have all wiring to each unit installed in accordance with the requirements of any of the wiring methods in Chapter 3. Flexible cord-and-plug connection shall be permitted, provided that the cord does not exceed 900 mm (3 ft) in length.

(3) The branch circuit feeding the unit equipment shall be the same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

   Exception: In a separate and uninterrupted area supplied by a minimum of three normal lighting circuits that are not part of a multiwire branch circuit, a separate branch circuit for unit equipment shall be permitted if it originates from the same panelboard as that of the normal lighting circuits and is provided with a lock-on feature.

(4) The branch circuit that feeds unit equipment shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a unit equipment and are not part of the unit equipment shall be wired to the unit equipment as required by 700.10 and by one of the wiring methods of Chapter 3.

(6) Remote heads providing lighting for the exterior of an exit door shall be permitted to be supplied by the unit equipment serving the area immediately inside the exit door.

Statement of Problem and Substantiation for Public Comment

Because subsection 700.12(F)(2)(5) allows remote luminaires to obtain power from the unit equipment batteries, the nominal 87-1/2% battery output voltage threshold must be maintained for field-mating compatibility purposes; otherwise, an operational field test will be needed every time such a remote luminaire is added or replaced if that remote luminaire is not specifically identified as suitable for use with the unit equipment at the time the unit equipment is listed. See my similar comment submitted under FR-3615. Also see similar comment submitted for 701.12(G), under FR-3628.

The simplest and most useful revision here is just to require the unit equipment to be listed and include an informational note pointing to UL 924 which addresses these products and includes the requirements for retention of battery power, along with a minimum light output requirement, at the end of 90 minutes (or longer, if the equipment is rated for longer operation). The standard performs this testing inclusive of any remote loads for which the equipment is rated and marked. I have submitted this option under a separate comment. This comment has been submitted in case the CMP does not want to rely exclusively on the product safety standard for this issue.

Terraview created some formatting problems -- subclause numbering (a) and (b) should remain under 700.12(F)(2)(1). Also, I have not submitted any changes to the exception under 700.12(F)(2)(3), but for some unknown reason it has become underlined in this submittal.

Related Item
First Revision No. 3618-NFPA 70-2015 [Section No. 700.12(F)(2)]

Submitter Information Verification

Submitter Full Name: MICHAEL SHULMAN
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 24 15:36:02 EDT 2015

Committee Statement
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<tr>
<td>Resolution:</td>
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NATIONAL FIRE PROTECTION ASSOCIATION REPORT

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
700.32 Selective Coordination.

Emergency system(s) overcurrent devices shall be selectively coordinated with all supply-side overcurrent protective devices.

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Exception: Selective coordination shall not be required between a paralleling breaker in a multiple generator paralleling system and downstream feeder devices.

Statement of Problem and Substantiation for Public Comment

While the panel dealt with my concerns in Public Input 1530 regarding ground fault issues with parallel applications, they did not deal with the 3rd point in my substantiation related to selective coordination in a paralleling application.

When multiple generators are paralleled on a common bus it is not uncommon for feeder breakers to be larger than the generator paralleling breakers that are “upstream” from the feeders. Consequently, it is impossible for a designer to demonstrate any level of coordination in the system unless it is assumed that all generators always equally share fault current and are always on the bus when the fault occurs–neither of which can be demonstrated to be true.

This change provides a means to deal with this concern in a similar fashion to how the panel dealt with the ground fault issues in paralleling applications.

Related Public Comments for This Document

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<tr>
<td>Public Comment No. 256-NFPA 70-2015 [New Section after 702.6]</td>
<td>part of solution to original PI 1530</td>
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<tr>
<td>Public Comment No. 259-NFPA 70-2015 [Section No. 701.27]</td>
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<tr>
<td>Public Input No. 1530-NFPA 70-2014 [New Article after 445]</td>
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</tbody>
</table>

Submitter Information Verification

Submitter Full Name: GARY OLSON
Organization: KW RX LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 16 10:06:43 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The additional text is not necessary. For parallel generator applications, there are many design, control, overcurrent protective device technologies, and overcurrent protection setting options whereby selective coordination is achievable between feeder overcurrent protective devices and generator paralleling circuit breakers, even when one or more generators fail to supply power.
Public Comment No. 750-NFPA 70-2015 [Section No. 701.5(D)]

(D) Documentation.
The short-circuit current rating of the transfer equipment, based on the specific overcurrent protective device type and settings protecting the transfer equipment, shall be field marked on the exterior of the transfer equipment.

Statement of Problem and Substantiation for Public Comment

IEC's position is to delete 701.5(D) - (FR 7519)

The code already requires that equipment be installed according to available fault current, so adding this requirement is redundant. The installer/supplier already has the responsibility/liability to install the proper equipment based on the characteristics of the system. This proposal puts too much liability on the contractor/supplier because after installation various factors can change which will affect the available fault current. Feeders can be reworked, transformers can be changed with different impedance values, motor loads can be added to the existing system and similar factors that can change the available fault current. In the case of a lawsuit, the installer will have the burden of proof that the installation was done according to code and would result in unnecessary costs for defending an installation that was installed correctly, but that had variables change that are out of their control. A better proposal would be to require the owner to relabel the equipment after any alteration to the system.

Related Public Comments for This Document

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| Related Item                                                                     |
|---------------------------------------------------------------------------------|--------------|
| First Revision No. 7519-NFPA 70-2015 [New Section after 701.5(B)]              |              |

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 18 20:39:26 EDT 2015

Committee Statement

Committee Action: Rejected

Resolution: Typically Automatic Transfer Switches have several overcurrent protection options each with different short-circuit current ratings (analogous to withstand close on ratings) which can cause confusion for AHJ during inspection or for service provider when replacing overcurrent protection after installation. This requirement requires the installer to mark the equipment exterior with the short-circuit current rating of the automatic transfer switch based upon the specific overcurrent protective device type/rating. This clarifies to the inspector and service provider the specifics of the protection scheme, which is vital for safety.
Public Comment No. 257-NFPA 70-2015 [Section No. 701.6(D)]

(D) Ground Fault.

To indicate a ground fault in solidly grounded wye, legally required standby systems of more than 150 volts to ground and circuit-protective devices rated 1000 amperes or more. The sensor for the ground-fault signal devices shall be located at, or ahead of, the main system disconnecting means for the legally required standby source, and the maximum setting of the signal devices shall be for a ground-fault current of 1200 amperes. Instructions on the course of action to be taken in event of indicated ground fault shall be located at or near the sensor location.

For systems with multiple emergency sources connected to a paralleling bus, the ground fault sensor shall be permitted at an alternate location.

Informational Note: For signals for generator sets, see NFPA 110-2013, Standard for Emergency and Standby Power Systems.

Statement of Problem and Substantiation for Public Comment

Section 700.6 was modified per FR3638 to allow for proper ground fault sensing in a multiple source application. Apparently the same intended change did not get into 701.6 as was intended. The text proposed is identical that that in 700.6 (D).

Related Item

Public Input No. 1530-NFPA 70-2014 [New Article after 445]

Submitter Information Verification

Submitter Full Name: GARY OLSON
Organization: KW RX LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 16 09:44:41 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3608-NFPA 70-2015
Statement: First level subdivision 701.6(D) is revised to correlate with the revision made in section 700.6.
(A) Storage Battery.

Storage batteries shall be of suitable rating and capacity to supply and maintain the total load for a minimum period of 1 \(\frac{1}{2}\) hours without the voltage applied to the load falling below the load equipment manufacturer's minimum operating value 87-1/2 percent of normal. Automotive-type batteries shall not be used.

An automatic battery charging means shall be provided.

Statement of Problem and Substantiation for Public Comment

Eliminating the standardized 87.5% minimum battery retention threshold would be highly problematic for the listing of the equipment containing the storage batteries and for maintenance of the systems after installation. If the first revision is adopted as currently proposed, a marking will be required on every power source to identify (by manufacturer and model number) those loads for which it has been evaluated and found to provide the required 90 minutes of power. Additionally, field testing may be required when any of the connected emergency luminaires (the load equipment) need to be replaced, to verify that the power source has sufficient capacity. The minimum voltage requirement (in the 2014 and earlier editions) is what allows the power source and the load equipment to be independently certified and then mated in the field without the need for field testing for compatibility. The related product standard (UL 924) is benchmarked to this 87.5% threshold. This standardization should be restored and not be permitted to 'float' as suggested by the first revision. The flexibility gained does not adequately offset the unintended consequences for the majority of stakeholders.

Similar comments have been submitted in regards to the same issue under FR 3615, 3618, and 3628.

Related Item

First Revision No. 3627-NFPA 70-2015 [Section No. 701.12(A)]

Submitter Information Verification

Submitter Full Name: MICHAEL SHULMAN
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 24 15:09:08 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3609-NFPA 70-2015
Statement: The 87.5% minimum battery retention threshold is reinstated. The minimum voltage requirement allows the power source and the load equipment to be independently certified and then mated in the field without the need for field testing for compatibility. The related product standard (UL 924) is benchmarked to this 87.5% threshold.
(G) Unit Equipment.

Individual unit equipment for legally required standby illumination shall consist of the following:

1. A rechargeable battery
2. A battery charging means
3. Provisions for one or more lamps mounted on the equipment and shall be permitted to have terminals for remote lamps
4. A relaying device arranged to energize the lamps automatically upon failure of the supply to the unit equipment

The batteries shall be of suitable rating and capacity to supply and maintain the total lamp load associated with the unit for not less than (a) or (b):

- For a period of \( 1 \frac{1}{2} \) hours, without the voltage falling below the equipment manufacturer’s minimum operating voltage value
- The unit equipment shall supply and maintain not less than 60 percent of the initial emergency illumination for a period of at least \( 1 \frac{1}{2} \) hours

Unit equipment shall be listed.

Informational note: See ANSI/UL 924, Emergency Lighting and Power Equipment, for information covering unit equipment.

Unit equipment shall be permanently fixed in place (i.e., not portable) and shall have all wiring to each unit installed in accordance with the requirements of any of the wiring methods in Chapter 3. Flexible cord-and-plug connection shall be permitted, provided that the cord does not exceed 900 mm (3 ft) in length. The branch circuit feeding the unit equipment shall be the same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches. Legally required standby luminaires that obtain power from a unit equipment and are not part of the unit equipment shall be wired to the unit equipment by one of the wiring methods of Chapter 3.

Exception: In a separate and uninterrupted area supplied by a minimum of three normal lighting circuits, a separate branch circuit for unit equipment shall be permitted if it originates from the same panelboard as that of the normal lighting circuits and is provided with a lock-on feature.

Statement of Problem and Substantiation for Public Comment

Because subsection 701.12(G)(3) allows remote luminaires to obtain power from the unit equipment batteries, the nominal 87-1/2% battery output voltage threshold must be maintained for field-mating compatibility purposes; otherwise, an operational field test will be needed every time such a remote luminaire is added or replaced if that remote luminaire is not specifically identified as suitable for use with the unit equipment at the time the unit equipment is listed. See my similar comment submitted under FR-3615. Also see similar comment submitted for 700.12(F)(2)(1), under FR-3618.

The simplest and most useful revision here is just to require the unit equipment to be listed and include an informational note pointing to UL 924 which addresses these products and includes the requirements for retention of battery power, along with a minimum light output requirement, at the end of 90 minutes (or longer, if the equipment is rated for longer operation). The standard performs this testing inclusive of any remote loads for which the equipment is rated and marked.

If the CMP does not want to rely exclusively on the product safety standard, then the 87-1/2% battery voltage should be retained in 700.12(G)(4). I have submitted a second (separate) comment showing this option.

Related Item

First Revision No. 3628-NFPA 70-2015 [Section No. 701.12(G)]

Submitter Information Verification

Submitter Full Name: MICHAEL SHULMAN
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 24 15:43:28 EDT 2015
<table>
<thead>
<tr>
<th>Committee Statement</th>
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</thead>
<tbody>
<tr>
<td><strong>Committee Action:</strong></td>
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<tr>
<td><strong>Resolution:</strong></td>
</tr>
<tr>
<td><strong>Statement:</strong></td>
</tr>
</tbody>
</table>
(G) Unit Equipment.

Individual unit equipment for legally required standby illumination shall consist of the following:

1. A rechargeable battery
2. A battery charging means
3. Provisions for one or more lamps mounted on the equipment and shall be permitted to have terminals for remote lamps
4. A relaying device arranged to energize the lamps automatically upon failure of the supply to the unit equipment

The batteries shall be of suitable rating and capacity to supply and maintain the total lamp load associated with the unit for not less than (a) or (b):

(a) For a period of \( \frac{1}{2} \) hours, without the voltage falling below the equipment manufacturer's minimum operating voltage value.

(b) The unit equipment shall supply and maintain not less than 60 percent of the initial emergency illumination for a period of at least \( \frac{1}{2} \) hours.

Unit equipment shall be permanently fixed in place (i.e., not portable) and shall have all wiring to each unit installed in accordance with the requirements of any of the wiring methods in Chapter 3. Flexible cord-and-plug connection shall be permitted, provided that the cord does not exceed 900 mm (3 ft) in length. The branch circuit feeding the unit equipment shall be the same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches. Legally required standby luminaires that obtain power from a unit equipment and are not part of the unit equipment shall be wired to the unit equipment by one of the wiring methods of Chapter 3.

Exception: In a separate and uninterrupted area supplied by a minimum of three normal lighting circuits, a separate branch circuit for unit equipment shall be permitted if it originates from the same panelboard as that of the normal lighting circuits and is provided with a lock-on feature.

Statement of Problem and Substantiation for Public Comment

Because subsection 701.12(G)(3) allows remote luminaires to obtain power from the unit equipment batteries, the nominal 87-1/2% battery output voltage threshold must be maintained for field-mating compatibility purposes; otherwise, an operational field test will be needed every time such a remote luminaire is added or replaced if that remote luminaire is not specifically identified as suitable for use with the unit equipment at the time the unit equipment is listed. See my similar comment submitted under FR-3615. Also see similar comment submitted for 700.12(F)(2)(1), under FR-3618.

The simplest and most useful revision here is just to require the unit equipment to be listed and include an informational note pointing to UL 924 which addresses these products and includes the requirements for retention of battery power, along with a minimum light output requirement, at the end of 90 minutes (or longer, if the equipment is rated for longer operation). The standard performs this testing inclusive of any remote loads for which the equipment is rated and marked. I have separately submitted such a comment. However, if the CMP does not want to rely exclusively on the product safety standard, then the 87-1/2% battery voltage should be retained in 700.12(G)(4), as shown here.

Related Item
First Revision No. 3628-NFPA 70-2015 [Section No. 701.12(G)]

Submitter Information Verification

Submitter Full Name: MICHAEL SHULMAN
Organization: UL LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Aug 24 15:50:20 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3610-NFPA 70-2015
| **Statement:** | The 87.5% minimum battery retention threshold is reinstated. The minimum voltage requirement allows the power source and the load equipment to be independently certified and then mated in the field without the need for field testing for compatibility. The related product standard (UL 924) is benchmarked to this 87.5% threshold. |
701.27 Selective Coordination.

Legally required standby system(s) overcurrent devices shall be selectively coordinated with all supply-side overcurrent protective devices.

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Exception: Selective coordination shall not be required between a paralleling breaker in a multiple generator paralleling system and downstream feeder devices.

Statement of Problem and Substantiation for Public Comment

See substantiation for proposed section 7.32.

Related Public Comments for This Document

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<th>Relationship</th>
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<tr>
<td>Public Comment No. 258-NFPA 70-2015 [Section No. 700.32]</td>
<td>provides the same exception for legally required applications</td>
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<tr>
<td>Public Input No. 1530-NFPA 70-2014 [New Article after 445]</td>
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</tbody>
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Submitter Information Verification

Submitter Full Name: GARY OLSON
Organization: KW RX LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 16 10:31:26 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The additional text is not necessary. For parallel generator applications, there are many design, control, overcurrent protective device technologies, and overcurrent protection setting options whereby selective coordination is achievable between feeder overcurrent protective devices and generator paralleling circuit breakers, even when one or more generators fail to supply power.
702.5 Transfer Equipment.

Transfer equipment shall be suitable for the intended use and designed and installed so as to prevent the inadvertent interconnection of normal and alternate sources of supply in any operation of the transfer equipment. Transfer equipment and electric power production systems installed to permit operation in parallel with the normal source shall meet the requirements of Article 705.

Transfer equipment, located on the load side of branch circuit protection, shall be permitted to contain supplemental overcurrent protection having an interrupting rating sufficient for the available fault current that the generator can deliver. The supplementary overcurrent protection devices shall be part of a listed transfer equipment.

Transfer equipment shall be required for all standby systems subject to the provisions of this article and for which an electric utility supply is either the normal or standby source.

Exception No. 1: Temporary connection of a portable generator without transfer equipment shall be permitted where conditions of maintenance and supervision ensure that only qualified persons service the installation and where the normal supply is physically isolated by a lockable disconnecting means or by disconnection of the normal supply conductors.

Exception No. 2: The installation of listed meter-mounted transfer switches that are under the exclusive control of the electric utility, as permitted in accordance with 90.2(B)(5)a. are not under the purview of the NEC. Listed meter-mounted transfer switches for use with portable generators shall be of the floating neutral type and connected with listed cords. A warning sign meeting the requirements of 702.7(C) shall be installed on meter-mounted transfer switches that are listed for use with portable generators.

Informational Note: See UL1008M, Outline Of Investigation For transfer Switch Equipment, Meter Mounted, for the requirements for listed and labeling meter-mounted transfer switches.

The short-circuit current rating of the transfer equipment, based on the specific overcurrent protective device type and settings protecting the transfer equipment, shall be field marked on the exterior of the transfer equipment.

Statement of Problem and Substantiation for Public Comment

The UL 1008M standard for meter-mounted transfer switches was recently amended by UL to allow for the connection of a permanently installed generator. The scope of this UL standard, in Section 1.3 clearly states that these types of devices be under the exclusive control of the serving utility, and are not under the purview of the NEC. Utility installation are not under the purview of the NEC, however if the device was installed by an electrical contractor, the installation would be under the purview of the NEC and the UL listing of the device would be violated. The proposed language would bring clarity that these types of devices are UL listed as utility equipment to be installed by the utility, and under the utilities exclusive control, and not as listed electrical equipment that can be installed by an electrical contractor.

UL 1008M TRANSFER SWITCH EQUIPMENT, METER MOUNTED

1 Scope

1.1 These requirements cover automatic and non-automatic (manual) transfer switch equipment, operating at 600 V ac less, and intended for installation in a utility meter base, in ordinary locations only.

1.2 These devices are intended for use in optional standby systems only, and are intended for cord connection of a portable generator to power a premise wiring system, where the neutral (grounded circuit conductor) of the generator is not bonded to ground or the generator frame. Bonding of the neutral (grounded circuit conductor) to ground will occur within the meter base. These devices are not intended for use in Emergency or Legally Required Standby Systems.

1.3 The installation of these devices is intended to be under the exclusive control of the serving utility, and these are not considered under the purview of the National Electrical Code, NFPA 70.

1.4 An automatic transfer switch as covered by these requirements is a device that automatically transfers a common load from a normal supply to an alternate supply in the event of failure of the normal supply, and automatically returns the load to the normal supply when the normal supply is restored. An automatic transfer switch may be provided with a logic control circuit that inhibits automatic operation of the device from either a normal to an alternate supply, or from an alternate to a normal supply when the switch reverts to automatic operation upon loss of power to the load.

1.5 A non-automatic transfer switch as covered by these requirements is a device, operated manually by a physical action, or electrically by a remote control, for transferring a common load between a normal and alternate supply.

1.6 A transfer switch may incorporate overcurrent protection for the main power circuits.

1.7 These requirements only cover transfer switches which are completely enclosed when installed in a meter base in conjunction with the electrical utility meter.
1.8 Transfer switches are rated in amperes and are considered to be acceptable for total system transfer, which includes control of motors, electric-heating loads, and transformer loads.

### Related Public Comments for This Document

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<tr>
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<td>Public Comment No. 123-NFPA 70-2015 [Section No. 90.2(B)]</td>
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<td>Public Comment No. 127-NFPA 70-2015 [Article 100]</td>
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**Related Item**

| First Revision No. 2-NFPA 70-2015 [Section No. 90.2(B)] |

### Submitter Information Verification

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<tr>
<th>Submitter Full Name</th>
<th>Organization</th>
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<tr>
<td>BRIAN BAUGHMAN</td>
<td>GENERAC POWER SYSTEMS</td>
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### Committee Statement

<table>
<thead>
<tr>
<th>Committee Action</th>
<th>Resolution</th>
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<tbody>
<tr>
<td>Rejected</td>
<td>The present requirements for transfer switches already cover such installations. The purview of the NEC per 90.2 sets the applicability of these requirements.</td>
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Public Comment No. 751-NFPA 70-2015 [Section No. 702.5]

702.5 Transfer Equipment.
Transfer equipment shall be suitable for the intended use and designed and installed so as to prevent the inadvertent interconnection of normal and alternate sources of supply in any operation of the transfer equipment. Transfer equipment and electric power production systems installed to permit operation in parallel with the normal source shall meet the requirements of Article 705.

Transfer equipment, located on the load side of branch circuit protection, shall be permitted to contain supplemental overcurrent protection having an interrupting rating sufficient for the available fault current that the generator can deliver. The supplementary overcurrent protection devices shall be part of a listed transfer equipment.

Transfer equipment shall be required for all standby systems subject to the provisions of this article and for which an electric utility supply is either the normal or standby source.

Exception: Temporary connection of a portable generator without transfer equipment shall be permitted where conditions of maintenance and supervision ensure that only qualified persons service the installation and where the normal supply is physically isolated by a lockable disconnecting means or by disconnection of the normal supply conductors.

The short-circuit current rating of the transfer equipment, based on the specific overcurrent protective device type and settings protecting the transfer equipment, shall be field marked on the exterior of the transfer equipment.

Statement of Problem and Substantiation for Public Comment
IEC's position is to delete the last sentence in 702.5 - (FR 7520)

The code already requires that equipment be installed according to available fault current, so adding this requirement is redundant. The installer/supplier already has the responsibility/liability to install the proper equipment based on the characteristics of the system. This proposal puts too much liability on the contractor/supplier because after installation various factors can change which will affect the available fault current. Feeders can be reworked, transformers can be changed with different impedance values, motor loads can be added to the existing system and similar factors that can change the available fault current. In the case of a lawsuit, the installer will have the burden of proof that the installation was done according to code and would result in unnecessary costs for defending an installation that was installed correctly, but that had variables change that are out of their control. A better proposal would be to require the owner to relabel the equipment after any alteration to the system.

Related Public Comments for This Document

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<td>First Revision No. 7520-NFPA 70-2015 [Section No. 702.5]</td>
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Submitter Information Verification
Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 18 20:41:59 EDT 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected</th>
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<tbody>
<tr>
<td>Resolution:</td>
<td>Typically Automatic Transfer Switches have several overcurrent protection options each with different short-circuit current ratings (analogous to withstand close on ratings) which can cause confusion for AHJ during inspection or for service provider when replacing overcurrent protection after installation. This requirement requires the installer to mark the equipment exterior with the short-circuit current rating of the automatic transfer switch based upon the specific overcurrent protective device type/rating. This clarifies to the inspector and service provider the specifics of the protection scheme, which is vital for safety.</td>
</tr>
</tbody>
</table>
702.6 Signals...

(D) Ground Fault. To indicate a ground fault in a solidly grounded wye, optional standby system of more than 150 volts to
ground and circuit-protective devices rated 1000 amperes or more. The sensor for the ground-fault signal devices shall be
located at, or ahead of the main disconnecting means for the optional standby source, and the maximum setting of the signal
devices shall be for a ground-fault current of 1200 amperes. Instructions on the course of action to be taken in event of
indicated ground fault shall be located at or near the sensor location.

For systems with multiple emergency sources connected to a paralleling bus, the ground fault sensor shall be permitted to be at
an alternate location.

Statement of Problem and Substantiation for Public Comment

If there is no text addressing ground fault design in optional standby systems, the requirements elsewhere in the code must be
followed. This potentially makes optional standby system generators have different design requirements from more critical systems,
and compromises the safety of the system by not requiring display of the ground fault condition in the most commonly used location for
generator sets.

The text is intended to make optional standby generators meet the same requirements as those for 700 and 701, except that they are
required to provide ground fault protection rather than simply indication.

As I understand the text in 700.26 and 701.26, a modification to add section 702.26 is not required because ground fault protection is
required for these applications.

Related Public Comments for This Document

<table>
<thead>
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<tr>
<td>Public Comment No. 258-NFPA 70-2015 [Section No. 700.32]</td>
<td>Related Item</td>
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<tr>
<td>First Revision No. 3638-NFPA 70-2015 [Section No. 700.6(D)]</td>
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Submitter Information Verification

Submitter Full Name: GARY OLSON
Organization: KW RX LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 16 09:19:38 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The requirement for ground fault indication, found in Articles 700 and 701 is required because ground fault tripping is not
required, as indicated in Sections 700.27 and 701.26. In Article 702, there is no relief to ground fault protection. Where
ground fault protection is required by other sections in the Code, it will be required in the appropriate locations in Optional
Standby Systems. Therefore, ground fault indication is not required, as it will be apparent that there's a ground fault when
a breaker trips and the affected load loses power.
Public Comment No. 664-NFPA 70-2015 [Section No. 702.7(C)]

(C) Power Inlet Portable Connection

Where a power inlet, cord and plug connection is used for a temporary connection to connect a portable generator, a warning sign shall be placed near the inlet connection that is attached to the building or structure to indicate the type of derived system that the system is capable of based on the wiring of the transfer equipment system installed. The sign shall display one of the following warnings:

WARNING:

FOR CONNECTION OF A SEPARATELY DERIVED (NEUTRAL BONDED NEUTRAL TO FRAME) SYSTEM ONLY

or

WARNING:

FOR CONNECTION OF A NONSEPARATELY DERIVED (FLOATING NEUTRAL BOND TO FRAME REMOVED) SYSTEM ONLY

Additional Proposed Changes

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<th>Description Approved</th>
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<tbody>
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Statement of Problem and Substantiation for Public Comment

The terms power inlet, flanged surface inlet (see 406.7(D) and cord and plug are used to describe this portable connection. The panel stated Power inlet is a general term used for a cord and plug connection, this is not the case, cord and plug is the general term used throughout the code and it covers a wide variety of connections including but not limited to pin and sleeve, receptacle, flange inlet, attachment plug and power inlet. If this is the case there would be no need to include the term cord and plug in section 702.12(B) and section 702.12 (B) also calls out a flanged inlet! we need consistency. the word temporary is misleading as shown in the PI 2810 photos. This connection should be located at the building location that is why I suggested the "on the building" language. the neutral bonded and floating language is half the story written is generator industry language, and clear understanding is needed. I have a companion PC on a informational note to address this issue. I realize the panel is tiring to coincide with the generator product in the field however I spoke to a few Generator manufacturers and they stated the term floating neutral does not mean there is no neutral to frame connection, to them it means no neutral to ground anywhere in the system. Section 702.11 deals with this subject and refers you to 250.30. If the panel wants to protect the homeowner having them ask the right question when buying the generator is important.: such as I need a generator with a neutral bonded to the frame.

Related Item

Public Input No. 2810-NFPA 70-2014 [Section No. 702.7(C)]

Submitter Information Verification

Submitter Full Name: ALFIO TORRISI
Organization: master
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 15 14:21:12 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed revision does not increase clarity or usability.
Portable Generators 15 kW or Less.

Where a portable generator, rated 15 kW or less, is installed using a flanged inlet or other cord- and plug-type connection, a disconnect is used to disconnect a feeder or branch circuit passing through or supplying the premise wiring of a building or structure, an additional disconnecting means shall not be required, where ungrounded conductors serve or pass through a flanged inlet, when the portable generator is installed with in sight of the building or structure.

Statement of Problem and Substantiation for Public Comment

Portable connection through a cord and plug connection is the general term. the way it is written no disconnect is required? you always need a disconnect in this case it is the cord and plug. the generator could be placed behind a shed or remote from the building the cord and plug use could also be at this location, leaving no disconnecting means at the building or with in sight as required with other section 702.12. the premise wiring language clarifies this installation only applies when the portable generators supply is attached to the premise wiring.

Related Item
First Revision No. 3633-NFPA 70-2015 [Section No. 702.12(A)]
Public Input No. 2807-NFPA 70-2014 [Section No. 702.12]

Submitter Information Verification
Submitter Full Name: ALFIO TORRISI
Organization: Master
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 12:10:01 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The proposed revision does not add clarity or usability. No technical substantiation was provided to revise this requirement.
Public Comment No. 974-NFPA 70-2015 [ Section No. 702.12(C) ]

(C) Power Inlets Rated at 100 Amperes or Greater, for Portable Generators.

Equipment containing power inlets for the connection of a generator source shall be listed for the intended use. Systems with power inlets shall be equipped with an interlocked disconnecting means.

Exception No. 1: If the inlet device is rated as a disconnecting means

Exception No. 2: Supervised industrial installations where permanent space is identified for the portable generator located within line of sight of the power inlets. Industrial installations where condition of maintenance and supervision ensure that only qualified persons service the equipment, shall not be required to have interlocked disconnecting means nor inlets rated as disconnects.

Statement of Problem and Substantiation for Public Comment

Having qualified persons service the equipment provides a safer installation/operation than having permanent space for the portable generator and within line of sight. The comment as submitted is more in alignment with the standard industrial exemptions granted elsewhere in the Code.

Related Item

First Revision No. 3632-NFPA 70-2015 [New Section after 702.12(B)]

Submitter Information Verification

Submitter Full Name: Travis Foster
Organization: Shell Oil Company
Affiliation: ACC (American Chemistry Council)
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 17:31:12 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The requirement for a “permanent identified space…within sight of the power inlets” is the basis for this industrial exception.
### Public Comment No. 1213-NFPA 70-2015 [Section No. 705.1]

**705.1 Scope.**

This article covers installation of one or more electric power production sources operating either in parallel with a primary source(s) of electricity, as intentionally islanded, as stand-alone, or in any combination thereof.

Informational Note: Examples of the types of primary sources include a utility supply or an on-site electric power source(s).

### Statement of Problem and Substantiation for Public Comment

A gap exists in the current code for both stand-alone and intentionally islanded systems, both of which typically involve the interconnection of multiple power sources but which were not directly addressed under 705. By revising the scope of 705 to clarify it applies to systems operating in parallel, as stand-alone, intentionally islanded or any combination, this article can clearly address these systems. Additional requirements for stand-alone and intentionally islanded systems are currently under consideration through other actions in this code cycle, this proposal is intended to coordinate with them.

**Related Item**

First Revision No. 1045-NFPA 70-2015 [New Part after III.]

### Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER  
Organization: OUTBACK POWER TECHNOLOGIES  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu Sep 24 13:25:16 EDT 2015

### Committee Statement

Committee Action: Rejected  
Resolution: The creation of Article 710 to address Stand-Alone Systems makes a revision to the scope of 705 unnecessary.
705.1 Scope.
This article covers installation of one or more electric power production sources operating in parallel with a primary source(s) of electricity or operating as an intentionally islanded system or operating as a stand-alone system.

Informational Note: Examples of the types of primary sources include a utility supply or an on-site electric power source(s).

Statement of Problem and Substantiation for Public Comment

Revision to the Scope as recommended by Mr. Roger McDaniel in his affirmative comment on FR 1045.

Related Item
First Revision No. 1045-NFPA 70-2015 [New Part after III.]

Submitter Information Verification

Submitter Full Name: TIMOTHY CROUSHORE
Organization: FIRSTENERGY
Affiliation: FirstEnergy
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 04 13:43:38 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The creation of Article 710 to address Stand-Alone Systems makes a revision to the scope of 705 unnecessary.
Public Comment No. 1006-NFPA 70-2015 [Definition: Intentionally Islanded System.]

Intentionally Islanded System.
A premises wiring system that has generation and/or energy storage and load, and has the ability to disconnect from and operate either in parallel with or intentionally disconnected from the primary source, and is intentionally planned.

Informational Note: An electrical system that separates from the primary source and can operate individually or interconnected is sometimes referred to as a microgrid.

Statement of Problem and Substantiation for Public Comment
The grammar in the original proposal was unclear

Related Item
First Revision No. 1046-NFPA 70-2015 [New Definition after Definition: Multimode Inverter.]

Submitter Information Verification
Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 23:46:01 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-988-NFPA 70-2015
Statement: This new language provides clarity and incorporates the request of the CC to remove “and/or”. The informational note was added to clarify that 90.2(B)(5) excludes electric utilities.
Intentionally Islanded System.

A premises wiring system that has generation and/or energy storage and load(s), has that includes the ability to disconnect from and be operated in parallel with, or intentionally disconnected from the primary source, and is intentionally planned.

Informational Note: An electrical system that separates from the primary source and can operate individually or interconnected is sometimes referred to as a microgrid.

Statement of Problem and Substantiation for Public Comment

The grammar in the definition is incorrect and confusing.

Suggest changing it to read: "A system that has generation and/or energy storage and load(s), that includes the ability to be operated in parallel with, or intentionally disconnected from the primary source."

Related Item
First Revision No. 1046-NFPA 70-2015 [New Definition after Definition: Multimode Inverter]

Submitter Information Verification

Submitter Full Name: Timothy Zgonena
Organization: UL LLC
Street Address:
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 15:40:52 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-988-NFPA 70-2015
Statement: This new language provides clarity and incorporates the request of the CC to remove “and/or”. The informational note was added to clarify that 90.2(B)(5) excludes electric utilities.
Public Comment No. 1864-NFPA 70-2015 [Definition: Intentionally Islanded System.]

Intentionally Islanded System.
A premises wiring system that has generation and/or energy storage and load, has the ability to disconnect from and parallel with the primary source, and is intentionally planned.

Informational Note: An electrical system that separates from the primary source and can operate individually or interconnected is sometimes referred to as a microgrid.

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs that further consideration be given to the comment expressed in voting on FR 1046. The Correlating Committee directs that “and/or” be replaced to comply with the NEC Style Manual.

Related Item
First Revision No. 1046-NFPA 70-2015 [New Definition after Definition: Multimode Inverter.]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:20:10 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-988-NFPA 70-2015
Statement: This new language provides clarity and incorporates the request of the CC to remove “and/or”. The informational note was added to clarify that 90.2(B)(5) excludes electric utilities.
Island Interconnection Device (IID).
A device that allows an intentionally islanded system to separate from and reconnect to a primary power source.

Statement of Problem and Substantiation for Public Comment

The interconnection function is already addressed in existing requirements and standards, and should not be duplicated in this manner. UL standards for interactive product address the specific considerations that must be addressed for this application and listed Interactive inverters which manage the interconnection to the area EPS are available from numerous manufacturers, yet these devices are not marked as being "Island Interconnection Devices" and so would not appear to comply with this requirement. In addition, there is no functional requirement for an intentionally islanded system to perform a seamless transfer, other than customer convenience; a listed manual double throw safety switch would provide the same level of safety, albeit at a lower level of convenience, but is not marked as an Island Interconnection Device. Overcurrent protection, disconnecting means, synchronizing means and the protection from multiple sources are addressed elsewhere in this article, so there is no benefit from adding this new requirement, only added complexity and potential confusion to AHJs and installers.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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</thead>
<tbody>
<tr>
<td>Public Comment No. 1208-NFPA 70-2015 [Section No. 705.170]</td>
<td></td>
</tr>
<tr>
<td>First Revision No. 1045-NFPA 70-2015 [New Part after III.]</td>
<td></td>
</tr>
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Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 12:26:13 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-989-NFPA 70-2015
Statement: This new language replaces the term “intentionally islanded” with the current industry term, “microgrid.”
**Island Interconnection Device (IID).**

A device that allows an microgrid (intentionally islanded) system to separate from and reconnect to a primary power source.

**Statement of Problem and Substantiation for Public Comment**

The term "intentionally islanded system" has been superseded in common usage and IEEE and IEC standards with the word "microgrid". IEEE in its new standard 2030.7 (Microgrid Controllers) has adopted the term Microgrid Interconnect Device, rather than Island Interconnect Device, as the former is self explanatory, while the latter is ambiguous. By 2017, the term "intentional island" will probably have disappeared entirely, as its source (IEEE 1547.4) is likely to be superseded.

**Related Item**

First Revision No. 1045-NFPA 70-2015 (New Part after III.)

**Submitter Information Verification**

Submitter Full Name: Robert Wills
Organization: Intergrid, LLC

**Committee Statement**

Committee Action: Rejected but see related SR
Resolution: SR-989-NFPA 70-2015
Statement: This new language replaces the term "intentionally islanded" with the current industry term, "microgrid."
Multimode Inverter.
Equipment having the capabilities of both the utility-interactive inverter and the stand-alone inverter.

Statement of Problem and Substantiation for Public Comment
The term "utility-interactive inverter" has been replaced with "interactive inverter."

Related Item
First Revision No. 1046-NFPA 70-2015 [New Definition after Definition: Multimode Inverter.]

Submitter Information Verification
Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 11:43:57 EDT 2015

Committee Statement
Committee Action: Accepted
Resolution: SR-990-NFPA 70-2015
Statement: The panel recognizes the acceptance of this public comment is necessary to maintain consistency with action taken in the First Draft in Article 705 to remove "utility" from "utility-interactive inverter."
Stand-Alone System.
A system that supplies power *independently* of an electrical production and distribution network.

Statement of Problem and Substantiation for Public Comment
Correct grammar (no -ly). Also this definition should move to Art 710 [proposed] Standalone Systems, as recommended by TCC. Standalone systems DOES NOT belong in Interconnected Systems! they are fundamental opposites. Creation of Article 710 standalone systems [new] should be referred to a task group prior to the SD meeting.

Related Item
First Revision No. 1045-NFPA 70-2015 [New Part after III.]

Submitter Information Verification
Submitter Full Name: Robert Wills
Organization: Intergird, LLC
Affiliation: NEC DC TG / Microgrid TG
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:19:35 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-991-NFPA 70-2015 The adverb "independently" is grammatically correct.
Statement: The definition is moved to Article 100, as it is used in multiple articles.
Section 705.3  Other Articles.

Interconnected electric power production sources shall comply with this article and also with the applicable requirements of the articles in Table 705.3.

Table 705.3 Other Articles

<table>
<thead>
<tr>
<th>Equipment/System</th>
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<tr>
<td>Generators</td>
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<td>Wind electric systems</td>
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</tr>
<tr>
<td>Emergency systems</td>
<td>700</td>
</tr>
<tr>
<td>Legally required standby systems</td>
<td>701</td>
</tr>
<tr>
<td>Optional standby systems</td>
<td>702</td>
</tr>
<tr>
<td>Energy storage systems</td>
<td>706</td>
</tr>
<tr>
<td>Standalone Systems</td>
<td>710</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

Add 710 Standalone Systems, if it is created as stand-alone systems, if multi-mode and capable of interconnection, must also comply with 705.

Related Item
First Revision No. 1045-NFPA 70-2015 [New Part after III.]

Submitter Information Verification

Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
Affiliation: NEC DC Task Force / Microgrid WG
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:28:29 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-992-NFPA 70-2015
Statement: The panel agrees these references are needed in this table. Stand Alone Systems Article 710 should show track change underline.
Public Comment No. 1865-NFPA 70-2015 [Section No. 705.3]

705.3 Other Articles.
Interconnected electric power production sources shall comply with this article and also with the applicable requirements of the articles in Table 705.3.

Table 705.3 Other Articles

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</tr>
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Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to consider adding Article 712 (DC Microgrids) to the list of Articles for improved correlation.

Related Item
First Revision No. 1016-NFPA 70-2015 [Section No. 705.3]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:21:25 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-992-NFPA 70-2015
Statement: The panel agrees these references are needed in this table. Stand Alone Systems Article 710 should show track change underline.
705.6 Equipment Approval.

All equipment shall be approved for the intended use. Utility-interactive inverters for interconnection systems are interactive, equipment intended to operate in parallel with the electric power system including, but not limited to, interactive inverters, engine generators, energy storage equipment, and wind turbines shall be listed and/or field labeled, and identified for the intended use of interconnection service.

Statement of Problem and Substantiation for Public Comment

This input is intended to clean up fragmented language and eliminate repetition, while maintaining the intent of the PI. Identification and options for field labeling is addressed in 110.3, and do not need to be repeated here. Inverters, wind turbines, energy storage systems and other equipment intended to operate in parallel with other sources are listed and marked as interactive, not as interconnection service. The incorrect language could lead to confusion with AHJs and installers.

Related Item
- Public Input No. 1085-NFPA 70-2014 [Section No. 705.4]
- Public Input No. 874-NFPA 70-2014 [Section No. 705.4]
- First Revision No. 1039-NFPA 70-2015 [Section No. 705.4]

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 00:05:22 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-993-NFPA 70-2015
Statement: This panel action provides clarity and consistency with FR 955 by removal of the word “utility” and addresses the issue of products being required to be labeled, as well as listed.
705.6 Equipment Approval.

All equipment shall be approved for the intended use. Utility-interactive inverters for interconnection systems interactive equipment intended to operate in parallel with the electric power system including, but not limited to, interactive inverters, engine generators, energy storage equipment, and wind turbines shall be listed, labeled, and identified or field labeled, and identified, for the intended use of interconnection service.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacturer remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item

Public Input No. 874-NFPA 70-2014 [Section No. 705.4]
First Revision No. 1039-NFPA 70-2015 [Section No. 705.4]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
### Committee Statement

<table>
<thead>
<tr>
<th>Committee</th>
<th>Rejected but see related SR</th>
</tr>
</thead>
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<tr>
<td>Action</td>
<td>SR-993-NFPA 70-2015</td>
</tr>
<tr>
<td>Resolution</td>
<td>This panel action provides clarity and consistency with FR 955 by removal of the word &quot;utility&quot; and addresses the issue of products being required to be labeled, as well as listed.</td>
</tr>
</tbody>
</table>
Public Comment No. 1866-NFPA 70-2015 [Section No. 705.6]

705.6 Equipment Approval.
All equipment shall be approved for the intended use. Utility-interactive inverters for interconnection systems interactive equipment intended to operate in parallel with the electric power system including, but not limited to, interactive inverters, engine generators, energy storage equipment, and wind turbines shall be listed and or field labeled, and identified for the intended use of interconnection service.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 1039. The Correlating Committee directs the panel to consider removing “Utility” from “Utility-interactive” as the first word of the second sentence to correlate with FR 955.

Related Item
First Revision No. 955-NFPA 70-2015 [Definition: Utility-Interactive Inverter]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:24:15 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-993-NFPA 70-2015
Statement: This panel action provides clarity and consistency with FR 955 by removal of the word “utility” and addresses the issue of products being required to be labeled, as well as listed.
705.6 Equipment Approval.

All equipment shall be approved for the intended use. Utility-interactive inverters for interconnection systems interactive equipment intended to operate in parallel with the electric power system including, but not limited to, interactive inverters, engine generators, energy storage equipment, and wind turbines shall be listed and or field labeled, and identified for the intended use of interconnection service.

Statement of Problem and Substantiation for Public Comment

Edit

Related Item
First Revision No. 1039-NFPA 70-2015 [Section No. 705.4]

Submitter Information Verification

Submitter Full Name: MIKE HOLT
Organization: MIKE HOLT ENTERPRISES INC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 16:55:57 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-993-NFPA 70-2015
Statement: This panel action provides clarity and consistency with FR 955 by removal of the word “utility” and addresses the issue of products being required to be labeled, as well as listed.
705.6 Equipment Approval.
All equipment shall be approved for the intended use. Utility-interactive, interactive inverters for interconnection to systems intended to operate in parallel with the electric power system including, but not limited to, interactive inverters, engine generators, energy storage equipment, and wind turbines shall be listed and or field labeled, and identified for the intended use of interconnection service.

Statement of Problem and Substantiation for Public Comment
The first revision sentence was incomplete and very confusing. This is an editorial change not intended to change the meaning.

Related Item
First Revision No. 1039-NFPA 70-2015 [Section No. 705.4]

Submitter Information Verification
Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 15 16:49:57 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-993-NFPA 70-2015
Statement: This panel action provides clarity and consistency with FR 955 by removal of the word “utility” and addresses the issue of products being required to be labeled, as well as listed.
705.6 Equipment Approval.

All equipment shall be approved for the intended use. Utility-interactive inverters for interconnection systems interactive equipment intended to operate in parallel with the electric power system including, but not limited to, interactive inverters, engine generators, energy storage equipment, and wind turbines shall be listed and or field labeled, and identified for the intended use of interconnection service.

Statement of Problem and Substantiation for Public Comment

The term "Utility-Interactive inverter" has been replaced with "Interactive inverter."

Related Item

First Revision No. 1036-NFPA 70-2015 [Sections 705.40, 705.42]

Submitter Information Verification

Submitter Full Name: MARK BALDASSARI
Organization: ENPHASE ENERGY
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 22 11:48:39 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-993-NFPA 70-2015
Statement: This panel action provides clarity and consistency with FR 955 by removal of the word “utility” and addresses the issue of products being required to be labeled, as well as listed.
705.8 System Installation.
Installation of one or more electrical power production sources operating in parallel with a primary source(s) of electricity shall be installed and be performed only by qualified persons.

Informational Note: See Article 100 for the definition of Qualified Person.

Statement of Problem and Substantiation for Public Comment

The present text includes incorrect grammar.

Related Item
First Revision No. 1040-NFPA 70-2015 [Section No. 705.6]

Submitter Information Verification

Submitter Full Name: Timothy Zgonena
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:50:05 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-994-NFPA 70-2015
Statement: This panel action corrects a grammar issue.
705.12  Point of Connection.

The output of an interconnected electric power source shall be connected as specified in 705.12(A) or (B), (C), or (D).

(A)  Supply Side.

An electric power production source shall be permitted to be connected to the supply side of the service disconnecting means as permitted in 230.82(6). The sum of the ratings of all overcurrent devices connected to power production sources shall not exceed the rating of the service.

(B)  Integrated Electrical Systems.

The outputs shall be permitted to be interconnected at a point or points elsewhere on the premises where the system qualifies as an integrated electrical system and incorporates protective equipment in accordance with all applicable sections of Article 685.

The outputs shall be permitted to be interconnected at a point or points elsewhere on the premises where all of the following conditions are met:

1. The aggregate of non-utility sources of electricity has a capacity in excess of 100 kW, or the service is above 1000 volts.

2. The conditions of maintenance and supervision ensure that qualified persons service and operate the system.

3. Safeguards, documented procedures, and protective equipment are established and maintained.

4. If the interconnection occurs in a switchboard or a panelboard that is fed simultaneously by a primary source(s) of electricity, and where this distribution equipment is capable of supplying multiple branch circuits or feeders or both, the interconnecting provisions for the interconnected electric power production source shall comply with 705.12(D)(1) through (D)(5).

(D)

Greater Than 100 kW.

Load Side.

The output of an electric power production source shall be permitted to be connected to the load side of the service disconnecting means of the other source(s) at any distribution equipment on the premises. Where distribution equipment, including switchgear, switchboards, or panelboards, is fed simultaneously by a primary source(s) of electricity and one or more other power source(s), and where this distribution equipment is capable of supplying multiple branch circuits or feeders, or both, the interconnecting provisions for other power sources shall comply with 705.12(D)(1) through (D)(5).

1. Dedicated Overcurrent and Disconnect.

Each source interconnection of one or more power sources installed in one system shall be made at a dedicated circuit breaker or fusible disconnecting means.
(2) Bus or Conductor Ampere Rating.

One hundred twenty-five percent of the power source output circuit current shall be used in ampacity calculations for the following:

(1) Feeders. Where the power source output connection is made to a feeder at a location other than the opposite end of the feeder from the primary source overcurrent device, that portion of the feeder on the load side of the power source output connection shall be protected by one of the following:

   (2) The feeder ampacity shall be not less than the sum of the primary source overcurrent device and 125 percent of the power source output circuit current.

   (3) An overcurrent device on the load side of the power source connection shall be rated not greater than the ampacity of the feeder.

(4) Taps. In systems where power source output connections are made at feeders, any taps shall be sized based on the sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the feeder conductors as calculated in 240.21(B). Power source output circuit conductors, where smaller than the feeder conductors, shall be sized to carry not less than the larger of 705.60 or 240.21(B).

(5) Busbars. One of the methods that follows shall be used to determine the ratings of busbars in panelboards.

   (a) The sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed the ampacity of the busbar.

      Informational Note: This general rule assumes no limitation in the number of the loads or sources applied to busbars or their locations.

   (b) Where two sources, one a primary power source and the other another power source, are located at opposite ends of a busbar that contains loads, the sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed 120 percent of the ampacity of the busbar. The busbar shall be sized for the loads connected in accordance with Article 220. A permanent warning label shall be applied to the distribution equipment adjacent to the back-fed breaker from the power source that displays the following or equivalent wording:

      WARNING:

      POWER SOURCE OUTPUT CONNECTION —

      DO NOT RELOCATE THIS OVERCURRENT DEVICE.

      The warning sign(s) or label(s) shall comply with 110.21(B).

   (c) The sum of the ampere ratings of all overcurrent devices on panelboards, both load and supply devices, excluding the rating of the overcurrent device protecting the busbar, shall not exceed the ampacity of the busbar. The rating of the overcurrent device protecting the busbar shall not exceed the rating of the busbar. Permanent warning labels shall be applied to distribution equipment displaying the following or equivalent wording:

      WARNING:

      THIS EQUIPMENT FED BY MULTIPLE SOURCES.

      TOTAL RATING OF ALL OVERCURRENT DEVICES

      EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE

      SHALL NOT EXCEED AMPACITY OF BUSBAR.

      The warning sign(s) or label(s) shall comply with 110.21(B).

   (d) Connections shall be permitted on multiple-ampacity busbars or center-fed panelboards where designed under engineering supervision that includes fault studies and busbar load calculations.

(3) Marking.

Equipment containing overcurrent devices in circuits supplying power to a busbar or conductor supplied from multiple sources shall be marked to indicate the presence of all sources.

(4) Suitable for Backfeed.

Circuit breakers, if backfed, shall be suitable for such operation.

Informational Note: Fused disconnects, unless otherwise marked, are suitable for backfeeding.
Listed plug-in-type circuit breakers backfed from interactive inverters or other electric power sources that are listed and identified as interactive shall be permitted to omit the additional fastener normally required by 408.36(D) for such applications.

Statement of Problem and Substantiation for Public Comment

With the change of title of 705.12(D) to "Load Side" and the text change from "inverter" to "power source" 705.12(D) now applies to all types of energy source interconnections. Since 705.12(D) allows interconnection "at any distribution equipment on the premises" it negates the need for B or C which made special allowances for systems that could be interconnected at other points on the premises. Sections B and C now serve no purpose and can be removed. All systems simply are load side or supply side interconnected, significant simplifying 705.12.

Related Item

Public Input No. 2566-NFPA 70-2014 [Section No. 705.12(C)]
Public Input No. 4464-NFPA 70-2014 [Section No. 705.12(D)]
First Revision No. 1025-NFPA 70-2015 [Section No. 705.12(D)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
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Submittal Date: Wed Sep 23 15:28:29 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-995-NFPA 70-2015
Statement: The Panel removes 705.12(B) and (C) as they are no longer necessary given the changes in the titles of (A) and (D) and the change of the term "utility-interactive inverter" to "power production source."
The output of an interconnected electric power production source shall be permitted to be connected to the load side of the service disconnecting means of the other source(s) at any distribution equipment on the premises. Where distribution equipment, including switchgear, switchboards, or panelboards, is fed simultaneously by a primary source(s) of electricity and one or more other power source(s), and where this distribution equipment is capable of supplying multiple branch circuits or feeders, or both, the interconnecting provisions for other power sources shall comply with 705.12(D)(1) through (D)(5).

Statement of Problem and Substantiation for Public Comment

Text changed to match the text under 705.12.

Related Item

Public Input No. 4464-NFPA 70-2014 [Section No. 705.12(D)]
First Revision No. 1025-NFPA 70-2015 [Section No. 705.12(D)]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
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Submittal Date: Wed Sep 23 15:41:53 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-997-NFPA 70-2015
Statement: The first paragraph is revised to match the text in 705.12.

The last sentence of the paragraph on Taps is deleted, and the concept moved to 705.60, which is more appropriate.

A new item (2)(3)(d) is added to permit connections to center-fed panels in dwellings at either end while maintaining the 120 percent rule.

(5) is revised for clarity.
(2) Bus or Conductor Ampere Rating.

One hundred twenty-five percent of the power source output circuit current shall be used in ampacity calculations for the following:

(1) Feeders. Where the power source output connection is made to a feeder at a location other than the opposite end of the feeder from the primary source overcurrent device, that portion of the feeder on the load side of the power source output connection shall be protected by one of the following:

(2) The feeder ampacity shall be not less than the sum of the primary source overcurrent device and 125 percent of the power source output circuit current.

(3) An overcurrent device on the load side of the power source connection shall be rated not greater than the ampacity of the feeder.

(4) Taps. In systems where power source output connections are made at feeders, any taps shall be sized based on the sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the feeder conductors as calculated in 240.21(B). Power source output circuit conductors, where smaller than the feeder conductors, shall be sized to carry not less than the larger of 705.60 or 240.21(B).

(5) Busbars. One of the methods that follows shall be used to determine the ratings of busbars in panelboards.

(a) The sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed the ampacity of the busbar.

Informational Note: This general rule assumes no limitation in the number of the loads or sources applied to busbars or their locations.

(b) Where two sources, one a primary power source and the other another power source, are located at opposite ends of a busbar that contains loads, the sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed 120 percent of the ampacity of the busbar. The busbar shall be sized for the loads connected in accordance with Article 220. A permanent warning label shall be applied to the distribution equipment adjacent to the back-fed breaker from the power source that displays the following or equivalent wording:

WARNING:
POWER SOURCE OUTPUT CONNECTION —
DO NOT RELOCATE THIS OVERCURRENT DEVICE.

(c) The warning sign(s) or label(s) shall comply with 110.21(B).

(d) The sum of the ampere ratings of all overcurrent devices on panelboards, both load and supply devices, excluding the rating of the overcurrent device protecting the busbar, shall not exceed the ampacity of the busbar. The rating of the overcurrent device protecting the busbar shall not exceed the rating of the busbar. Permanent warning labels shall be applied to distribution equipment displaying the following or equivalent wording:

WARNING:
THIS EQUIPMENT FED BY MULTIPLE SOURCES,
TOTAL RATING OF ALL OVERCURRENT DEVICES
EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE
SHALL NOT EXCEED AMPACITY OF BUSBAR.

The warning sign(s) or label(s) shall comply with 110.21(B).

(e) Connections shall be permitted on multiple-ampacity busbars or center-fed panelboards where designed under engineering supervision that includes available fault studies, current and busbar load calculations.

Statement of Problem and Substantiation for Public Comment

The following is an email from Fred Hartwell of CMP9 and who was involved with the original 2008 NEC approval of the 120% rule
related to panelboards.

****Hartwell email dated 3/29

I think there is a fundamental misunderstanding of the 100% rule versus the 120% rule that pervades some current NEC requirements in 705.12(D) as well as the Wiles articles, which I have now reread more carefully than I should have when they first came out.

First, the 120% rule has nothing to do with busbar overloading. I can take a panelboard bus and protect opposite ends at 100% of rating (thus, connect it to sources at 200% of its rating), and never subject it to more amperes than its ampacity would allow. For example, consider a 200A bus with 200A supply circuit breakers arranged at opposite ends. No segment of the intervening busbars will see over 200A of current. If we had 250A of load connected to this busbar, there are two possibilities: Either one end receives over 200A, or not. If over 200A comes in from one side, then that side trips and regular conditions apply from the other end. If less than 200A comes in from one side, then the remaining current comes in from the other side which subtracts from the current needed from the first side. The 200A number cannot be exceeded in practice.

Second, even though the busbars could not be overloaded in terms of ampacity, the panelboard as an entity can be overloaded in terms of power delivered with any multiple sources of supply totaling above 100% of the rating for which it was tested. In the above example, the 200A bus assembly delivers 400A times voltage times applicable power factor in the form of power. My understanding, and this goes back to that cell phone conversation with the former CMP 9 NEMA rep I elaborated on at length in one of our previous conversations, is that this power density provides an overall heating effect that the panelboard manufacturers have not designed for.

The 120% rule should be understood, therefore, as an allowable fudge factor that can be applied due to concerns about practicalities and the knowledge that there doesn’t seem to be any loss experience to challenge it. I am looking at language that allows the 120% rule to be extended to a center-fed panelboard even though the 100% protection rule has an academic potential of being violated in some minor way unlikely to be experienced in the real world.

******End of email.

This email explains that the removal of the requirement of the opposite end of the busbar will not have a significant impact on the thermal loading of a panelboard. To simplify the process for enforcement and construction, removal of the opposite end of the busbar will be simpler and essentially no different than applying the current rule for the opposite end of the busbar.

The last comment edits the wording of the last section about multi-ampacity buswork by removing the reference to center-fed panels, since it is now longer relevant. Also, it clarifies the original wording to specifically address the relevant concern of available fault current rather than the less defined term of fault studies.
Bus or Conductor Ampere Rating.

One hundred twenty-five percent of the power source output circuit current shall be used in ampacity calculations for the following:

1. **Feeders.** Where the power source output connection is made to a feeder at a location other than the opposite end of the feeder from the primary source overcurrent device, that portion of the feeder on the load side of the power source output connection shall be protected by one of the following:

   a. The feeder ampacity shall be not less than the sum of the primary source overcurrent device and 125 percent of the power source output circuit current.

   b. An overcurrent device on the load side of the power source connection shall be rated not greater than the ampacity of the feeder.

2. **Taps.** In systems where power source output connections are made at feeders, any taps, the output conductors shall be sized based on the sum of 125 percent of the power source(s) output circuit current and the permitted to be sized as tap conductors according to 240.21(B) under the following conditions:

   a. For calculation purposes, the assumed rating of the overcurrent device protecting the feeder conductors as calculated in 240.21(B). Power source output circuit conductors, where smaller than the feeder conductors, shall be sized to carry not less than the larger of 705.60 or 240.21(B).

   b. The power source output conductors and overcurrent device shall not be smaller than required by 705.60.

5. **Busbars.** One of the methods that follows shall be used to determine the ratings of busbars in panelboards.

   a. The sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed the ampacity of the busbar.

   Informational Note: This general rule assumes no limitation in the number of the loads or sources applied to busbars or their locations.

   b. Where two sources, one a primary power source and the other another power source, are located at opposite ends of a busbar that contains loads, the sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed 120 percent of the ampacity of the busbar. The busbar shall be sized for the loads connected in accordance with Article 220. A permanent warning label shall be applied to the distribution equipment adjacent to the back-fed breaker from the power source that displays the following or equivalent wording:

   **WARNING:**

   POWER SOURCE OUTPUT CONNECTION —

   DO NOT RELOCATE THIS OVERCURRENT DEVICE.

   The warning sign(s) or label(s) shall comply with 110.21(B).

   c. The sum of the ampere ratings of all overcurrent devices on panelboards, both load and supply devices, excluding the rating of the overcurrent device protecting the busbar, shall not exceed the ampacity of the busbar. The rating of the overcurrent device protecting the busbar shall not exceed the rating of the busbar. Permanent warning labels shall be applied to distribution equipment displaying the following or equivalent wording:

   **WARNING:**

   THIS EQUIPMENT FED BY MULTIPLE SOURCES.

   TOTAL RATING OF ALL OVERCURRENT DEVICES EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE SHALL NOT EXCEED AMPACITY OF BUSBAR.

   The warning sign(s) or label(s) shall comply with 110.21(B).

   d. Connections shall be permitted on multiple-ampacity busbars or center-fed panelboards where designed under engineering supervision that includes fault studies and busbar load calculations.

**Statement of Problem and Substantiation for Public Comment**

This comment is mainly editorial, with the goal of having the code better communicate the requirements in section 705.12(D)(2)(2).
However it also contains a technical change which allows the requirements to comprehensively cover types of installations that are neglected by the current language.

The original language of 705.12(2)(2) from the 2014 code, as well as the First Draft language, can be easily misinterpreted as requiring the ampacity of a tap conductor to be the sum of the minimum requirements of 705.60 and 240.21(B), which is much larger than necessary. While the phrase "as calculated in 240.21(B)" seems intended to apply to the entire sum, it is not properly placed grammatically so as to make this clear and certain. This leaves many readers trying to interpret the meaning of phrase "the rating of the overcurrent device protecting the feeders as calculated in 240.21(B)". It is not entirely insensible to interpret that phrase as meaning the minimum requirements of 240.21(B). Thus some readers add the minimum requirements of the two sections together.

The new language proposed in this comment clears up any potential confusion about how 240.21(B) is to be followed. It uses the term 'tap conductors' properly as defined in 240.21(B). And by referring to an 'assumed rating', which is a sum more clearly defined in this section, it clears up which number is supposed to be used for 240.21(B) calculations, and in what manner.

In addition, the proposed language covers installations that have multiple sources connected to the same feeder, whether by taps or in panelboards fed by the feeder, or both. The rules in 240.21(B) are designed to account for the amount of available fault current, and the intention of 705.12(2)(2) is to have the fault current from all sources considered. However, the current First Draft language (like the 2014 code) assumes that the tap is the only non-primary source connection to the feeder. And yet a system could have one or more sources connected by taps, plus one or more sources connected with circuit breakers in downstream panelboards. There is no prohibition on such setups, nor should there be, but the First Draft language offers no guidance on such cases. By changing the relevant sum to include "all other sources that can supply additional fault current to the feeder", the new language concisely covers even the most complicated of real-world possibilities. All sources of fault current will be considered when sizing tap conductors.

Finally, in case the minimum size requirements of 240.21(B) are not clear because they refer to a 'load', the language proposed in this comment retains the minimum size requirements of 705.60.

In summary, I believe the language I've proposed here better communicates the intentions of CMP4 with respect to 705.12(D)(2)(2), while extending those intentions as much as possible to all conceivable installations.

Related Item
First Revision No. 1025-NFPA 70-2015 [Section No. 705.12(D)]

Submitter Information Verification

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Organization: Skytech Solar
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City:
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Submittal Date: Wed Sep 23 23:12:18 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-997-NFPA 70-2015
Statement: The first paragraph is revised to match the text in 705.12.

The last sentence of the paragraph on Taps is deleted, and the concept moved to 705.60, which is more appropriate.

A new item (2)(3)(d) is added to permit connections to center-fed panels in dwellings at either end while maintaining the 120 percent rule.

(5) is revised for clarity.
Public Comment No. 1356-NFPA 70-2015 [ Section No. 705.12(D)(2) ]

(2) Bus or Conductor Ampere Rating.

One hundred twenty-five percent of the power source output circuit current shall be used in ampacity calculations for the following:

(1) Feeders. Where the power source output connection is made to a feeder at a location other than the opposite end of the feeder from the primary source overcurrent device, that portion of the feeder on the load side of the power source output connection shall be protected by one of the following:

   (2) The feeder ampacity shall be not less than the sum of the primary source overcurrent device and 125 percent of the power source output circuit current.

   (3) An overcurrent device on the load side of the power source connection shall be rated not greater than the ampacity of the feeder.

(4) Taps. In systems where power source output connections are made at feeders, any taps shall be sized based on the sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the feeder conductors as calculated in 240.21(B). Power source output circuit conductors, where smaller than the feeder conductors, shall be sized to carry not less than the larger of 705.60 or 240.21(B).

(5) Busbars. One of the methods that follows shall be used to determine the ratings of busbars in panelboards.

   (a) The sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed the ampacity of the busbar.

      Informational Note: This general rule assumes no limitation in the number of the loads or sources applied to busbars or their locations.

   (b) Where two sources, one a primary power source and the other another power source, are located at opposite ends of a busbar that contains loads, the sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed 120 percent of the ampacity current rating of the busbar. The busbar shall be sized for the loads connected in accordance with Article 220. A permanent warning label shall be applied to the distribution equipment adjacent to the back-fed breaker from the power source that displays the following or equivalent wording:

      WARNING:

      POWER SOURCE OUTPUT CONNECTION —

      DO NOT RELOCATE THIS OVERCURRENT DEVICE.

      The warning sign(s) or label(s) shall comply with 110.21(B).

   (c) The sum of the ampere ratings of all overcurrent devices on panelboards, both load and supply devices, excluding the rating of the overcurrent device protecting the busbar, shall not exceed the ampacity of the busbar. The rating of the overcurrent device protecting the busbar shall not exceed the rating of the busbar. Permanent warning labels shall be applied to distribution equipment displaying the following or equivalent wording:

      WARNING:

      THIS EQUIPMENT FED BY MULTIPLE SOURCES.

      TOTAL RATING OF ALL OVERCURRENT DEVICES

      EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE

      SHALL NOT EXCEED AMPACITY OF BUSBAR.

      The warning sign(s) or label(s) shall comply with 110.21(B).

   (d) A connection at either end, but not both ends, of a center-fed panelboard shall be permitted where the rating of the overcurrent device does not exceed 120 percent of the current rating of the busbar. Connections shall be permitted on multiple-ampacity busbars or center-fed panelboards where designed under engineering supervision that includes available fault studies, current and busbar load calculations.

Statement of Problem and Substantiation for Public Comment
This is another option for the wording related to busbars in 705.12(D). This wording was recommended by Fred Hartwell as a way to simply allow center-fed panels to have a source connection. His explanation follows in a quote from an email he composed:

I think there is a fundamental misunderstanding of the 100% rule versus the 120% rule that pervades some current NEC requirements in 705.12(D) as well as the Wiles articles, which I have now reread more carefully than I should have when they first came out.

First, the 120% rule has nothing to do with busbar overloading. I can take a panelboard bus and protect opposite ends at 100% of rating (thus, connect it to sources at 200% of its rating), and never subject it to more amperes than its ampacity would allow. For example, consider a 200A bus with 200A supply circuit breakers arranged at opposite ends. No segment of the intervening busbars will see over 200A of current. If we had 250A of load connected to this busbar, there are two possibilities: Either one end receives over 200A, or not. If over 200A comes in from one side, then that side trips and regular conditions apply from the other end. If less than 200A comes in from one side, then the remaining current comes in from the other side which subtracts from the current needed from the first side. The 200A number cannot be exceeded in practice.

Second, even though the busbars could not be overloaded in terms of ampacity, the panelboard as an entity can be overloaded in terms of power delivered with any multiple sources of supply totaling above 100% of the rating for which it was tested. In the above example, the 200A bus assembly delivers 400A times voltage times applicable power factor in the form of power. My understanding, and this goes back to that cell phone conversation with the former CMP 9 NEMA rep I elaborated on at length in one of our previous conversations, is that this power density provides an overall heating effect that the panelboard manufacturers have not designed for. The 120% rule should be understood, therefore, as an allowable fudge factor that can be applied due to concerns about practicalities and the knowledge that there doesn’t seem to be any loss experience to challenge it. I am looking at language that allows the 120% rule to be extended to a center-fed panelboard even though the 100% protection rule has an academic potential of being violated in some minor way unlikely to be experienced in the real world.

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Submitter Information Verification

Submitter Full Name: Bill Brooks
Organization: Brooks Engineering
Street Address: 
City: 
State: 
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Submittal Date: Thu Sep 24 22:41:25 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-997-NFPA 70-2015
Statement: The first paragraph is revised to match the text in 705.12.
The last sentence of the paragraph on Taps is deleted, and the concept moved to 705.60, which is more appropriate.
A new item (2)(3)(d) is added to permit connections to center-fed panels in dwellings at either end while maintaining the 120 percent rule.
(5) is revised for clarity.
Public Comment No. 1079-NFPA 70-2015 [Section No. 705.12(D)(5) ]

(5) Fastening.
Listed plug-in-type circuit breakers backfed from interactive inverters or other electric power sources that are listed and identified as interactive shall be permitted to omit the additional fastener normally required by 408.36(D) for such applications.

Statement of Problem and Substantiation for Public Comment
This section is now a little problematic. The allowance for not requiring fastening is based on the requirement that utility interactive inverters shut down on loss of utility power. Is saying "listed and identified as interactive" enough to ensure that the electric power source will shut down on loss of utility power? I'm not sure the term "interactive" will force that compliance.

Since the term "inverter" has been removed elsewhere in 705.12(D) is should also be removed from 705.12(D)(5) and electric power source will encompass it.

Related Item
First Revision No. 1025-NFPA 70-2015 [Section No. 705.12(D)]

Submitter Information Verification
Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 15:49:25 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-997-NFPA 70-2015
Statement: The first paragraph is revised to match the text in 705.12.

The last sentence of the paragraph on Taps is deleted, and the concept moved to 705.60, which is more appropriate.

A new item (2)(3)(d) is added to permit connections to center-fed panels in dwellings at either end while maintaining the 120 percent rule.

(5) is revised for clarity.
Disconnect Device.

The disconnecting means for ungrounded conductors shall consist of a manually or power operable switch(es) or circuit breaker(s) with the following features:

1. Located where readily accessible
2. Externally operable without exposing the operator to contact with live parts and, if power operable, of a type that could be opened by hand in the event of a power-supply failure
3. Plainly indicating whether in the open (off) or closed (on) position
4. Having ratings not less than the load to be carried and the fault current to be interrupted. For disconnect equipment energized from both sides, a marking shall be provided to indicate that all contacts of the disconnect equipment might be energized.
   
   Informational Note to (4): In parallel generation systems, some equipment, including knife blade switches and fuses, is likely to be energized from both directions. See 240.40.

5. Simultaneous disconnect of all ungrounded conductors of the circuit
6. Capable of being locked in the open (off) position

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to reconsider the wording of the section and adjust as necessary for proper grammar and clarity.

Related Item

First Revision No. 1047-NFPA 70-2015 [New Section after 705.22]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:25:15 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-998-NFPA 70-2015
Statement: The revision makes several editorial corrections.

The sentence related to ratings was revised to correlate with actions in Article 690.

The reference to 690.13(B) was added to ensure consistent wording of signs.

The reference to 110.25 was added for the lockable feature.
705.23 Interactive System Disconnecting Means.
Means shall be provided in a readily accessible location, to disconnect the interactive system from all wiring systems including power systems, energy storage systems, and utilization equipment and its associated premises wiring.

Statement of Problem and Substantiation for Public Comment

The purpose to add the phrase "readily accessible location" to the first revision is for clarity in the requirement to indicate that those requisite to operate the disconnecting means can access it quickly for operation without climbing over, or removing obstacles or resort to portable ladders, etc.

Related Item
First Revision No. 1047-NFPA 70-2015 [New Section after 705.22]

Submitter Information Verification
Submitter Full Name: TIMOTHY CROUSHORE
Organization: FIRSTENERGY
Affiliation: FirstEnergy
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Submittal Date: Tue Aug 04 13:23:40 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-999-NFPA 70-2015
Statement: This action adds clarity in the requirement to indicate that those required to operate the disconnecting means can access it quickly for operation without climbing over, or removing obstacles or resort to portable ladders, etc. This also correlates with 690.13.
705.31 Location of Overcurrent Protection.

Overcurrent protection for electric power production source conductors, connected to the supply side of the service disconnecting means in accordance with 705.12(A), shall be located within 3 m (10 ft) of the point where the electric power production source conductors are connected to the service.

Informational Note: This overcurrent protection protects against short-circuit current supplied from the primary source(s) of electricity.

Exception: Where the overcurrent protection for the power production source is located more than 3 m (10 ft) from the point of connection for the electric power production source to the service, cable limiters or current-limited circuit breakers for each ungrounded conductor shall be installed at the point where the electric power production conductors are connected to the service.

Statement of Problem and Substantiation for Public Comment

I agree with the PI. Service entrance conductors are by definition not protected by NEC for over current. Art 705.31 was added to the 2014 NEC according to the substantiation, "These unprotected conductors from the service entrance equipment to the remote disconnect with overcurrent protection are a safety hazard since they do not have adequate short-circuit current protection." But the same can be said of any service entrance conductors allowed in Art 230. Why hold these particular service entrance conductors to a higher standard than all other service entrance conductors?

In the resolution to this PI the CMP wrote, "Electric power production source conductors differ from service conductors by the definition in Article 100."

I point out that "Electric power production source conductors" are not defined in Art 100. They are no different than service entrance conductors from the utility. So far no one has indicated a specific hazard from service entrance conductors in Art 750 that are different than those in Art 230. If these service extract conductors require overcorrect protection then we need to apply the same logic to service entrance conductors from the utility and require they be protected also.

Related Item
Public Input No. 3208-NFPA 70-2014 [Section No. 705.31]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 18:32:35 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There is not sufficient substantiation to delete the entire section. The section address a level of protection on conductors from an alternative power source that are permitted to be smaller than the service entrance conductors and yet subject to the same fault currents.
705.65 Overcurrent Protection.

(A) Circuits and Equipment.

Inverter input circuits, inverter output circuits, and storage battery circuit conductors and equipment shall be protected in accordance with the requirements of Article 240. Circuits connected to more than one electrical source shall have overcurrent devices located so as to provide overcurrent protection from all sources.

Exception: An overcurrent device shall not be required for circuit conductors sized in accordance with 705.60(B) and located where one of the following applies:

(1) There are no external sources such as parallel-connected source circuits, batteries, or backfeed from inverters.

(2) The short-circuit currents from all sources do not exceed the ampacity of the conductors.

Informational Note: Possible backfeed of current from any source of supply, including a supply through an inverter into the inverter output circuit and inverter source circuits, is a consideration in determining whether adequate overcurrent protection from all sources is provided for conductors and modules.

(B) Power Transformers.

Overcurrent protection for a transformer with a source(s) on each side shall be provided in accordance with 450.3 by considering first one side of the transformer, then the other side of the transformer, as the primary.

Exception: A power transformer with a current rating on the side connected toward the interactive inverter output that is not less than the rated continuous output current of the inverter shall be permitted without overcurrent protection from that source.

Statement of Problem and Substantiation for Public Comment

The correlating Committee directs further consideration be given to the comments expressed in voting on FR 3663.

Related Item

First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
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Submittal Date: Tue Sep 29 12:29:44 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The ballot comments are more appropriately addressed by Panel 13 in Article 712.
705.155 Disconnecting Means.
Stand-alone power sources shall be provided with a lockable disconnecting means according to 705.21 and overcurrent protection in accordance with 240.21.

Statement of Problem and Substantiation for Public Comment
This requirement as originally proposed gives no guidance to where such disconnect(s) should be located or what it should be capable of performing that isn’t already better said by 705.21 and by reference 705.22. This includes the ability to being locked in the open (off) position.

Related Item
First Revision No. 1045-NFPA 70-2015 [New Part after III.]

Submitter Information Verification
Submitter Full Name: PHIL UNDERCUFFLER
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Street Address: 
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Zip: 
Submittal Date: Thu Sep 24 14:20:43 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1000-NFPA 70-2015
Statement: “Intentionally islanded systems” were changed to “microgrid systems” for consistency.

References to stand-alone systems were eliminated, as they are now addressed in Article 710.

The disconnecting means section was deleted as it is addressed elsewhere.

An informational note was added to explicitly indicate that MID functionality can be included in other devices.
705.170 - Island Interconnection Devices (IID).

1. An IID shall be required for any connection between an intentionally islanded or stand-alone system and a primary power source.

2. Interconnection devices shall be listed, or field labeled, as suitable for the intended interconnection application.

3. Interconnection devices shall have sufficient number of overcurrent devices located so as to provide overcurrent protection from all sources.

Statement of Problem and Substantiation for Public Comment

The interconnection function is already addressed in existing requirements and standards, and should not be duplicated in this manner. UL standards for interactive product address the specific considerations that must be addressed for this application and listed Interactive inverters which manage the interconnection to the area EPS are available from numerous manufacturers, yet these devices are not marked as being "Island Interconnection Devices" and so would not appear to comply with this requirement. In addition, there is no functional requirement for an intentionally islanded system to perform a seamless transfer, other than customer convenience; a listed manual double throw safety switch would provide the same level of safety, albeit at a lower level of convenience, but is not marked as an Island Interconnection Device. Overcurrent protection, disconnecting means, synchronizing means and the protection from multiple sources are addressed elsewhere in this article, so there is no benefit from adding this new requirement, only added complexity and potential confusion to AHJs and installers.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 1209-NFPA 70-2015 [Section No. 705.170]</td>
<td></td>
</tr>
<tr>
<td>Public Comment No. 1457-NFPA 70-2015 [Definition: Island Interconnection Device (IID).]</td>
<td>Related Item</td>
</tr>
<tr>
<td>First Revision No. 1045-NFPA 70-2015 [New Part after III.]</td>
<td></td>
</tr>
</tbody>
</table>

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 13:12:39 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1000-NFPA 70-2015
Statement: "Intentionally islanded systems" were changed to "microgrid systems" for consistency.

References to stand-alone systems were eliminated, as they are now addressed in Article 710.

The disconnecting means section was deleted as it is addressed elsewhere.

An informational note was added to explicitly indicate that MID functionality can be included in other devices.
Public Comment No. 1209-NFPA 70-2015 [Section No. 705.170]

705.170 Island Interconnection Devices (IID).

(1) An IID shall be required for any connection between an intentionally islanded or stand-alone system and a primary power source.

Exception: where an interactive inverter, ESS or other device listed for interactive operation incorporates the interconnection function.

(1) Interconnection devices shall be listed, or field labeled, as suitable for the intended interconnection application.

(2) Overcurrent protection for interconnection devices shall have sufficient number of overcurrent devices located so as to provide overcurrent protection from all sources, be in accordance with 705.30.

Statement of Problem and Substantiation for Public Comment

The proposed 705.170 Island Interconnection Device (IID) does not add value and should be rejected, per comment 1208. However, if the CMP disagrees and sees merit in the concept, this section should be revised to allow available listed interactive product which manage the utility interconnection as part of their listed function to be used. Overcurrent protection requirements for multiple sources is already addressed in 705.30 in a more comprehensive manner, this section should simply reference that.

NOTE: Terraview inadvertently renumbered the requirements, this was not an intentional change.

Related Public Comments for This Document

<table>
<thead>
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<tr>
<td>Public Comment No. 1208-NFPA 70-2015 [Section No. 705.170]</td>
<td>Related Item</td>
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<tr>
<td>First Revision No. 1045-NFPA 70-2015 [New Part after III.]</td>
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Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 13:14:06 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1000-NFPA 70-2015
Statement: “Intentionally islanded systems” were changed to “microgrid systems” for consistency.

References to stand-alone systems were eliminated, as they are now addressed in Article 710.

The disconnecting means section was deleted as it is addressed elsewhere.

An informational note was added to explicitly indicate that MID functionality can be included in other devices.
705.170 Island Microgrid Interconnection Devices (IID MID).

1. An IID Microgrid Interconnection Device shall be required for any connection between an intentionally islanded or stand-alone system and a primary power source.

2. Interconnection devices, MIDs shall be listed, or field labeled, as suitable for the intended interconnection application.

3. Interconnection devices, MIDs shall have sufficient number of overcurrent devices located so as to provide overcurrent protection from all sources.

Statement of Problem and Substantiation for Public Comment

IEEE is changing the name and definition of this device to better reflect its function. See for example, IEEE2030.7 (draft). Island Interconnect Device often requires explanation, while Microgrid Interconnect Device is self explanatory.

Related Item
First Revision No. 1045-NFPA 70-2015 [New Part after III.]

Submitter Information Verification

Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
Affiliation: NEC DC Task Force / Microgrid WG.

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-1000-NFPA 70-2015
Statement: "Intentionally islanded systems" were changed to "microgrid systems" for consistency.

References to stand-alone systems were eliminated, as they are now addressed in Article 710.

The disconnecting means section was deleted as it is addressed elsewhere.

An informational note was added to explicitly indicate that MID functionality can be included in other devices.
Public Comment No. 1015-NFPA 70-2015 [Section No. 705.175]

705.175 Stand-Alone Wiring Systems.
This section relates to stand-alone systems operating in stand-alone mode.
Premises wiring systems shall be adequate to meet the requirements of this Code for similar installations supplied by a feeder or service. The wiring on the supply side of the building or structure disconnecting means shall comply with the requirements of this Code, except as modified by 705.175(A) through (F).

(A) Supply Output.
Power supply to premises wiring systems shall be permitted to have less capacity than the calculated load. The capacity of the stand-alone supply shall be equal to or greater than the load posed by the largest single utilization equipment connected to the system. Calculated general lighting loads shall not be considered as a single load.

(B) Sizing and Protection.
The circuit conductors between a stand-alone source and a building or structure disconnecting means shall be sized based on the sum of the output ratings of the stand-alone sources.

(C) Single 120-Volt Supply.
Stand-alone systems shall be permitted to supply 120 volts to single-phase, 3-wire, 120/240-volt service equipment or distribution panels where there are no 240-volt outlets and where there are no multiwire branch circuits. In all installations, the sum of the ratings of the power sources shall be less than the rating of the neutral bus in the service equipment. This equipment shall be marked with the following words or equivalent:
WARNING:
SINGLE 120-VOLT SUPPLY. DO NOT CONNECT MULTIWIRE BRANCH CIRCUITS!
The warning sign(s) or label(s) shall comply with 110.21(B).

(D) Energy Storage or Backup Power System Requirements.
Energy storage or backup power supplies are not required.

(E) Back-Fed Circuit Breakers.
Plug-in type back-fed circuit breakers connected to an interconnected supply shall be secured in accordance with 408.36(D). Circuit breakers marked "line" and "load" shall not be back-fed.

(F) Voltage and Frequency Control.
The stand-alone supply shall be controlled so that voltage and frequency remain within suitable limits for the connected loads.

Statement of Problem and Substantiation for Public Comment
This commentor agrees with moving these requirements out of 690 and into 705, where they will apply to all interconnected systems. However, the title should be revised to more clearly indicate the issues being addressed.

Related Item
First Revision No. 1045-NFPA 70-2015 [New Part after III]

Submitter Information Verification
Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address:
City:
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Submittal Date: Wed Sep 23 00:34:19 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-987-NFPA 70-2015
Statement: This panel action addresses the operating parameters for electric power production sources in Stand Alone Mode.

The requirements for stand-alone systems do not fit well in 705 (interconnected systems). For stand-alone systems to remain at the end of 705, the scope and title of 705 would have to be changed to encompass both interconnected and non-interconnected systems. Creating a new article makes sense, and is supported by the original proposers and the CC.

An NEC Article for stand-alone systems is important as, while these requirements exist in Articles 690, 692 and 694 of the 2014 Code, they should apply to other power sources such as engine generators. The hazards of feeding multi-wire branch circuits with single-phase 120V are the same whether the source is a generator or an inverter.
705.175  Wiring, Stand-Alone, Systems. [also move whole section to new Article 710]

This section relates to stand-alone systems operating in stand-alone mode.

Premises wiring systems shall be adequate to meet the requirements of this Code for similar installations supplied by a feeder or service. The wiring on the supply side of the building or structure disconnecting means shall comply with the requirements of this Code, except as modified by 705.175(A) through (F).

(A) Supply Output.

Power supply to premises wiring systems shall be permitted to have less capacity than the calculated load. The capacity of the stand-alone supply shall be equal to or greater than the load posed by the largest single utilization equipment connected to the system. Calculated general lighting loads shall not be considered as a single load.

(B) Sizing and Protection.

The circuit conductors between a stand-alone source and a building or structure disconnecting means shall be sized based on the sum of the output ratings of the stand-alone sources.

(C) Single 120-Volt Supply.

Stand-alone systems shall be permitted to supply 120 volts to single-phase, 3-wire, 120/240-volt service equipment or distribution panels where there are no 240-volt outlets and where there are no multiwire branch circuits. In all installations, the sum of the ratings of the power sources shall be less than the rating of the neutral bus in the service equipment. This equipment shall be marked with the following words or equivalent:

**WARNING:**

SINGLE 120-VOLT SUPPLY. DO NOT CONNECT MULTIWIRE BRANCH CIRCUITS!

The warning sign(s) or label(s) shall comply with 110.21(B).

(D) Energy Storage or Backup Power System Requirements.

Energy storage or backup power supplies are not required.

(E) Back-Fed Circuit Breakers.

Plug-in type back-fed circuit breakers connected to an interconnected supply shall be secured in accordance with 408.36(D). Circuit breakers marked “line” and “load” shall not be back-fed.

(F) Voltage and Frequency Control.

The stand-alone supply shall be controlled so that voltage and frequency remain within suitable limits for the connected loads.

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**Statement of Problem and Substantiation for Public Comment**

The title of this section should be "Stand-alone systems".

Stand-alone systems do not belong in 705, as acknowledged by the TCC report.

A working group should be formed to draft a new Article 710 Stand-Alone Systems based on this section from FR 705.175

Some content for this can be extracted from the original proposal for 710 Microgrids (PI 4026).

To be clear, all interconnection aspects of intentional island / microgrid behavior will remain in 705.

The stand-alone (forming 710) language is essentially the same as what has been removed from 690, 690 and 694.

There is general consensus that utilization aspects of renewable and off-grid power systems should not be in energy source articles such as 690.

We recommend that Article 710 be kept in CMP4 as it is a natural companion to 705, and the members of CMP4 are already familiar with its content as it came from 690, 694 etc.

Utility industry members of our WG have said:

We see [stand-alone systems] as several photovoltaic panels with batteries operating signs, lights, point-of-sale parking, and instrumentation. In addition, there are people with installations who wish to be “off-grid” as an individual choice. The utility industry supports the concept for those types of connections. However, our position is that if a “stand-alone” system does wish to interconnect with the AC system, then the requirements of Article 705 would apply. We also support the concept of an interconnected system that complies with Article 705 to re-configure to a stand-alone system for any operational purpose.

There is some disagreement over the use of the term "microgrid", vs "intentional island".

We plan to build consensus on this and other issues among our members in a working group prior to the November meeting.

**Related Item**

First Revision No. 1045-NFPA 70-2015 [New Part after III.]

Public Input No. 4026-NFPA 70-2014 [Global Input]
Submitter Information Verification

Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
Affiliation: NEC DC TG/ Microgrid WG
Street Address:
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Submittal Date: Fri Sep 25 13:51:05 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-987-NFPA 70-2015
Statement: This panel action addresses the operating parameters for electric power production sources in Stand Alone Mode.

The requirements for stand-alone systems do not fit well in 705 (interconnected systems). For stand-alone systems to remain at the end of 705, the scope and title of 705 would have to be changed to encompass both interconnected and non-interconnected systems. Creating a new article makes sense, and is supported by the original proposers and the CC.

An NEC Article for stand-alone systems is important as, while these requirements exist in Articles 690, 692 and 694 of the 2014 Code, they should apply to other power sources such as engine generators. The hazards of feeding multi-wire branch circuits with single-phase 120V are the same whether the source is a generator or an inverter.
Public Comment No. 349-NFPA 70-2015 [Section No. 705.175]

705.175 Stand-alone Wiring Systems.
This section relates to stand-alone Premises wiring systems operating in stand-alone mode . Premises wiring systems shall be adequate to meet the requirements of this Code for similar installations supplied by a feeder or service. The wiring on the supply side of the building or structure disconnecting means shall comply with the requirements of this Code, except as modified by 705.175(A) through (F).

(A) Supply Output.
Power supply to premises wiring systems shall be permitted to have less capacity than the calculated load. The capacity of the stand-alone supply shall be equal to or greater than the load posed by the largest single utilization equipment connected to the system. Calculated general lighting loads shall not be considered as a single load.

(B) Sizing and Protection.
The circuit conductors between a stand-alone source and a building or structure disconnecting means shall be sized based on the sum of the output ratings of the stand-alone sources.

(C) Single 120-Volt Supply.
Stand-alone systems shall be permitted to supply 120 volts to single-phase, 3-wire, 120/240-volt service equipment or distribution panels where there are no 240-volt outlets and where there are no multiwire branch circuits. In all installations, the sum of the ratings of the power sources shall be less than the rating of the neutral bus in the service equipment. This equipment shall be marked with the following words or equivalent:

WARNING: SINGLE 120-VOLT SUPPLY. DO NOT CONNECT MULTIWIRE BRANCH CIRCUITS!
The warning sign(s) or label(s) shall comply with 110.21(B).

(D) Energy Storage or Backup Power System Requirements.
Energy storage or backup power supplies are not required.

(E) Back-Fed Circuit Breakers.
Plug-in type back-fed circuit breakers connected to an interconnected supply shall be secured in accordance with 408.36(D). Circuit breakers marked "line" and "load" shall not be back-fed.

(F) Voltage and Frequency Control.
The stand-alone supply shall be controlled so that voltage and frequency remain within suitable limits for the connected loads.

Statement of Problem and Substantiation for Public Comment

Revisions as suggested by Mr. Roger McDaniel in comment on affirmative vote.

Related Item
First Revision No. 1045-NFPA 70-2015 [New Part after III.]

Submitter Information Verification

Submitter Full Name: TIMOTHY CROUSHORE
Organization: FIRSTENERGY
Affiliation: FirstEnergy
Street Address:
City:
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Submittal Date: Tue Aug 04 13:37:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-987-NFPA 70-2015
<table>
<thead>
<tr>
<th><strong>Statement:</strong></th>
<th>This panel action addresses the operating parameters for electric power production sources in Stand Alone Mode.</th>
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<td>The requirements for stand-alone systems do not fit well in 705 (interconnected systems). For stand-alone systems to remain at the end of 705, the scope and title of 705 would have to be changed to encompass both interconnected and non-interconnected systems. Creating a new article makes sense, and is supported by the original proposers and the CC.</td>
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</tr>
</tbody>
</table>
This section relates to stand-alone systems or multi-mode systems, operating in stand-alone mode. Premises wiring systems shall be adequate to meet the requirements of this Code for similar installations supplied by a feeder or service. The wiring on the supply side of the building or structure disconnecting means shall comply with the requirements of this Code, except as modified by 705.175(A) through (F).

Statement of Problem and Substantiation for Public Comment

This commentor agrees with moving these requirements out of 690 and into 705, where they will apply to all interconnected systems. However, the requirements should apply not only stand-alone systems but also to multi-mode systems operating in stand-alone mode.

Related Item
First Revision No. 1045-NFPA 70-2015 [New Part after III.]

Submitter Information Verification
Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 00:31:39 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-987-NFPA 70-2015
Statement: This panel action addresses the operating parameters for electric power production sources in Stand Alone Mode.

The requirements for stand-alone systems do not fit well in 705 (interconnected systems). For stand-alone systems to remain at the end of 705, the scope and title of 705 would have to be changed to encompass both interconnected and non-interconnected systems. Creating a new article makes sense, and is supported by the original proposers and the CC.

An NEC Article for stand-alone systems is important as, while these requirements exist in Articles 690, 692 and 694 of the 2014 Code, they should apply to other power sources such as engine generators. The hazards of feeding multi-wire branch circuits with single-phase 120V are the same whether the source is a generator or an inverter.
Article 706  Energy Storage Systems

Part I.  General

706.1  Scope.
This article applies to all permanently installed energy storage systems (ESS) that may be stand-alone or interactive with other electric power production sources.

Informational Note: The following standards are frequently referenced for the installation of energy storage systems:

1. NFPA 111-2013, Standard on Stored Electrical Energy Emergency and Standby Systems
2. IEEE 484-2008, Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications
3. IEEE 485-1997, Recommended Practice for Sizing Vented Lead-Acid Storage Batteries for Stationary Applications
4. IEEE 1145-2007, Recommended Practice for Installation and Maintenance of Nickel-Cadmium Batteries for Photovoltaic (PV) Systems
5. IEEE 1187-2002, Recommended Practice for Installation Design, and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications
6. IEEE 1578-2007, Recommended Practice for Stationary Battery Spill Containment and Management
8. UL 1973, Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications
9. UL Subject 2436, Spill Containment For Stationary Lead Acid Battery Systems
10. UL 1989, Standby Batteries
11. UL 810A, Electrochemical Capacitors
12. UL Subject 9540, Safety of Energy Storage Systems and Equipment

706.2  Definitions.

Battery.  
Two or more cells connected together electrically in series, in parallel, or a combination of both to provide the required operating voltage and current levels.

Battery Terminal.  
That part of a cell, container, or battery to which an external connection is made (commonly identified as post, pillar, pole, or terminal post).

Cell.  
The basic electrochemical unit, characterized by an anode and a cathode, used to receive, store, and deliver electrical energy.

Container.  
A vessel that holds the plates, electrolyte, and other elements of a single unit, comprised of one or more cells, in a battery. It can be referred to as a jar or case.

Diversion Charge Controller.  
Equipment that regulates the charging process of an ESS by diverting power from energy storage to direct-current or alternating-current loads or to an interconnected utility service.

Electrochemical Battery.  
A battery comprised of one or more rechargeable cells of the lead-acid, nickel-cadmium, or other rechargeable electrochemical types.

Electrolyte.  
The medium that provides the ion transport mechanism between the positive and negative electrodes of a cell.

Energy Storage System (ESS).  
A device or more than one device assembled together capable of storing energy for use at a future time. ESS(s) includes but is not limited to electrochemical storage devices (e.g., batteries), flow batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). These systems can have ac or dc output for utilization and can include inverters and converters to change stored energy into electrical energy.

Energy storage systems where the energy storage devices such as cells, batteries, or modules and any necessary controls, ventilation, illumination, fire suppression, or alarm systems are assembled, installed, and packaged into a singular energy storage container or unit.

Informational Note: Self-contained systems will generally be manufactured by a single entity, tested and listed to safety standards relevant to the system, and readily connected on site to the electrical system and in the case of multiple systems to each other.

Energy Storage System, Pre-engineered of Matched Components.

Energy storage systems that are not self-contained systems but instead are provided as separate components of a system by a singular entity that are matched and intended to be assembled as an energy storage system at the system installation site.

Informational Note: Pre-engineered systems of matched components for field assembly as a system will generally be designed by a single entity and comprised of components that are tested and listed separately or as an assembly to safety standards relevant to the component and readily assembled on site as a system and connected on site to the electrical system.

Energy Storage System, Other.

Energy storage systems that are not self-contained or pre-engineered systems of matched components but instead are composed of individual components assembled as a system.

Informational Note: Other systems will generally be comprised of different components combined on site to create an ESS. Those components would generally be tested and listed to safety standards relevant to the application.

Flow Battery.

An energy storage device similar to a fuel cell that stores its active materials in the form of two electrolytes external to the reactor interface. When in use, the electrolytes are transferred between reactor and storage tanks.

Informational Note: Two commercially available flow battery technologies are zinc bromine and vanadium redox, sometimes referred to as pumped electrolyte ESS.

Intercell Connector.

An electrically conductive bar or cable used to connect adjacent cells.

Inter-tier Connector.

In an electrochemical battery system, an electrical conductor used to connect two cells on different tiers of the same rack or different shelves of the same rack.

Inverter Input Circuit.

Conductors between the inverter and the ESS in stand-alone and multimode inverter systems.

Inverter Output Circuit.

Conductors between the inverter and another electric power production source, such as a utility for an electrical production and distribution network.

Inverter Utilization Output Circuit.

Conductors between the multimode or standalone inverter and utilization equipment.

Nominal Voltage (Battery or Cell).

The value assigned to a cell or battery of a given voltage class for the purpose of convenient designation. The operating voltage of the cell or battery may vary above or below this value.

Sealed Cell or Battery.

A cell or battery that has no provision for the routine addition of water or electrolyte or for external measurement of electrolyte specific gravity.

Informational Note: Some cells that are considered to be sealed under conditions of normal use, such as valve-regulated lead-acid or some lithium cells, contain pressure relief valves.

706.3 Other Articles.

Wherever the requirements of other articles of this Code and Article 706 differ, the requirements of Article 706 shall apply. If the ESS is capable of being operated in parallel with a primary source(s) of electricity, the requirements in 705.6, 705.14, 705.16, 705.32, and 705.143 shall apply.

706.4 System Classification.

ESS shall be classified as one of the types described as follows:

(1) Self-contained ESS

Informational Note: Some self-contained systems may be listed.

(2) Pre-engineered of matched components ESS intended for field assembly as a system

(3) Energy storage system, other
706.5 Equipment.
Monitors and controls, switches and breakers, power conversion systems, inverters and transformers, energy storage devices, and other components of the energy storage system shall be listed for the intended application as a part of an energy storage system. Alternatively, prepackaged self-contained systems shall be permitted to be listed for the intended application as a complete energy storage system. Only inverters listed and identified as interactive shall be permitted on interactive systems.

706.6 Multiple Systems.
Multiple ESSs shall be permitted to be installed in or on a single building or structure.

706.7 Disconnecting Means.
(A) ESS Disconnecting Means.
A disconnecting means shall be provided for all ungrounded conductors derived from an ESS. A disconnecting means shall be readily accessible and located within sight of the ESS.

Informational Note: See 240.21(H) for information on the location of the overcurrent device for conductors.

(B) Remote Actuation.
Where controls to activate the disconnecting means of an ESS are not located within sight of the system, the disconnecting means shall be capable of being locked in the open position, in accordance with 110.25, and the location of the controls shall be field marked on the disconnecting means.

(C) Busway.
Where a dc busway system is installed, the disconnecting means shall be permitted to be incorporated into the busway.

(D) Notification.
The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the ESS if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

1. Nominal ESS voltage
2. Maximum available fault current derived from the ESS
3. Arc flash risk assessment at the disconnecting means
4. Date the calculation was performed

Informational Note: Battery equipment suppliers can provide information about short-circuit current on any particular battery model. NFPA 70E provides requirements for arc flash risk assessment.

(E) Partitions and Distance.
Where energy storage device input and output terminals are more than 1.5 m (5 ft) from connected equipment, or where the circuits from these terminals pass through a wall or partition, the installation shall comply with the following:

1. A disconnecting means and overcurrent protection shall be provided at the energy storage device end of the circuit. Fused disconnecting means or circuit breakers shall be permitted to be used.
2. Where fused disconnecting means are used, the line terminals of the disconnecting means shall be connected toward the energy storage device terminals.
3. Overcurrent devices or disconnecting means shall not be installed in energy storage device enclosures where explosive atmospheres can exist.
4. A second disconnecting means located at the connected equipment shall be installed where the disconnecting means required by 706.7(E) (1) is not within sight of the connected equipment.
5. Where the energy storage device disconnecting means is not within sight of the ESS disconnecting means, placards or directories shall be installed at the locations of all disconnecting means indicating the location of all disconnecting means.

706.8 Connection to Other Energy Sources.
Connection to other energy sources shall comply with the requirements of 705.12.

(A) Load Disconnect.
A load disconnect that has multiple sources of power shall disconnect all energy sources when in the off position.

(B) Identified Interactive Equipment.
Only inverters and ac modules listed and identified as interactive shall be permitted on interactive systems.

(C) Loss of Interactive System Power.
An inverter in an interactive energy storage system shall automatically de-energize its output to the connected electrical production and distribution network upon loss of voltage in that system and shall remain in that state until the electrical production and distribution network voltage has been restored. A normally interactive energy storage system shall be permitted to operate as a stand-alone system to supply loads that have been disconnected from electrical production and distribution network sources.
(D) Unbalanced Interconnections.

Unbalanced connections between an energy storage system and electric power production sources shall be in accordance with 705.100.

(E) Point of Connection.

The point of connection between an energy storage system and electric power production sources shall be in accordance with 705.12.

706.10 Energy Storage System Locations.

Battery locations shall conform to 706.10(A), (B), and (C).

(A) Ventilation.

Provisions appropriate to the energy storage technology shall be made for sufficient diffusion and ventilation of any possible gases from the storage device, if present, to prevent the accumulation of an explosive mixture. A pre-engineered or self-contained ESS shall be permitted to provide ventilation in accordance with the manufacturer’s recommendations and listing for the system.

Informational Note No. 1: See NFPA 1-2015, Fire Code, Chapter 52, for ventilation considerations for specific battery chemistries.

Informational Note No. 2: Some storage technologies do not require ventilation.


Informational Note No. 4: Fire protection considerations are addressed in NFPA 1-2015, Fire Code.

(B) Guarding of Live Parts.

Guarding of live parts shall comply with 110.27.

(C) Spaces About ESS Components.

Spaces about the ESS shall comply with 110.26. Working space shall be measured from the edge of the ESS modules, battery cabinets, racks, or trays. For battery racks, there shall be a minimum clearance of 25 mm (1 in.) between a cell container and any wall or structure on the side not requiring access for maintenance. ESS modules, battery cabinets, racks, or trays shall be permitted to contact adjacent walls or structures, provided that the battery shelf has a free air space for not less than 90 percent of its length. Pre-engineered and self-contained ESSs shall be permitted to have working space between components within the system in accordance with the manufacturer’s recommendations and listing of the system.

Informational Note: Additional space is often needed to accommodate ESS equipment hoisting equipment, tray removal, or spill containment.

(D) Egress.

A personnel door(s) intended for entrance to and egress from rooms designated as ESS rooms shall open in the direction of egress and shall be equipped with listed panic hardware.

(E) Illumination.

Illumination shall be provided for working spaces associated with ESS and their equipment and components. Luminaires shall not be controlled by automatic means only. Additional luminaires shall not be required where the work space is illuminated by an adjacent light source. The location of luminaires shall not do either of the following:

1. Expose personnel to energized system components while performing maintenance on the luminaires in the system space
2. Create a hazard to the system or system components upon failure of the luminaire

706.11 Directory.

ESS shall be indicated by 706.11(A) and (B). The markings or labels shall be in accordance with 110.21(B).

(A) Directory.

A permanent plaque or directory denoting all electric power sources on or in the premises shall be installed at each service equipment location and at locations of all electric power production sources capable of being interconnected.

Exception: Installations with large numbers of power production sources shall be permitted to be designated by groups.

(B) Facilities with Stand-Alone Systems.

Any structure or building with an ESS that is not connected to a utility service source and is a stand-alone system shall have a permanent plaque or directory installed on the exterior of the building or structure at a readily visible location acceptable to the authority having jurisdiction. The plaque or directory shall indicate the location of system disconnecting means and that the structure contains a stand-alone electrical power system.

Part II. Circuit Requirements

706.20 Circuit Sizing and Current.

(A) The maximum current for the specific circuit shall be calculated in accordance with 706.20(A)(1) through (A)(5).
(1) Nameplate Rated Circuit Current.
The nameplate(s) rated circuit current shall be the rated current indicated on the ESS nameplate(s) or system listing for
pre-engineered or self-contained systems of matched components intended for field assembly as a system.

(2) Inverter Output Circuit Current.
The maximum current shall be the inverter continuous output current rating.

(3) Inverter Input Circuit Current.
The maximum current shall be the continuous inverter input current rating when the inverter is producing rated power at the
lowest input voltage.

(4) Inverter Utilization Output Circuit Current.
The maximum current shall be the continuous inverter output current rating when the inverter is producing rated power at the
lowest input voltage.

(5) DC to DC Converter Output Current.
The maximum current shall be the dc-to-dc converter continuous output current rating.

(B) Conductor Ampacity and Overcurrent Device Ratings.
The ampacity of the feeder circuit conductors from the ESS(s) to the wiring system serving the loads to be serviced by the
system shall not be less than the greater of the (1) nameplate(s) rated circuit current as determined in accordance with
706.20(A) or (2) the rating of the ESS(s) overcurrent protective device(s).

(C) Ampacity of Grounded or Neutral Conductor.
If the output of a single-phase, 2-wire ESS output(s) is connected to the grounded or neutral conductor and a single ungrounded
conductor of a 3-wire system or of a 3-phase, 4-wire, wye-connected system, the maximum unbalanced neutral load current
plus the ESS(s) output rating shall not exceed the ampacity of the grounded or neutral conductor.

706.21 Overcurrent Protection.
(A) Circuits and Equipment.
Energy storage circuit conductors shall be protected in accordance with the requirements of Article 240. Protection devices for
ESS circuits shall be in accordance with the requirements of 706.11(B) through (F). Circuits shall be protected at the source
from overcurrent.

(B) Overcurrent Device Ampere Ratings.
Overcurrent protective devices, where required, shall be rated in accordance with Article 240 and the rating provided on
systems serving the ESS and shall be not less than 125 percent of the maximum currents calculated in 706.10(A) .

(C) Direct Current Rating.
Overcurrent protective devices, either fuses or circuit breakers, used in any dc portion of an ESS shall be listed and shall have
the appropriate voltage, current, and interrupting ratings.

(D) Prime Movers.
Overcurrent protection shall not be required for conductors from an ESS with a nominal voltage of 50 volts or less if these
conductors provide power for starting, ignition, or control of prime movers. Section 300.3 shall not apply to these conductors.

(E) Current Limiting.
A listed, current-limiting, overcurrent device shall be installed in each dc output circuit adjacent to the ESS.

(F) Fuses.
Means shall be provided to disconnect any fuses associated with ESS equipment and components when the fuse is energized
from both directions and is accessible to other than qualified persons. Switches, pullouts, or similar devices that are rated for the
application shall be permitted to serve as a means to disconnect fuses from all sources of supply.

706.22 Wiring from and Equipment Supplied by Energy Storage Systems.
Wiring and equipment supplied from ESS(s) and system components shall be subject to the applicable provisions of this Code
applying to wiring and equipment operating at the same voltage, unless otherwise permitted by this article.

706.23 Charge Control.
(A) General.
Provisions shall be provided to control the charging process of the ESS. All adjustable means for control of the charging
process shall be accessible only to qualified persons.

Informational Note: Certain types of energy storage equipment such as valve-regulated lead acid or nickel cadmium
can experience thermal failure when overcharged.

(B) Diversion Charge Controller.
(1) Sole Means of Regulating Charging.
An ESS employing a diversion charge controller as the sole means of regulating charging shall be equipped with a second
independent means to prevent overcharging of the storage device.
Circuits with Diversion Charge Controller and Diversion Load.

Circuits containing a diversion charge controller and a diversion load shall comply with the following:

1. The current rating of the diversion load shall be less than or equal to the current rating of the diversion load charge controller. The voltage rating of the diversion load shall be greater than the maximum ESS voltage. The power rating of the diversion load shall be at least 150 percent of the power rating of the charging source.

2. The conductor ampacity and the rating of the overcurrent device for this circuit shall be at least 150 percent of the maximum current rating of the diversion charge controller.


Systems using utility-interactive inverters to control energy storage state-of-charge by diverting excess power into the utility system shall comply with 706.23(B)(3)(a) and (B)(3)(b).

(a) These systems shall not be required to comply with 706.23(B)(2).

(b) These systems shall have a second, independent means of controlling the ESS charging process for use when the utility is not present or when the primary charge controller fails or is disabled.

Charge controllers and DC converters.

When charge controllers and other dc power converters that increase or decrease the output current or output voltage with respect to the input current or input voltage are installed the ampacity of the conductors in output circuits shall be based on the maximum rated continuous output current of the charge controller or converter for the selected output voltage range, and the voltage rating of the output circuits shall be based on the maximum voltage output of the charge controller or converter for the selected output voltage range.

Part III. Electrochemical Energy Storage Systems

Part III of this article applies to ESSs that are comprised of sealed and non-sealed cells or batteries or system modules that are comprised of multiple sealed cells or batteries.

706.30 Installation of Batteries.

Storage batteries associated with an ESS shall be installed in accordance with the provisions this article.

(A) Dwelling Units.

ESSs for dwellings shall be configured so as to operate at a voltage of 100 volts or less.

Exception: Where live parts are not accessible during routine ESS maintenance, an ESS voltage greater than 100 volts shall be permitted.

(B) Storage System Nonconductive Cases and Conductive Racks.

Flooded, vented lead-acid batteries where operating at more than 100 volts shall not use conductive cases or shall not be installed in conductive cases. Conductive racks used to support nonconductive cases shall be permitted where no rack material is located within 150 mm (6 in.) of the tops of the nonconductive cases.

Exception: This requirement shall not apply to any type of valve-regulated lead-acid (VRLA) battery or other types of sealed batteries that may require steel cases for proper operation.

Note: Parts VI and VII of Article 250 address exposed metal parts.

(C) Disconnection of Series Battery Circuits.

Battery circuits subject to field servicing, where operating at more than 100 volts, shall have provisions to disconnect the series-connected strings into segments of 100 volts or less for maintenance by qualified persons. Non–load-break bolted or plug-in disconnects shall be permitted.

(D) Storage System Maintenance Disconnecting Means.

ESS greater than 100 volts shall have a disconnecting means, accessible only to qualified persons, that disconnects the grounded circuit conductor(s) in the electrical storage system for maintenance. This disconnecting means shall not disconnect the grounded circuit conductor(s) for the remainder of any other electrical system. A non–load-break-rated switch shall be permitted to be used as a disconnecting means.

(E) Storage Systems of More Than 100 Volts.

On electrochemical ESS operating at more than 100 volts, the system shall be permitted to operate with ungrounded conductors, provided a ground-fault detector and indicator is installed to monitor for ground faults within the storage system.

706.31 Battery and Cell Terminations.

(A) Corrosion Prevention.

Antioxidant material suitable for the battery connection shall be used when recommended by the battery or cell manufacturer.

Informational Note: The battery manufacturer's installation and instruction manual can be used for guidance for acceptable materials.
Intercell and Intertier Conductors and Connections.

The ampacity of field-assembled intercell and intertier connectors and conductors shall be of such cross-sectional area that the temperature rise under maximum load conditions and at maximum ambient temperature shall not exceed the safe operating temperature of the conductor insulation or of the material of the conductor supports.

Informational Note: Conductors sized to prevent a voltage drop exceeding 3 percent of maximum anticipated load, and where the maximum total voltage drop to the furthest point of connection does not exceed 5 percent, may not be appropriate for all battery applications. IEEE 1375-2003, Guide for the Protection of Stationary Battery Systems, provides guidance for overcurrent protection and associated cable sizing.

Battery Terminals.

Electrical connections to the battery and the cable(s) between cells on separate levels or racks shall not put mechanical strain on the battery terminals. Terminal plates shall be used where practicable.

Flexible cables, as identified in Article 400, in sizes 2/0 AWG and larger shall be permitted within the battery enclosure from battery terminals to a nearby junction box where they shall be connected to an approved wiring method. Flexible battery cables shall also be permitted between batteries and cells within the battery enclosure. Such cables shall be listed and identified as moisture resistant. Flexible, fine-stranded cables shall only be used with terminals, lugs, devices, or connectors in accordance with 110.14.

Accessibility.

The terminals of all cells or multicell units shall be readily accessible for readings, inspection, and cleaning where required by the equipment design. One side of transparent battery containers shall be readily accessible for inspection of the internal components.

Battery Locations.

Electrochemical battery locations shall conform to 706.34(A), (B), and (C).

(A) Live Parts.

Guarding of live parts shall comply with 110.27.

(B) Top Terminal Batteries.

Where top terminal electrochemical energy storage devices are installed on tiered racks or on shelves of battery cabinets, working space in accordance with the storage equipment manufacturer’s instructions shall be provided between the highest point on a storage system component and the row, shelf, or ceiling above that point.

Informational Note No. 1: The installation instructions of the system component manufacturer typically define how much top working space is necessary for a particular system component. Informational Note No. 2: IEEE 1187 provides guidance for top clearance of VRLA batteries, which are the most commonly used battery in cabinets.

(C) Gas Piping.

Gas piping shall not be permitted in dedicated battery rooms or spaces dedicated to electrochemical ESS.

Vents.

(A) Vented Cells.

Each vented cell shall be equipped with a flame arrester.

Informational Note: A flame arrester is designed to prevent destruction of the cell due to ignition of gases within the cell by an external spark or flame under normal operating conditions.

(B) Sealed Cells.

Sealed battery or cells shall be permitted to be equipped with a pressure-release vent to prevent excessive accumulation of gas pressure.

Part III. Flow Battery Energy Storage Systems

The provisions Part IV apply to ESSs composed of or containing flow batteries.

General.

All electrical connections to and from the system and system components shall be in accordance with the applicable provisions of Article 692. The system and system components shall also meet the provisions of Parts I and II of this article. Unless otherwise directed by this article, flow battery ESS shall comply with the applicable provisions of Article 692.

Electrolyte Classification.

The electrolyte(s) that are acceptable for use in the batteries associated with the ESS shall be identified by name and chemical composition. Such identification shall be provided by readily discernable signage adjacent to every location in the system where the electrolyte can be put into or taken out of the system.

Electrolyte Containment.

Flow battery systems shall be provided with a means for electrolyte containment to prevent spills of electrolyte from the system. An alarm system is to be provided to signal an electrolyte leaks from the system. Electrical wiring and connections shall be located and routed in a manner that mitigates the potential for exposure to electrolytes.
706.43 Flow Controls.
Controls shall be provided to safely shut down the system in the event of electrolyte blockage such as a malfunctioning electrolyte pump or valve.

706.44 Pumps and Other Fluid Handling Equipment.
Pumps and other fluid handling equipment are to be rated/specifed suitable for exposure to the electrolytes.

Part V. Other Energy Storage Technologies
The provisions of Part V apply to ESSs using other technologies intended to store energy and when there is a demand for electrical power to use the stored energy to generate the needed power.

706.50 General.
All electrical connections to and from the system and system components shall be in accordance with the applicable provisions of this Code. Unless otherwise directed by this article, other energy storage technologies shall comply with the applicable provisions of Part III of Article 705.

Statement of Problem and Substantiation for Public Comment
The purpose of the NEC is not to be an instruction manual or educational textbook, informational note text removed was instructional and not needed to apply the code.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification
Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 16:54:19 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The Informational Notes provide valuable info for users which is important as this is a new Article. Also, referencing another NFPA document is not considered instructional.
Public Comment No. 1712-NFPA 70-2015 [Definition: Battery Terminal.]

Battery Terminal.
That part of a cell, container, or battery to which an external connection is made (commonly identified as post, pillar, pole, or terminal post).

Statement of Problem and Substantiation for Public Comment

Deleting "Battery" from the title aligns this definition with the definition of "terminal" in Article 480.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address:
City:
State:
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Submittal Date: Fri Sep 25 17:20:32 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3633-NFPA 70-2015
Statement: Deleting "Battery" from the title aligns this definition with the definition of "terminal" in Article 480.
Battery. Two or more cells connected together electrically in series, in parallel, or a combination of both to provide the required operating voltage and current levels to form an electrical energy storage device.

Statement of Problem and Substantiation for Public Comment

The text on series and parallel connections is not needed to describe a single battery. It is more of a battery bank or system. Actually this should be moved to Art. 100 since batteries are used throughout the NEC.

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
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City:
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Submittal Date: Wed Sep 23 16:24:10 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The text proposed to be deleted contains critical information clarifying battery connections to obtain desired voltage and/or current and is necessary to properly define a battery.
**Electrochemical Battery.**

A battery comprised of one or more rechargeable cells of the lead-acid, nickel-cadmium, or other rechargeable electrochemical types.

**Statement of Problem and Substantiation for Public Comment**

All the batteries we use are electrochemical batteries, the term electrochemical does not denote that the battery is rechargeable. Unless we want to have to write "electrochemical battery" everywhere instead of battery we should get rid of this term.

As an aside the correct way to differentiate between one use and rechargeable batteries is to use the term primary cell for one use and secondary cell for rechargeable.

**Related Public Comments for This Document**

<table>
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<tr>
<th>Related Comment</th>
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<tr>
<td>Public Comment No. 1094-NFPA 70-2015 [Definition: Intertier Connector.]</td>
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<tr>
<td>Public Comment No. 1482-NFPA 70-2015 [Part III.]</td>
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<tr>
<td>Public Comment No. 1487-NFPA 70-2015 [Section No. 706.34 [Excluding any Sub-Sections]]</td>
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**Related Item**

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

**Submitter Information Verification**

- **Submitter Full Name:** MARVIN HAMON
- **Organization:** HAMON ENGINEERING INC
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Fri Sep 25 12:59:11 EDT 2015

**Committee Statement**

- **Committee Action:** Accepted
- **Resolution:** SR-3634-NFPA 70-2015
- **Statement:** Batteries can be electrochemical or other types depending on the technology.
**Public Comment No. 1258-NFPA 70-2015 [ Definition: Energy Storage System, Pre-engineered of Matche... ]**

**Energy Storage System, Pre-engineered of Matched Components.**

Energy storage systems that are not self-contained systems but instead are provided as separate components of pre-engineered and field-assembled using separate components supplied as a system by a singular entity, that are matched and intended to be assembled as an energy storage system at the system installation site.

Informational Note: Pre-engineered systems of matched components for field assembly as a system will generally be designed by a single entity and comprised of components that are tested and listed separately or as an assembly to safety standards relevant to the component and readily assembled on site as a system and connected on site to the electrical system.

**Statement of Problem and Substantiation for Public Comment**

The proposed change clarifies the meaning and distinction of this definition by inserting “field-assembled” in the first sentence. The remaining edits are intended to eliminate redundant language. For the “Informational Note”, the proposed change removes redundant language and in doing so puts more emphasis on the listing information, which will be useful for AHJs when checking compliance.

**Related Item**

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

**Submitter Information Verification**

Submitter Full Name: Cyril Daran  
Organization: Tesla Motors teamed up with OutBack Power Technologies  
Street Address:  
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Submittal Date: Thu Sep 24 16:48:56 EDT 2015

**Committee Statement**

Committee Action: Accepted  
Resolution: SR-3635-NFPA 70-2015  
Statement: This revision eliminates redundant text and provides necessary clarity by inserting “pre-engineered” and “field-assembled”.
Intertier Connector.
In an electrochemical battery system, an electrical conductor used to connect two cells on different tiers of the same rack or different shelves of the same rack.

Statement of Problem and Substantiation for Public Comment
This applies to any battery bank and not just to electrochemical batteries.

Related Public Comments for This Document

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<tr>
<td>Public Comment No. 1478-NFPA 70-2015 [Definition: Electrochemical Battery]</td>
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Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification
Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
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Submittal Date: Wed Sep 23 16:41:26 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3636-NFPA 70-2015
Statement: This revision provides necessary clarity to this definition, which addresses a “connector” not the battery.
Public Comment No. 1116-NFPA 70-2015 [Definitions (706.2): Electrolyte... to Energy Stor...]

Definitions (706.2): Electrolyte... to Energy Stor...

Electrolyte.
The medium that provides the ion transport mechanism between the positive and negative electrodes of a cell.

Energy Storage Device.
A device for storing energy, e.g., batteries, capacitors, and kinetic energy devices.

Energy Storage System (ESS).
A device or more than one device assembled together capable of storing energy for use at a future time. ESS(s) includes but is not limited to electrochemical storage devices (e.g., batteries), flow batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). These systems can have ac or dc output for utilization and can include inverters and converters to change stored energy into electrical energy.

Energy storage systems where the energy storage devices such as cells, batteries, or modules and any necessary controls, ventilation, illumination, fire suppression, or alarm systems are assembled, installed, and packaged into a singular energy storage container or unit.

Informational Note: Self-contained systems will generally be manufactured by a single entity, tested and listed to safety standards relevant to the system, and readily connected on site to the electrical system and in the case of multiple systems to each other.

Energy Storage System, Pre-engineered of Matched Components.
Energy storage systems that are not self-contained systems but instead are provided as separate components of a system by a singular entity that are matched and intended to be assembled as an energy storage system at the system installation site.

Informational Note: Pre-engineered systems of matched components for field assembly as a system will generally be designed by a single entity and comprised of components that are tested and listed separately or as an assembly to safety standards relevant to the component and readily assembled on site as a system and connected on site to the electrical system.

Energy Storage System, Other.
Energy storage systems that are not self-contained or pre-engineered systems of matched components but instead are composed of individual components assembled as a system.

Informational Note: Other systems will generally be comprised of different components combined on site to create an ESS. Those components would generally be tested and listed to safety standards relevant to the application.

Statement of Problem and Substantiation for Public Comment

The term "Energy Storage Device" is used many times in this article but is not defined nor differentiated from ESS. I have provided a sample definition but another fix might be to change all uses of energy storage device to ESS.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
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Submittal Date: Wed Sep 23 19:32:53 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
| **Statement:** | This action revises multiple definitions to delete the undefined term “energy storage device”. For correlation purposes, similar changes were made throughout Article 706. |
706.3 Other Articles.

Wherever the requirements of other articles of this Code and Article 706 differ, the requirements of Article 706 shall apply. If the ESS is capable of being operated in parallel with a primary source(s) of electricity, the requirements in 705.6, 705.12, 705.14, 705.16, 705.32, and 705.143 shall apply. 705.100, 705.143, and Part IV shall apply.

Statement of Problem and Substantiation for Public Comment

The list in this section is not complete. This revision identifies the provisions in Article 705 that would apply that are not modified by Article 706.

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: Timothy Croushore
Organization: FirstEnergy
Affiliation: FirstEnergy
Street Address:
City:
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Submittal Date: Fri Sep 25 13:02:37 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3639-NFPA 70-2015
Statement: The references to other articles are editorially revised and supplemented for correlation throughout the NEC. The panel notes that action taken by Panel 4 to revise Part IV of Article 705 may affect the reference added in this revision.
706.3 Other Articles.
Wherever the requirements of other articles of this Code and Article 706 differ, the requirements of Article 706 shall apply. If the ESS is capable of being operated in parallel with a primary source(s) of electricity, the requirements in 705.6, 705.12, 705.14, 705.16, 705.32, and 705.143 shall apply.

Statement of Problem and Substantiation for Public Comment
Sections 705.12 and 705.100 are mentioned in Section 706.8 of the current First Revision and new Part IV of Article 705 covering Stand-Alone systems should be added to the list of 705 sections in 706.3 Other Articles.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification
Submitter Full Name: John Kovacik
Organization: UL LLC
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:23:18 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3639-NFPA 70-2015
Statement: The references to other articles are editorially revised and supplemented for correlation throughout the NEC. The panel notes that action taken by Panel 4 to revise Part IV of Article 705 may affect the reference added in this revision.
706.3 Other Articles.
Wherever the requirements of other articles of this Code and Article 706 differ, the requirements of Article 706 shall apply. If the ESS is capable of being operated in parallel with a primary source(s) of electricity, the requirements in 705.6, 705.14, 705.16, 705.32, and 705.143 shall apply. An ESS being used as a service source shall comply with Parts V, VI and VII of Article 230.

Statement of Problem and Substantiation for Public Comment

A reference to the applicable parts of Article 230 has been added for an ESS being used as a service source to address the Committee Statement on the applicability of SUSE ratings.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 19:07:31 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: A premises wiring ESS cannot be used as a service source. See the defined term “service” in Article 100.
706.4 System Classification.

ESS shall be classified as one of the types described as follows:

1. Self-contained ESS
   
   Informational Note: Some self-contained systems may be listed.

2. Pre-engineered of matched components ESS intended for field assembly as a system

3. Energy storage system ESS, other

Statement of Problem and Substantiation for Public Comment

Text changed for consistency.

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
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Submittal Date: Wed Sep 23 19:30:32 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3640-NFPA 70-2015
Statement: This revision aligns the terms with definitions in 706.2.
Public Comment No. 1557-NFPA 70-2015 [Section No. 706.5]

706.5 Equipment.
Monitors and controls, switches, fuses, and breakers, power conversion systems, inverters and transformers, energy storage devices, and other components of the energy storage system shall be listed, labeled, and identified for the intended application, as a part of an energy storage system. Alternatively, prepackaged self-contained systems shall be permitted to be listed, labeled and identified for the intended application as a complete energy storage system. Only inverters listed, labeled, and identified as interactive shall be permitted on interactive systems.

Statement of Problem and Substantiation for Public Comment

Included fuses in the list of components. "As a part of an energy storage system" is not necessary and may be misconstrued. For instance, circuit breakers and fuses for application in dc portion of energy storage system must be suitable for dc application. That is they must be "listed, labeled, and identified for the intended dc application." "Identified for the application" ensures the product is appropriate for dc. This will help the installers and inspectors provide the proper equipment and components. However, for a Code compliant system for safety, the designers, installers, and inspectors still additional has to ensure equipment and components comply with the general NEC requirements such as proper voltage rating, interrupting rating, and short-circuit current ratings.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: TIMOTHY CRNKO
Organization: EATON, Bussmann Division
Street Address:
City:
State:
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Submittal Date: Fri Sep 25 14:14:22 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3641-NFPA 70-2015
Statement: This revision removes listing requirements for "lead-acid batteries" to correlate with the Second Revision in Article 480. Multiple editorial revisions are made for clarity and usability. This revision clarifies that self contained ESS are required to be listed.
706.5 Equipment.

Monitors and controls, switches and breakers, power conversion systems, inverters and transformers, energy storage devices, and other components of the energy storage system shall be listed, labeled and identified for the intended application as a part of an energy storage system. Alternatively, prepackaged self-contained systems shall be permitted to be listed and labeled for the intended application as a complete energy storage system. Only inverters listed, labeled and identified as interactive shall be permitted on interactive systems.

Additional Proposed Changes

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<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
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<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3641-NFPA 70-2015
Statement: This revision removes listing requirements for “lead-acid batteries” to correlate with the Second Revision in Article 480. Multiple editorial revisions are made for clarity and usability. This revision clarifies that self contained ESS are required to be listed.
### Public Comment No. 1725-NFPA 70-2015 [Section No. 706.7]

<table>
<thead>
<tr>
<th><strong>706.7</strong></th>
<th>Disconnecting Means.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(A)</strong></td>
<td>ESS Disconnecting Means.</td>
</tr>
</tbody>
</table>

A disconnecting means shall be provided for all ungrounded conductors derived from an ESS. A disconnecting means shall be readily accessible and located within sight of the ESS.

- **Informational Note:** See 240.21(H) for information on the location of the overcurrent device for conductors.

- **(B)** Locking. The disconnecting means shall be lockable in accordance with 110.25.

#### (B) Remote Actuation.

Where controls to activate the disconnecting means of an ESS are not located within sight of the system, the disconnecting means shall be capable of being locked in the open position, in accordance with 110.25, and the location of the controls shall be field marked on the disconnecting means.

- **(C)** Busway.

Where a dc busway system is installed, the disconnecting means shall be permitted to be incorporated into the busway.

- **(D)** Notification.

The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the ESS if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

1. Nominal ESS voltage
2. Maximum available fault current derived from the ESS
3. Arc flash risk assessment at the disconnecting means
4. Date the calculation was performed

- **Informational Note:** Battery equipment suppliers can provide information about short-circuit current on any particular battery model. NFPA 70E provides requirements for arc flash risk assessment.

- **(E)** Partitions and Distance.

Where energy storage device input and output terminals are more than 1.5 m (5 ft) from connected equipment, or where the circuits from these terminals pass through a wall or partition, the installation shall comply with the following:

1. A disconnecting means and overcurrent protection shall be provided at the energy storage device end of the circuit. Fused disconnecting means or circuit breakers shall be permitted to be used.
2. Where fused disconnecting means are used, the line terminals of the disconnecting means shall be connected toward the energy storage device terminals.
3. Overcurrent devices or disconnecting means shall not be installed in energy storage device enclosures where explosive atmospheres can exist.
4. A second disconnecting means located at the connected equipment shall be installed where the disconnecting means required by 706.7(E) (1) is not within sight of the connected equipment.
5. Where the energy storage device disconnecting means is not within sight of the ESS disconnecting means, placards or directories shall be installed at the locations of all disconnecting means indicating the location of all disconnecting means.

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**Statement of Problem and Substantiation for Public Comment**

A requirement for the disconnecting means to be lockable is added as noted in the Committee Statement. A new subclause 706.7(B) is proposed to be added as follows, and the existing subclauses thereafter to be assigned a new letter.

- **(B)** Locking. The disconnecting means shall be lockable in accordance with 110.25.

**Related Item**

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

**Submitter Information Verification**

- **Submitter Full Name:** John Kovacik
- **Organization:** UL LLC
<table>
<thead>
<tr>
<th>Committee Statement</th>
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</thead>
<tbody>
<tr>
<td><strong>Committee Action:</strong></td>
</tr>
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<td><strong>Resolution:</strong></td>
</tr>
</tbody>
</table>
Public Comment No. 1101-NFPA 70-2015 [Section No. 706.7(B)]

(B) Remote Actuation Location.
Where controls to activate the disconnecting means of an ESS are not located within sight of the system, the disconnecting means shall be capable of being locked in the open position, in accordance with 110.25, and the location of the controls shall be field marked on the disconnecting means.

Statement of Problem and Substantiation for Public Comment

This section deals with the location of the controls that control the disconnection means not being within line of sight of the ESS, not remote actuation of something as the heading suggests. "Actuation" was changed to "Location" to correct this.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 17:47:57 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This section addresses actuation, not location of the disconnecting means.
Public Comment No. 1102-NFPA 70-2015 [Section No. 706.7(D)]

(D) Notification.

The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the ESS if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved, meet the requirements of 110.21(B) and shall include the following:

1. Nominal ESS voltage
2. Maximum available fault current derived from the ESS
3. Arc flash risk assessment at the disconnecting means. Date the calculation was performed hazard warning meeting the requirements of 110.16.

Informational Note: Battery equipment suppliers can provide information about short-circuit current on any particular battery model. NFPA 70E provides requirements for arc flash risk assessment.

Statement of Problem and Substantiation for Public Comment

Changed the marking requirements to point to 110.21(B) since an arc flash warning is a hazard marking and this article provides more information on markings. Changed (3) to point to the arc flash hazard warning requirements of 110.16. Removed requirement for calculation date since that requirement is going to be covered by NFPA 70E. No reason to double dip on the requirements.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 18:05:24 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3642-NFPA 70-2015
Statement: The second sentence was deleted as there is no exception in 706.7 (A) to allow the disconnect to be omitted. "Fault current" was changed to "short circuit current" for proper terminology. Arc flash risk assessment was expanded to include marking requirements in 110.16.
Public Comment No. 1137-NFPA 70-2015 [Section No. 706.7(D)]

(D) Notification.
The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the ESS if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

1. Nominal ESS voltage
2. Maximum available fault current, short-circuit current, derived from the ESS
3. Arc flash risk assessment at the disconnecting means
4. Date the calculation was performed

Informational Note: Battery equipment suppliers can provide information about short-circuit current on any particular battery model. NFPA 70E provides requirements for arc flash risk assessment.

Statement of Problem and Substantiation for Public Comment

The language should state short-circuit current, not fault current.

Note: Terraview is indicating that the informational note has been changed (it is underlined) however no intentional changes were made to the note in this comment.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 22:02:20 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3642-NFPA 70-2015
Statement: The second sentence was deleted as there is no exception in 706.7 (A) to allow the disconnect to be omitted. “Fault current” was changed to “short circuit current” for proper terminology. Arc flash risk assessment was expanded to include marking requirements in 110.16.
Public Comment No. 1138-NFPA 70-2015 [Section No. 706.7(D)]

(D) Notification.
The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the ESS if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

1. Nominal ESS voltage
2. Maximum available fault current derived from the ESS
3. Arc flash risk assessment at the disconnecting means
4. Date the calculation was performed

Informational Note: Battery equipment suppliers can provide information about short-circuit current on any particular battery model. NFPA 70E provides requirements for arc flash risk assessment.

Statement of Problem and Substantiation for Public Comment

The assessment of arc fault risk is better addressed in NFPA 70E, and marking each disconnecting means with a label advising an installer to perform a risk assessment does not add value. Marking the specific calculated arc flash exposure could be more relevant, but this is already addressed in 110.16. 110.16 does not specifically apply to dwelling units, however the operating voltage of most residential storage systems will be less than 100v; which is not addressed in NFPA 70E (the minimum hazard voltage in 70E Table 130.7(C)(15)(B) is 100-250VDC); therefore this requirement adds little to no increase in installer safety yet will cause confusion and conflicting interpretations, with no standards-based guidance on performing the calculation.

Note: Terraview is indicating that the informational note has been changed (it is underlined) however no intentional changes were made to the note in this comment.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 22:04:49 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter has not provided adequate substantiation to warrant removal of list item (3).
Public Comment No. 1184-NFPA 70-2015 [Section No. 706.7(D)]

(D) Notification.

The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the ESS if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

1. Nominal ESS voltage
2. Maximum available fault current derived from the ESS
3. Arc flash risk assessment at hazard value at the disconnecting means
4. Date the calculation was performed

Informational Note: Battery equipment suppliers can provide information about short-circuit current on any particular battery model. NFPA 70E provides requirements for arc flash risk assessment.

Statement of Problem and Substantiation for Public Comment

It is not clear what is wanted in 706.7(D)(3), "arc flash risk assessment." As hazard identification and risk assessment are two separate things in NFPA 70E, I assume that the intent is to identify the arc flash value and/or the PPE at the disconnecting means.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUER
Organization: STEVE MCCLUER LLC
Street Address:
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 10:47:24 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3642-NFPA 70-2015
Statement: The second sentence was deleted as there is no exception in 706.7 (A) to allow the disconnect to be omitted. "Fault current" was changed to "short circuit current" for proper terminology. Arc flash risk assessment was expanded to include marking requirements in 110.16.
Public Comment No. 1596-NFPA 70-2015 [Section No. 706.7(D)]

(D) Notification.

The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the ESS if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

1. Nominal ESS voltage
2. Maximum available fault short-circuit current derived from the ESS
3. Arc flash risk assessment at the disconnecting means
4. Date the calculation was performed

Informational Note: Battery equipment suppliers can provide information about short-circuit current on any particular battery model. NFPA 70E provides requirements for arc flash risk assessment.

Statement of Problem and Substantiation for Public Comment

706.7(A) requires a disconnect within sight of the ESS, so the second sentence of the FR is not necessary. Maximum available short-circuit current is a more suitable term for this section than maximum available fault current.

Related Item
First Revision No. 3632-NFPA 70-2015 [New Section after 702.12(B)]

Submitter Information Verification

Submitter Full Name: TIMOTHY CRNKO
Organization: EATON, Bussmann Division
Street Address:
City:  
State:  
Zip:  
Submittal Date: Fri Sep 25 15:01:26 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3642-NFPA 70-2015
Statement: The second sentence was deleted as there is no exception in 706.7 (A) to allow the disconnect to be omitted. "Fault current" was changed to "short circuit current" for proper terminology. Arc flash risk assessment was expanded to include marking requirements in 110.16.
**Public Comment No. 1714-NFPA 70-2015 [Section No. 706.7(D)]**

(D) Notification.

The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the ESS if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

1. Nominal ESS voltage
2. Maximum available fault current derived from the ESS
3. Arc flash risk assessment at the disconnecting means
4. Date the calculation was performed

*Informational Note:* Battery equipment suppliers can provide information about short-circuit current on any particular battery model. NFPA 70E provides requirements for arc flash risk assessment.

**Statement of Problem and Substantiation for Public Comment**

“Short-circuit” is the correct terminology.

**Related Item**

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

**Submitter Information Verification**

Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 17:31:40 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR
Resolution: SR-3642-NFPA 70-2015
Statement: The second sentence was deleted as there is no exception in 706.7 (A) to allow the disconnect to be omitted. “Fault current” was changed to “short circuit current” for proper terminology. Arc flash risk assessment was expanded to include marking requirements in 110.16.
Partitions and Distance.

Where energy storage device input and output terminals are more than 1.5 m (5 ft) from connected equipment, or where the circuits from these terminals pass through a wall or partition, the installation shall comply with the following:

1. A disconnecting means and overcurrent protection shall be provided at the energy storage device end of the circuit. Fused disconnecting means or circuit breakers shall be permitted to be used.

2. Where fused disconnecting means are used, the line terminals of the disconnecting means shall be connected toward the energy storage device terminals.

3. Overcurrent devices or disconnecting means shall not be installed in energy storage device enclosures where explosive atmospheres can exist.

4. A second disconnecting means located at the connected equipment shall be installed where the disconnecting means required by 706.7(E) (1) is not within sight of the connected equipment.

5. Where the energy storage device disconnecting means is not within sight of the ESS disconnecting means, placards or directories shall be installed at the locations of all disconnecting means indicating the location of all disconnecting means.

Statement of Problem and Substantiation for Public Comment

This section needs to be harmonized with 706.21. Right now they are fighting over the same turf. Since this section is supposed to relate to disconnecting means the requirements for overcurrent devices should be moved to 706.21.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tr>
<td>Public Comment No. 1121-NFPA 70-2015 [Section No. 706.21]</td>
<td>Related Item</td>
</tr>
<tr>
<td>First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]</td>
<td></td>
</tr>
</tbody>
</table>

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 19:40:22 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3644-NFPA 70-2015
Statement: List items are editorially revised for clarity.

- References to overcurrent protection and overcurrent devices are deleted as this section addresses only disconnecting means.
- New list item (4) is modified for clarity to reference hazardous locations.
- New informational notes are added to aid the Code user.
- Additional editorial corrections are made for clarity.
Partitions and Distance.

Where energy storage device input and output terminals are more than 1.5 m (5 ft) from connected equipment, or where the circuits from these terminals pass through a wall or partition, the installation shall comply with the following:

1. A disconnecting means and overcurrent protection shall be provided at the energy storage device end of the circuit. Fused disconnecting means or circuit breakers shall be permitted to be used.

2. Where fused disconnecting means are used, the line terminals of the disconnecting means shall be connected toward the energy storage device terminals.

3. Overcurrent devices or disconnecting means shall not be installed in energy storage device enclosures where explosive atmospheres can exist if listed for hazardous locations.

4. A second disconnecting means located at the connected equipment shall be installed where the disconnecting means required by 706.7(E) (1) is not within sight of the connected equipment.

5. Where the energy storage device disconnecting means is not within sight of the ESS disconnecting means, placards or directories shall be installed at the locations of all disconnecting means indicating the location of all disconnecting means.

Statement of Problem and Substantiation for Public Comment

If devices listed for hazardous locations are used they can be mounted in explosive atmospheres.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 19:55:44 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3644-NFPA 70-2015
Statement:
List items are editorially revised for clarity.

References to overcurrent protection and overcurrent devices are deleted as this section addresses only disconnecting means.

New list item (4) is modified for clarity to reference hazardous locations.

New informational notes are added to aid the Code user.

Additional editorial corrections are made for clarity.
Partitions and Distance.

Where energy storage device input and output terminals are more than 1.5 m (5 ft) from connected equipment, or where the circuits from these terminals pass through a wall or partition, the installation shall comply with the following:

1. A disconnecting means and overcurrent protection shall be provided at the energy storage device end of the circuit. Fused disconnecting means or circuit breakers shall be permitted to be used.

2. A second disconnecting means located at the connected equipment shall be installed where the disconnecting means required by 706.7(E)(1) is not within sight of the connected equipment.

Informational Note No. 1: For remote disconnect controls in information technology equipment rooms, see 645.10

Informational Note No. 2: For overcurrent protection of batteries, see 240.21(H)

1. Where fused disconnecting means are used, the line terminals of the disconnecting means shall be connected toward the energy storage device terminals.

2. Overcurrent devices or disconnecting means shall not be installed in energy storage device enclosures where explosive atmospheres can exist.

3. A second disconnecting means located at the connected equipment shall be installed where the disconnecting means required by 706.7(E)(1) is not within sight of the connected equipment.

4. Where the energy storage device disconnecting means is not within sight of the ESS disconnecting means, placards or directories shall be installed at the locations of all disconnecting means indicating the location of all disconnecting means.

Statement of Problem and Substantiation for Public Comment

This public comment recommends the following:
1. Editorial change: Move Item #4 to Item #2 for a more logical sequence.
2. Add two new informational notes regarding the location of the disconnecting means
   a. When an ESS is for information technology equipment, such as an uninterruptible power supply (UPS) system, the reader should follow the rules in Article 645 for remote disconnecting means.
   b. 240.21(H) says that overcurrent protection shall be permitted to be installed "as close as practicable" to the storage battery terminals. Use of this terminology was deliberate. Due to physical obstructions in a room, it may not always be possible - or at least practicable - to place the OCPD within 1.5m (5 ft) of the battery terminals. The goal is to keep the unprotected dc cables as short as reasonably possible.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUER
Organization: STEVE MCCLUER LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 11:14:38 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3644-NFPA 70-2015
Statement: List items are editorially revised for clarity.

References to overcurrent protection and overcurrent devices are deleted as this section addresses only disconnecting means.

New list item (4) is modified for clarity to reference hazardous locations.

New informational notes are added to aid the Code user.
Additional editorial corrections are made for clarity.
Partitions and Distance.

Where energy storage device input and output terminals are more than 1.5 m (5 ft) from connected equipment, or where the circuits from these terminals pass through a wall or partition, the installation shall comply with the following:

1. A disconnecting means and overcurrent protection shall be provided at the energy storage device end of the circuit. Fused disconnecting means or circuit breakers shall be permitted to be used.
2. Where fused disconnecting means are used, the line terminals of the disconnecting means shall be connected toward the energy storage device terminals.
3. Overcurrent devices or disconnecting means shall not be installed in energy storage device enclosures where explosive atmospheres can exist.
4. A second disconnecting means located at the connected equipment shall be installed where the disconnecting means required by 706.7(E) (1) is not within sight of the connected equipment.
5. Where the energy storage device disconnecting means is not within sight of the ESS disconnecting means, placards or directories shall be installed at the locations of all disconnecting means indicating the location of all disconnecting means.

Statement of Problem and Substantiation for Public Comment

The term "energy storage device" is ambiguous and could be interpreted to apply to individual components of a pre-engineered ESS listed for field assembly. The listing for the field assembly will address all requirements for the interconnection of separate components within the pre-engineered ESS, including disconnecting means. It should be clear to installers and AHJs in this case that no additional disconnects are required. The proposed exception addresses this scenario specifically. The replacement of "the following" with "(1) through (5)" in the intro paragraph better facilitates the insertion of the exception language.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: Cyril Daran
Organization: Tesla Motors teamed up with OutBack Power Technologies
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 17:27:31 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed exception conflicts with list item 4. See definition of ESS in 706.2.
Public Comment No. 1271-NFPA 70-2015 [Section No. 706.8 [Excluding any Sub-Sections]]

Connection to other energy sources. The connection of interactive ESS systems in parallel with primary sources of electricity shall comply with the requirements of 705.12.

Statement of Problem and Substantiation for Public Comment

The proposed revision clarifies that the intent of this requirement pertains only to interactive a.c. side parallel connections of ESS systems with other primary sources, as defined by the connection requirements of 705.12.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: Cyril Daran
Organization: Tesla Motors teamed up with OutBack Power Technologies
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 17:30:33 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The intent of this section is to apply to several types of energy sources, not just interactive a.c. side parallel connections of ESS with other primary sources.
Identified Interactive Equipment.

Only inverters and ac modules listed and identified as interactive shall be permitted on interactive systems.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: JEFFREY FECHTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
Street Address:
City:
<table>
<thead>
<tr>
<th>Committee Statement</th>
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<tr>
<td><strong>Committee Action:</strong></td>
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<td><strong>Resolution:</strong></td>
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<tr>
<td><strong>Statement:</strong></td>
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</tbody>
</table>
An inverter in an interactive energy storage system shall automatically de-energize its output to the connected electrical production and distribution network upon loss of voltage in that system and shall remain in that state until the electrical production and distribution network voltage has been restored. A normally interactive energy storage system shall be permitted to operate as a stand-alone system to supply loads that have been disconnected from electrical production and distribution network sources. ESS with a utility interactive inverter shall comply with the requirements of 705.40 upon loss of primary source.

Statement of Problem and Substantiation for Public Comment

This requirement does not differ from those specified in 705.40 for any utility interactive power source. The proposed revision references 705.40 directly instead of rephrasing language.

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name: Cyril Daran</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization: Tesla Motors teamed up with OutBack Power Technologies</td>
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<tr>
<td>Street Address:</td>
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<td>State:</td>
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<td>Zip:</td>
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<td>Submittal Date: Thu Sep 24 17:32:52 EDT 2015</td>
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Committee Statement

| Committee Action: Rejected but see related SR |
| Resolution: SR-3645-NFPA 70-2015 |
| Statement: This revision references 705.40 directly instead of rephrasing language. |
Loss of Interactive System Power.

An inverter in an interactive energy storage system shall automatically de-energize its output to the connected electrical production and distribution network upon loss of voltage in that system and shall remain in that state until the electrical production and distribution network voltage has been restored. A normally interactive energy storage system shall be permitted to operate as a stand-alone system to supply loads that have been disconnected from electrical production and distribution network sources. *This requirement is in conflict with low-voltage ride-through.*

**Statement of Problem and Substantiation for Public Comment**

Some systems require low-voltage ride-through which seems to be in conflict with this requirement at least short-term.

**Related Item**

Public Input No. 4219-NFPA 70-2014 [Global Input]

**Submitter Information Verification**

Submitter Full Name: Richard Hockney  
Organization: Beacon Power LLC  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Jul 29 06:55:00 EDT 2015

**Committee Statement**

Committee Action: Rejected  
Resolution: The submitter provides no proposed revisions. The comment does not comply with Section 4.4.4.4 of the NFPA Regulations Governing The Development of NFPA Standards include proposed text in the Public Comment including the wording to be added, revised, or deleted.
Public Comment No. 1189-NFPA 70-2015 [Section No. 706.10(A)]

(A) Ventilation.
Provisions appropriate to the energy storage technology shall be made for sufficient diffusion and ventilation of any possible gases from the storage device, if present, to prevent the accumulation of an explosive or poisonous mixture. A pre-engineered or self-contained ESS shall be permitted to provide ventilation in accordance with the manufacturer’s recommendations and listing for the system.

Informational Note No. 1: See NFPA 1-2015, Fire Code, Chapter 52, for ventilation considerations and fire protection, for specific battery chemistries.

Informational Note No. 2: Some storage technologies do not require ventilation.


Informational Note No. 4: Fire protection considerations are addressed in NFPA 1-2015, Fire Code.

Statement of Problem and Substantiation for Public Comment

Ventilation is required not only for explosive gasses vented by some batteries (e.g., hydrogen). Poisonous gas is also a possibility (e.g., hydrogen sulfide). This PC adds the words “or poisonous”

This PC also revises Informational Note No. 1 to include the words “and fire protection” because Chapter 52 of NFPA 1 addresses the ventilation design and controls necessary for fire protection

This PC also deletes Informational Note No. 4 because it duplicates Informational Note #1.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUER
Organization: STEVE MCCLUER LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 11:27:08 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel does not accept “poisonous” as it is outside the scope of the NEC. Both Informational Notes are retained. Informational Note 1 references Chapter 52 of NFPA 1 and Informational Note 4 references NFPA 1 in its entirety.
706.10(D) Top Terminal Batteries. Where top terminal batteries are installed on tiered racks, working space in accordance with the battery manufacturer’s instructions shall be provided between the highest point on a cell and the row or ceiling above that point. Informational Note: Battery manufacturer’s installation instructions typically define how much top working space is necessary for a particular battery model.

Statement of Problem and Substantiation for Public Comment

It seems to be the intent of the new Article 706, Energy Storage Systems, to incorporate all of the requirements from Article 480, Storage Batteries. Section 480.9(D) was not carried over. Because the greatest risk of electrocution or arc flash occurs when a worker inadvertently comes in contact with battery terminals, the amount of clearance above the terminals is crucial. This is especially important for top-terminal batteries that are installed inside of cabinets.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUER
Organization: STEVE MCCLUER LLC
Street Address:
City:
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Submittal Date: Thu Sep 24 11:37:55 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: This proposed text presently exists in 480.9(D) which applies generally as per Section 90.3.
Public Comment No. 1277-NFPA 70-2015 [Section No. 706.10(D)]

(D) Egress.
A. Where an ESS includes a room dedicated solely for the containment of electrochemical batteries, personnel door(s) intended for entrance to and egress from rooms designated as ESS rooms, the battery room, shall open in the direction of egress and shall be equipped with listed panic hardware.

Statement of Problem and Substantiation for Public Comment

The draft requirement copies the egress requirement found in 480.9(E) for designated battery rooms, but applies the language to "ESS rooms." As ESS is a broad term with multiple categories, this requirement could be interpreted to apply to rooms containing listed ESS components and assemblies that already address containment of the storage devices, and which are suitable for installation in multi-purpose rooms. The revision clarifies that the intent of the egress requirement is for dedicated and designated battery rooms.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: Cyril Daran
Organization: Tesla Motors teamed up with OutBack Power Technologies
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 17:34:59 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Rooms designated for ESS may present hazards similar to those presented by batteries where quick and immediate egress is required.
Public Comment No. 1191-NFPA 70-2015 [New Section after 706.10(E)]

(F) Piping In Battery Rooms.
Gas piping shall not be permitted to dedicated battery rooms.

Statement of Problem and Substantiation for Public Comment
It seems to be the intent of the new Article 706, Energy Storage Systems to incorporate all of the requirements from Article 480, Storage Batteries. Section 480.9(F) was not carried over. This PC creates a new paragraph. The logical place to put this section is following 706.10(E)(2), Illumination. Renumber any subsequent sub-paragraphs.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification
Submitter Full Name: STEPHEN MCCLUER
Organization: STEVE MCCLUER LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 11:40:48 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Section 706.10 covers Energy Storage System Locations. The proposed requirement is not relevant to this section. If a room is dedicated for batteries as part of an ESS, then Article 480 applies.
### Public Comment No. 1139-NFPA 70-2015 [Section No. 706.20(A)]

#### Calculation of Maximum Circuit Current

The maximum current for the specific circuit shall be calculated in accordance with 706.20(A)(1) through (A)(5).

1. **Nameplate Rated Circuit Current.**
   - The nameplate(s) rated circuit current shall be the rated current indicated on the ESS nameplate(s) or system listing for pre-engineered or self-contained systems of matched components intended for field assembly as a system.

2. **Inverter Output Circuit Current.**
   - The maximum current shall be the inverter continuous output current rating.

3. **Inverter Input Circuit Current.**
   - The maximum current shall be the continuous inverter input current rating when the inverter is producing rated power at the lowest input voltage.

4. **Inverter Utilization Output Circuit Current.**
   - The maximum current shall be the continuous inverter output current rating when the inverter is producing rated power at the lowest input voltage.

5. **DC to DC Converter Output Current.**
   - The maximum current shall be the dc-to-dc converter continuous output current rating.

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#### Statement of Problem and Substantiation for Public Comment

The title for this requirement was inadvertently deleted or left off.

**Related Item**

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

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#### Submitter Information Verification

- **Submitter Full Name:** PHIL UNDERCUFFLER
- **Organization:** OUTBACK POWER TECHNOLOGIES
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Wed Sep 23 22:07:17 EDT 2015

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#### Committee Statement

- **Committee Action:** Rejected but see related SR
- **Resolution:** SR-3646-NFPA 70-2015
- **Statement:** A first level subdivision title is added as required by the NEC Style Manual.
Public Comment No. 1715-NFPA 70-2015 [Section No. 706.20(A)]

(A) Maximum Rated Current for a Specific Circuit
The maximum current for the specific circuit shall be calculated in accordance with 706.20(A)(1) through (A)(5).

(1) Nameplate Rated Circuit Current.
The nameplate(s) rated circuit current shall be the rated current indicated on the ESS nameplate(s) or system listing for pre-engineered or self-contained systems of matched components intended for field assembly as a system.

(2) Inverter Output Circuit Current.
The maximum current shall be the inverter continuous output current rating.

(3) Inverter Input Circuit Current.
The maximum current shall be the continuous inverter input current rating when the inverter is producing rated power at the lowest input voltage.

(4) Inverter Utilization Output Circuit Current.
The maximum current shall be the continuous inverter output current rating when the inverter is producing rated power at the lowest input voltage.

(5) DC to DC Converter Output Current.
The maximum current shall be the dc-to-dc converter continuous output current rating.

Statement of Problem and Substantiation for Public Comment
A title is needed in 706.20(A) as pointed out in Linda Little’s affirmative ballot comments.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification
Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 17:35:29 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3646-NFPA 70-2015
Statement: A first level subdivision title is added as required by the NEC Style Manual.
(3) Inverter Input Circuit Current.

The (1) For applications in which the full load reserve time is rated for longer than three hours, the maximum current shall be the continuous inverter input current rating when the inverter is producing rated power at the lowest input voltage.

(2) For applications in which the full load reserve time is rated for less than three hours, the maximum current shall be 80 percent of the inverter input current rating when the inverter is producing rated power at the lowest input voltage.

Statement of Problem and Substantiation for Public Comment

Article 100 defines "continuous load" as "a load where the maximum current is expected to continue for 3 hours or more." Per Ohm’s Law, current increases proportionately to a decrease in voltage. In a battery system, voltage continues to drop from the time it starts discharging. The rate of voltage drop (and corresponding current rise) increases rapidly as the battery nears end voltage. In photovoltaic, wind system, and some telecommunications applications, run times in excess of three hours are expected. In uninterrupted power supply (UPS) applications, run times of less than one hour are the rule, with most being between 5 to 15 minutes. Rating the input current from a battery to a UPS inverter based upon the maximum current during the final minute of discharge will result in significantly over-sizing conductors and overcurrent protective devices. The present language of 706.20(A)(3) fails to take into account multiple variables, which can include voltage, time, temperature, and current.

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUER
Organization: STEVE MCCLUER LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 11:43:15 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter did not provide technical substantiation which supports the 80% rating for all battery technologies and derating may not be applicable to all inverter technologies.
706.21 Overcurrent Protection.

(A) Circuits and Equipment.

Energy storage circuit conductors shall be protected in accordance with the requirements of Article 240. Protection devices for ESS circuits shall be in accordance with the requirements of 706.11(B) through (F). Circuits shall be protected at the source from overcurrent.

(B) Overcurrent Device Ampere Ratings.

Overcurrent protective devices, where required, shall be rated in accordance with Article 240 and the rating provided on systems serving the ESS and shall be not less than 125 percent of the maximum currents calculated in 706.10(A).

(C) Direct Current Rating.

Overcurrent protective devices, either fuses or circuit breakers, used in any dc portion of an ESS shall be listed and shall have the appropriate voltage, current, and interrupting ratings.

(D) Prime Movers.

Overcurrent protection shall not be required for conductors from an ESS with a nominal voltage of 50 volts or less if these conductors provide power for starting, ignition, or control of prime movers. Section 300.3 shall not apply to these conductors.

(E) Current Limiting.

A listed, current-limiting, overcurrent device shall be installed in each dc output circuit adjacent to the ESS.

(F) Fuses.

Means shall be provided to disconnect any fuses associated with ESS equipment and components when the fuse is energized from both directions and is accessible to other than qualified persons. Switches, pullouts, or similar devices that are rated for the application shall be permitted to serve as a means to disconnect fuses from all sources of supply.

(G) Location

Where energy storage device input and output terminals are more than 1.5 m (5 ft) from connected equipment, or where the circuits from these terminals pass through a wall or partition overcurrent protection shall be provided at the ESS.

Statement of Problem and Substantiation for Public Comment

Moved text here from 706.7 to better harmonize the two sections. Section 706.7 should be limited to disconnecting means and this section to OCPD.

Related Public Comments for This Document

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<td>Public Comment No. 1117-NFPA 70-2015 [Section No. 706.7(E)]</td>
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Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 19:59:47 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3648-NFPA 70-2015
| **Statement:** | This revision editorially revises first level subdivisions (A)(B), and (C). First level subdivision (D) is deleted as it is presently covered in Article 480. First level subdivision (E) (now (D)) is revised for clarity and a new exception is added to address situations where current limiting overcurrent protection is provided for the dc output circuits of a listed and labeled ESS. A new first level subdivision (F) is added to clarify the location of the required OCPD where conductors pass through a wall or partition. |
(A) Circuits and Equipment.

Energy storage circuit conductors shall be protected in accordance with the requirements of Article 240. Protection devices for ESS circuits shall be in accordance with the requirements of 706.44 (B) through (F). Circuits shall be protected at the source from overcurrent.

Statement of Problem and Substantiation for Public Comment

Corrected to section reference

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 19:19:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3648-NFPA 70-2015
Statement: This revision editorially revises first level subdivisions (A)(B), and (C). First level subdivision (D) is deleted as it is presently covered in Article 480. First level subdivision (E) (now (D)) is revised for clarity and a new exception is added to address situations where current limiting overcurrent protection is provided for the dc output circuits of a listed and labeled ESS. A new first level subdivision (F) is added to clarify the location of the required OCPD where conductors pass through a wall or partition.
Public Comment No. 1193-NFPA 70-2015 [Section No. 706.21(A)]

(A) Circuits and Equipment.

Energy storage circuit conductors shall be protected in accordance with the requirements of Article 240. Protection devices for ESS circuits shall be in accordance with the requirements of 706.21(B) through (F). Circuits shall be protected at the source from overcurrent.

Statement of Problem and Substantiation for Public Comment

Editorial comment changes the reference from 706.11(B) to 706.21(B).

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUER
Organization: STEVE MCCLUER LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 11:52:47 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3648-NFPA 70-2015
Statement: This revision editorially revises first level subdivisions (A)(B), and (C). First level subdivision (D) is deleted as it is presently covered in Article 480. First level subdivision (E) (now (D)) is revised for clarity and a new exception is added to address situations where current limiting overcurrent protection is provided for the dc output circuits of a listed and labeled ESS. A new first level subdivision (F) is added to clarify the location of the required OCPD where conductors pass through a wall or partition.
Sections 706.21(A), 706.21(B), 706.21(C)

(A) Circuits and Equipment.
Energy storage circuit conductors shall be protected in accordance with the requirements of Article 240. Protection devices for ESS circuits shall be in accordance with the requirements of 706.21(B), through (F). Circuits shall be protected at the source from overcurrent.

(B) Overcurrent Device Ampere Ratings.
Overcurrent protective devices, where required, shall be rated in accordance with Article 240 and the rating provided on systems serving the ESS and shall be not less than 125 percent of the maximum currents calculated in 706.10(A).

(C) Direct Current Rating.
Overcurrent protective devices, either fuses or circuit breakers, used in any dc portion of an ESS shall be listed, labeled, and shall have identified with the appropriate voltage, current, and interrupting ratings.

Statement of Problem and Substantiation for Public Comment

The reference to 706.11 appeared to be a typo.

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
Affiliation: UL
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State:  
Zip:  
**Submittal Date:** Fri Sep 25 15:11:50 EDT 2015

**Committee Statement**

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(B) Overcurrent Device Ampere Ratings.
Overcurrent protective devices, where required, shall be rated in accordance with Article 240 and the rating provided on systems serving the ESS and shall be not less than 125 percent of the maximum currents calculated in 706.10 (A).

Statement of Problem and Substantiation for Public Comment

Editorial comment changes the reference from 706.10(A) to 706.20(A).

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUER
Organization: STEVE MCCLUER LLC
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu Sep 24 11:54:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3648-NFPA 70-2015
Statement: This revision editorially revises first level subdivisions (A)(B), and (C). First level subdivision (D) is deleted as it is presently covered in Article 480. First level subdivision (E) (now (D)) is revised for clarity and a new exception is added to address situations where current limiting overcurrent protection is provided for the dc output circuits of a listed and labeled ESS. A new first level subdivision (F) is added to clarify the location of the required OCPD where conductors pass through a wall or partition.
(C) Direct Current Rating.
Overcurrent protective devices, either fuses or circuit breakers, used in any dc portion of an ESS shall be listed and labeled for dc and shall have the appropriate voltage, current ampere, and interrupting ratings for the application.

Statement of Problem and Substantiation for Public Comment

If a product is labeled it makes it easier for the installer and AHJ to ensure a product is listed for dc. Ampere rating as used in 240.6 is the proper term rather than current rating. It is important the product has a proper voltage rating, ampere rating, and interrupting rating for the specific application.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: TIMOTHY CRNKO
Organization: EATON, Bussmann Division
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:34:25 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3648-NFPA 70-2015
Statement: This revision editorially revises first level subdivisions (A)(B), and (C). First level subdivision (D) is deleted as it is presently covered in Article 480. First level subdivision (E) (now (D)) is revised for clarity and a new exception is added to address situations where current limiting overcurrent protection is provided for the dc output circuits of a listed and labeled ESS. A new first level subdivision (F) is added to clarify the location of the required OCPD where conductors pass through a wall or partition.
Public Comment No. 1196-NFPA 70-2015 [Section No. 706.21(E)]

(E) Current Limiting.
A listed, current-limiting, overcurrent device shall be installed adjacent to the ESS for each dc output circuit adjacent to the ESS.

Statement of Problem and Substantiation for Public Comment

Editorial comment rearranges the sentence for clarity.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUER
Organization: STEVE MCCLUER LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 11:56:05 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3648-NFPA 70-2015
Statement: This revision editorially revises first level subdivisions (A)(B), and (C). First level subdivision (D) is deleted as it is presently covered in Article 480. First level subdivision (E) (now (D)) is revised for clarity and a new exception is added to address situations where current limiting overcurrent protection is provided for the dc output circuits of a listed and labeled ESS. A new first level subdivision (F) is added to clarify the location of the required OCPD where conductors pass through a wall or partition.
Public Comment No. 1280-NFPA 70-2015 [Section No. 706.21(E)]

(E) Current Limiting.
A listed, current-limiting, overcurrent device shall be installed in each dc output circuit adjacent to the ESS.

*Exception: DC output circuits between components of a listed, pre-engineered ESS shall be permitted without additional overcurrent devices where in accordance with the manufacturer's listing.*

Statement of Problem and Substantiation for Public Comment

The requirement could be interpreted to apply to circuits that interconnect components within a pre-engineered ESS listed for field assembly. The listing for the field assembly will address all requirements for the interconnection of the separate components, including overcurrent protection. It should therefore be clear to installers and AHJs in this case that no additional overcurrent protection components are required. The proposed exception addresses this scenario specifically.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: Cyril Daran
Organization: Tesla Motors teamed up with OutBack Power Technologies
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 17:38:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3648-NFPA 70-2015
Statement: This revision editorially revises first level subdivisions (A)(B), and (C). First level subdivision (D) is deleted as it is presently covered in Article 480. First level subdivision (E) (now (D)) is revised for clarity and a new exception is added to address situations where current limiting overcurrent protection is provided for the dc output circuits of a listed and labeled ESS. A new first level subdivision (F) is added to clarify the location of the required OCPD where conductors pass through a wall or partition.
Public Comment No. 1393-NFPA 70-2015 [Section No. 706.21(E)]

(E) Current Limiting.
A listed, labeled and identified current-limiting overcurrent device shall be installed in each dc output circuit adjacent to the ESS.

Additional Proposed Changes

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Item
Public Input No. 944-NFPA 70-2014 [Section No. 690.71(C)]
First Revision No. 1012-NFPA 70-2015 [Sections Part VIII., 690.71]
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification
Submitter Full Name: JEFFREY FECTEAU
Organization: UNDERWRITERS LABORATORIES LLC
<table>
<thead>
<tr>
<th>Committee Statement</th>
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<tr>
<td><strong>Committee Action:</strong></td>
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<tr>
<td><strong>Resolution:</strong></td>
</tr>
<tr>
<td><strong>Statement:</strong></td>
</tr>
</tbody>
</table>
Wiring and equipment supplied from ESS(s) and system components shall be subject to the applicable provisions of this Code applying to wiring and equipment operating at the same voltage, unless otherwise permitted by this article.

Statement of Problem and Substantiation for Public Comment
The requirement is a bit confusing and does not add any new requirements, and therefore is "teaching the code." The proposed deletion is for brevity and clarity.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification
Submitter Full Name: Cyril Daran
Organization: Tesla Motors teamed up with OutBack Power Technologies
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 17:40:32 EDT 2015

Committee Statement
Committee Action: Accepted
Resolution: SR-3649-NFPA 70-2015
Statement: Section 706.22 is deleted because it did not contain a requirement, only references to other areas of the NEC.

Systems using utility interactive inverters to control energy storage state-of-charge by diverting excess power into the utility system shall comply with 706.23(B)(3)(a) and (B)(3)(b).

(a) These systems shall not be required to comply with 706.23(B)(2).

(b) These systems shall have a second, independent means of controlling the ESS charging process for use when the electrical production and distribution network is not present or when the primary charge controller fails or is disabled.

Statement of Problem and Substantiation for Public Comment

Harmonize this with the other changes to remove the "utility" limitation from interactive inverters.

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 20:24:17 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter did not provide adequate substantiation to remove "utility" along with the other suggested changes.

Systems using utility-interactive inverters to control energy storage state-of-charge by diverting excess power into the utility system shall comply with 706.23(B)(3) (a) and (B)(3)(b).

(a) These systems shall not be required to comply with 706.23(B)(2).

(b) These systems shall have a second, independent means of controlling the ESS charging process for use when the utility is not present or when the primary charge controller fails or is disabled. *My understanding of utility-interactive inverters is that charging the storage system is not possible when the utility is not present. Also, this appears to be asking for redundant charge controllers. This seems burdensome. Could the intent be accomplished with a fail-safe controller?*

Statement of Problem and Substantiation for Public Comment

Redundant charge controllers seems like a burdensome requirement.

Related Item

Public Input No. 4219-NFPA 70-2014 [Global Input]

Submitter Information Verification

Submitter Full Name: Richard Hockney
Organization: Beacon Power LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 29 06:56:58 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter provides no proposed revisions. The comment does not comply with Section 4.4.4.4 of the NFPA Regulations Governing The Development of NFPA Standards include proposed text in the Public Comment including the wording to be added, revised, or deleted.
Public Comment No. 1140-NFPA 70-2015 [Section No. 706.23(C)]

(C) Charge controllers and DC, dc-to-dc, converters.

When charge controllers and other dc-to-dc power converters that increase or decrease the output current or output voltage with respect to the input current or input voltage are installed the requirements shall comply with 706.23(C)(1) and (C)(2).

1. The ampacity of the conductors in output circuits shall be based on the maximum rated continuous output current of the charge controller or converter for the selected output voltage range, and

2. The voltage rating of the output circuits shall be based on the maximum voltage output of the charge controller or converter for the selected output voltage range.

Statement of Problem and Substantiation for Public Comment

Revised for clarity, and the term DC converters was replaced with dc-to-dc converters to harmonize with other articles and sections of the code.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 23 22:12:44 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3650-NFPA 70-2015
Statement: The requirement is split into list items for clarity and “dc power converters” is changed to “DC-DC power converters”.
(C) Charge controllers and DC converters.

When charge controllers and other dc power converters that increase or decrease the output current or output voltage with respect to the input current or input voltage are installed, they shall comply with the following:

1) The ampacity of the conductors in output circuits shall be based on the maximum rated continuous output current of the charge controller or converter for the selected output voltage range, and

2) The voltage rating of the output circuits shall be based on the maximum voltage output of the charge controller or converter for the selected output voltage range.

Statement of Problem and Substantiation for Public Comment

This section is reformatted and revised for clarity as noted in Linda Little's affirmative comment. The proposed wording is as follows:

(C) Charge controllers and DC converters. Charge controllers and other dc power converters that increase or decrease the output current or output voltage with respect to the input current or input voltage shall comply with the following:

1) The ampacity of the conductors in output circuits shall be based on the maximum rated continuous output current of the charge controller or converter for the selected output voltage range, and

2) The voltage rating of the output circuits shall be based on the maximum voltage output of the charge controller or converter for the selected output voltage range.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 17:53:40 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3650-NFPA 70-2015
Statement: The requirement is split into list items for clarity and “dc power converters” is changed to “DC-DC power converters”.

National Fire Protection Association Report http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
Installation of Batteries.

Storage batteries associated with an ESS shall be installed in accordance with the provisions this article.

(A) Dwelling Units.

ESSs. An ESS for dwellings shall be configured so as to operate at a voltage of 100 volts or less. Dwelling units shall not exceed 100 volts between conductors or to ground.

Exception: Where live parts are not accessible during routine ESS maintenance, an ESS voltage greater than, exceeding, 100 volts shall be permitted.

(B) Storage System Nonconductive Cases and Conductive Racks.

Flooded, vented lead-acid batteries where operating at more than, exceeding, 100 volts, shall, nominal, between terminals shall, not use conductive cases or shall not be installed in conductive cases. Conductive racks used to support nonconductive cases shall be permitted where no rack material is located within 150 mm (6 in.) of the tops of the nonconductive cases.

Exception: This requirement shall not apply to any type of valve-regulated lead-acid (VRLA) battery or other types of sealed batteries that may require steel cases for proper operation.

Note: Parts VI and VII of Article 250 address exposed metal parts.

(C) Disconnection of Series Battery Circuits.

Battery circuits subject to field servicing, where operating at more than, exceeding, 100 volts between conductors or to ground, shall have provisions to disconnect the series-connected strings into segments of, not exceeding, 100 volts or less, for maintenance by qualified persons. Non–load-break bolted or plug-in disconnects shall be permitted.

(D) Storage System Maintenance Disconnecting Means.

ESS greater than, exceeding, 100 volts shall, between conductors or to ground, have a disconnecting means, accessible only to qualified persons, that disconnects the grounded circuit conductor(s) in the electrical storage system for maintenance. This disconnecting means shall not disconnect the grounded circuit conductor(s) for the remainder of any other electrical system. A non–load-break-rated switch shall be permitted to be used as a disconnecting means.

(E) Storage Systems of More Than, Exceeding, 100 Volts.

On electrochemical ESS operating at more than, exceeding, 100 volts between conductors or to ground, the system shall be permitted to operate with ungrounded conductors, provided a ground-fault detector and indicator is installed to monitor for ground faults within the storage system.

Statement of Problem and Substantiation for Public Comment

Text did not use recommended limit expressions from the NEC style manual.

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:37:43 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3651-NFPA 70-2015
Statement: The parent text to 706.30 has been removed for clarity.

This revision editorially revises first level subdivision (A) and the associated exception.
First level subdivision (B) is deleted as this requirement presently exists in Article 480.

First level subdivisions (C), (D), and (E) (now (B), (C), and (D)) are editorially revised.

The 100 volt threshold in (C) (now (D)) is modified to address current practice.
Public Comment No. 1283-NFPA 70-2015 [Section No. 706.30(A)]

(A) Dwelling Units.

ESSs for dwellings shall have the batteries configured so as to operate at a voltage of 100 volts or less.

Exception: Where live parts are not accessible during routine ESS maintenance, an ESS with batteries voltage greater than 100 volts shall be permitted.

Statement of Problem and Substantiation for Public Comment

ESS by itself is a broad term, and the requirement historically applies to the energy storage (battery) circuits. An ESS with dc/dc converters or inverters may have voltages exceeding 100V. These should not have accessible live parts in any case, but it is important to make this distinction to reduce confusion for AHJs.

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: Cyril Daran
Organization: Tesla Motors teamed up with OutBack Power Technologies
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 17:41:57 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The revision is not necessary as 706.30 applies only to batteries.
(A) One and Two Family Dwelling Units.

ESSs for dwellings, one and two family dwelling units, shall be configured so as to operate at a voltage of 100 volts or less.

Exception: Where live parts are not accessible during routine ESS maintenance, an ESS voltage greater than 100 volts shall be permitted.

Statement of Problem and Substantiation for Public Comment

I do not see that is is necessary to apply this restriction to large multi unit dwellings where the facility services are normally secured and accessed only by qualified service personnel.

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:50:11 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel does not agree that the facility services for large multi-unit dwellings are normally secured and accessed only by qualified service personnel.
(B) Storage System Nonconductive Cases and Conductive Racks.

Flooded, vented lead-acid batteries where operating at more than 100 volts shall not use conductive cases or shall not be installed in conductive cases. Conductive racks used to support nonconductive cases shall be permitted where no rack material is located within 150 mm (6 in.) of the tops of the nonconductive cases.

Exception: This requirement shall not apply to any type of valve-regulated lead-acid (VRLA) battery or other types of sealed batteries that may require steel cases for proper operation.

Note: Parts VI and VII of Article 250 address exposed metal parts.

Statement of Problem and Substantiation for Public Comment

The exception is technically not required since (B) only applies to vented batteries. Maybe it is here to make it exceedingly clear the it does not apply to sealed batteries but it is redundant.

Related Item

First Revision No. 3362-NFPA 70-2015 [Definition: Power-Supply Cord.]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:20:38 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3651-NFPA 70-2015
Statement: The parent text to 706.30 has been removed for clarity.

This revision editorially revises first level subdivision (A) and the associated exception.

First level subdivision (B) is deleted as this requirement presently exists in Article 480.

First level subdivisions (C), (D), and (E) (now (B), (C), and (D)) are editorially revised.

The 100 volt threshold in (C) (now (D)) is modified to address current practice.
Public Comment No. 1284-NFPA 70-2015 [Section No. 706.30(D)]

(D) Storage System Maintenance Disconnecting Means.

ESS greater than Electrochemical ESS with both grounded conductors and batteries configured so as to operate at more than 100 volts shall have a disconnecting means, accessible only to qualified persons, that disconnects the grounded circuit conductor(s) in the electrical storage system for maintenance. This disconnecting means shall not disconnect the grounded circuit conductor(s) for the remainder of any other electrical system(s). A non-load-break-rated switch shall be permitted to be used as a disconnecting means.

Statement of Problem and Substantiation for Public Comment

ESS by itself is a broad term and could include converted dc and ac circuits, while the requirement historically applies to the energy storage (battery) circuits. The proposed change clarifies the criteria. The condition "with grounded conductors" is also added to clarify that additional disconnecting means is not required if the battery circuits are ungrounded.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 706.143]

Submitter Information Verification

Submitter Full Name: Cyril Daran
Organization: Tesla Motors teamed up with OutBack Power Technologies
Street Address: 
City:
State:
Zip:
Submittal Date: Thu Sep 24 17:44:25 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: These revisions are not necessary as 706.30 applies only to the installation of batteries.
Public Comment No. 1512-NFPA 70-2015 [Section No. 706.30(D)]

(D) Storage System Maintenance Disconnecting Means.

ESS greater than 100 volts shall have a disconnecting means, accessible only to qualified persons, that disconnects the ungrounded and grounded circuit conductor(s) in the electrical storage system for maintenance. This disconnecting means shall not disconnect the grounded circuit conductor(s) for the remainder of any other electrical system. A non-load-break-rated switch shall be permitted to be used as a disconnecting means.

Statement of Problem and Substantiation for Public Comment

Maybe I am missing something here but I'm not sure what the purpose is to have a disconnecting means that only disconnects the grounded circuit conductor. I would think we would want to disconnect all the current carrying conductors to perform maintenance while insuring that it does not effect the grounding of other system conductors.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:24:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3651-NFPA 70-2015
Statement: The parent text to 706.30 has been removed for clarity.

This revision editorially revises first level subdivision (A) and the associated exception.
First level subdivision (B) is deleted as this requirement presently exists in Article 480.
First level subdivisions (C), (D), and (E) (now (B), (C), and (D)) are editorially revised.
The 100 volt threshold in (C) (now (D)) is modified to address current practice.
(E) Storage Systems of More Than 100 Volts.

On electrochemical ESS operating at more than 100 volts, the system battery circuits shall be permitted to operate with ungrounded conductors, provided a ground-fault detector and indicator is installed to monitor for ground faults within the storage system.

Statement of Problem and Substantiation for Public Comment

690.71(G), which this requirement replaces, has permitted systems above this voltage threshold to operate with ungrounded conductors, provided ground-fault detection and indication is installed. This option has been provided due to the low level of leakage current common with some electrochemical batteries which if not operated as ungrounded and isolated might lead to unintended failures. In addition, the Handbook under 250.167 DC ground fault protection indicates that some DC applications cannot use a grounded system. While the Handbook commentary is informative and not Code, it provides real-world examples. Ultimately, the product Listing should prevail. This revision is to clarify that this permissive operation applies only to the battery circuits.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 16:40:50 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3651-NFPA 70-2015
Statement: The parent text to 706.30 has been removed for clarity.

This revision editorially revises first level subdivision (A) and the associated exception.

First level subdivision (B) is deleted as this requirement presently exists in Article 480.

First level subdivisions (C), (D), and (E) (now (B), (C), and (D)) are editorially revised.

The 100 volt threshold in (C) (now (D)) is modified to address current practice.
Public Comment No. 1286-NFPA 70-2015 [Section No. 706.30(E)]

(E) Storage Systems of More Than 100 Volts.

On electrochemical ESS with battery voltage operating at more than 100 volts, the system battery circuits shall be permitted to operate with ungrounded conductors, provided a ground-fault detector and indicator is installed to monitor for ground faults within the storage system.

Statement of Problem and Substantiation for Public Comment

ESS by itself is a broad term and could include converted dc and ac circuits, while the requirement historically applies to the energy storage (battery) circuits. The proposed change clarifies the criteria. 250.162 outlines the specific grounding requirements for all DC systems, and the Handbook under 250.167 DC ground fault protection indicates that some DC applications cannot use a grounded system. While the Handbook commentary is informative and not Code, it provides real-world examples. Ultimately, the product Listing should prevail.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 706.143]

Submitter Information Verification

Submitter Full Name: Cyril Daran
Organization: Tesla Motors teamed up with OutBack Power Technologies
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 17:47:11 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: These revisions are not necessary as 706.30 applies only to the installation of batteries.
Public Comment No. 1485-NFPA 70-2015 [Section No. 706.30(E)]

(E) Storage Systems of More Than 100 Volts.

On electrochemical ESS operating at more than 100 volts, the system shall be permitted to operate with ungrounded conductors, provided a ground-fault detector and indicator is installed to monitor for ground faults within the storage system.

Statement of Problem and Substantiation for Public Comment

Since this is in Part III that covers electrochemical ESS it is redundant to have the word electrochemical repeated in (E).

Related Item

First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:07:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3651-NFPA 70-2015
Statement: The parent text to 706.30 has been removed for clarity.

The revision editorially revises first level subdivision (A) and the associated exception.

First level subdivision (B) is deleted as this requirement presently exists in Article 480.

First level subdivisions (C), (D), and (E) (now (B), (C), and (D)) are editorially revised.

The 100 volt threshold in (C) (now (D)) is modified to address current practice.
Statement of Problem and Substantiation for Public Comment

A ground-fault detector is not required to disconnect the ungrounded conductors of a circuit. Disconnection of the ungrounded conductors is necessary in the event of a ground fault to ensure safety of the ESS. The ground fault detector should be capable of disconnecting the ungrounded conductors in the event of a ground fault or the ground-fault detector should be capable of providing a signal to a separate device capable of disconnecting the ungrounded conductors in the event of a ground fault.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: John Kovacik
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 23:18:17 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The current text is clear and the proposed text is unnecessary.
Electrochemical battery. Battery locations shall conform to 706.34(A), (B), and (C).

Simplifying the text. Let's just use battery in place of electrochemical battery. See related definition change.

Related Public Comments for This Document

<table>
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<tr>
<th>Related Comment</th>
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<tr>
<td>Public Comment No. 1478-NFPA 70-2015 [Definition: Electrochemical Battery]</td>
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<tr>
<td>First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]</td>
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Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:09:36 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3652-NFPA 70-2015
Statement: This revision deletes electrochemical for clarity and correlation throughout Article 706.
Public Comment No. 1493-NFPA 70-2015 [Section No. 706.34(B)]

(B) Top Terminal Batteries.

Where top terminal electrochemical energy storage devices, batteries, are installed on tiered racks or on shelves of battery cabinets, working space in accordance with the storage equipment manufacturer’s instructions shall be provided between the highest point on a storage system component and the row, shelf, or ceiling above that point.

Informational Note No. 1: The installation instructions of the system component manufacturer typically define how much top working space is necessary for a particular system component.

Informational Note No. 2: IEEE 1187 provides guidance for top clearance of VRLA batteries, which are the most commonly used battery in cabinets.

Statement of Problem and Substantiation for Public Comment

Simplifying the text. (B) has “battery” in the heading so why change to the more complicated term “electrochemical energy storage devices” in the text.

Related Item

First Revision No. 3362-NFPA 70-2015 [Definition: Power-Supply Cord.]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:11:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3653-NFPA 70-2015
Statement: Informational Note 1 is removed to correlate with Article 480. The language in first level subdivision (B) is revised for clarity.
Gas piping shall not be permitted in dedicated battery rooms or spaces dedicated to electrochemical ESS.

Statement of Problem and Substantiation for Public Comment

Since 706.34 is about Battery Locations the use of the term "electrochemical" in 706.34(C) is redundant. It can be removed, shortening the text without effecting clarity.

Related Item
First Revision No. 3362-NFPA 70-2015 [Definition: Power-Supply Cord.]

Submitter Information Verification
Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
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Submittal Date: Fri Sep 25 13:14:55 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-3654-NFPA 70-2015
Statement: First level subdivision (C) is editorially revised as 706.34 addresses battery locations only.
706.35  Vents.

(A)  Vented Cells.
Each vented cell shall be equipped with a flame arrester.

Informational Note: A flame arrester is designed to prevent destruction of the cell due to ignition of gases within the cell by an external spark or flame under normal operating conditions.

(B)  Sealed Cells.
Sealed battery or cells shall be permitted to be equipped with a pressure-release vent to prevent excessive accumulation of gas pressure.

Statement of Problem and Substantiation for Public Comment

All sealed batteries have an emergency venting system. Calling it out in the NEC is redundant and is not under the control of the user anyway.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
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Submittal Date: Fri Sep 25 13:55:52 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3655-NFPA 70-2015
Statement: The material covered by 706.35 is presently covered adequately in Article 480.
Public Comment No. 1197-NFPA 70-2015 [Section No. 706.42]

706.42 Electrolyte Containment.
Flow battery systems shall be provided with a means for electrolyte containment to prevent spills of electrolyte from the system. An alarm system shall be provided to signal an electrolyte leak from the system. Electrical wiring and connections shall be located and routed in a manner that mitigates the potential for exposure to electrolytes.

Statement of Problem and Substantiation for Public Comment

Editorial comment for mandatory requirement to comply with NEC Style Manual, use of "shall"

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUER
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Affiliation: None
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Zip: 
Submittal Date: Thu Sep 24 12:01:33 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3656-NFPA 70-2015
Statement: This revision changes "leaks" to "leak" and modifies the second paragraph for compliance with the NEC Style Manual.
706.43  Flow Controls.

Controls shall be provided to safely shut down the system in the event of electrolyte blockage, such as a malfunctioning electrolyte pump or valve.

Statement of Problem and Substantiation for Public Comment

I have simplified the text. A simple statement of the requirement without examples is all that is needed.

This section deals with system design requirements that the NEC user will have no control over and would be hard pressed to verify. It is better enforced through the use of UL Standards.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address:
City:
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Zip:
Submittal Date: Fri Sep 25 14:12:12 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-3657-NFPA 70-2015
Statement: This revision editorially modifies the requirement for clarity.
**Public Comment No. 1565-NFPA 70-2015 [Section No. 706.44]**

706.44 Pumps and Other Fluid Handling Equipment.  
Pumps and other fluid handling equipment are to be rated/specified suitable for exposure to the electrolytes.

**Statement of Problem and Substantiation for Public Comment**

This section deals with system design requirements that the NEC user will have no control over and would be hard pressed to verify. It is better enforced through the use of UL Standards.

**Related Item**  
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

**Submitter Information Verification**

Submitter Full Name: MARVIN HAMON  
Organization: HAMON ENGINEERING INC  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Fri Sep 25 14:23:24 EDT 2015

**Committee Statement**

Committee Action: Rejected  
Resolution: The submitter provides no proposed revisions. The comment does not comply with Section 4.4.4.4 of the NFPA Regulations Governing The Development of NFPA Standards include proposed text in the Public Comment including the wording to be added, revised, or deleted.
(2) Fire Protection for Feeders.

Feeders shall be protected for 2 hours using one of the following methods:

(1) The cable or raceway is protected by a listed electrical circuit protective system with a minimum 2-hour fire rating.

Informational Note:
The listing organization provides UL guide information for electrical circuit protection systems (FHIT) contains information on proper installation requirements to maintain the fire rating.

(2) Be protected by a listed fire resistive cable system.

Informational Note No. 1: Fire resistive cables are tested to ANSI/UL 2196, Tests for Fire Resistive Cables.

Informational Note No. 2: The listing organization provides information for fire resistive cable systems on proper installation requirements to maintain the fire rating.

The cable or raceway is encased in:

(3) A rated assembly that has a minimum fire rating of 2 hours.

(4) Be encased in minimum 50 mm (2 in) of concrete.

Additional Proposed Changes

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<td>708_10_c_2_FR_3635-5m.pdf</td>
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Statement of Problem and Substantiation for Public Comment

The revisions that were accepted in 708.10(C)(2) change time-proven methods of providing fire and mechanical protection to these conductors without any substantiation of a problem with the existing requirements.

- The addition of the words “protected from fire for 2 hours” in 708.10(C)(2) is ambiguous and unenforceable for the concrete encasement allowance in new (3) which states: “the cable or raceway is encased in concrete”. It could be interpreted that any amount of concrete is sufficient or it could be interpreted that the concrete assembly has to be tested to prove that it has a 2 hour fire rating. The allowance for 2” of concrete encasement has been in this section of the Code for years and has been recognized as providing both mechanical and fire protection sufficient for this application. During the 2014 code cycle, a similar change was proposed using an International Building Code table showing fire resistive ratings of various concrete thicknesses as substantiation. It was defeated during the NFPA Technical Meetings. One of the supporters of the motion to reject the change and to allow the continued use of 2” of concrete was the past chairman of the ASCE SFP Committee on Structural Fire Protection who stated that the use of that table was a “complete and total misapplication”. This time there was no substantiation at all to remove the 2” requirement.

- The additional changes made to this section do not add clarity. One removes the option for 2 hour fire-rated assemblies, which should be retained, and one adds “a listed fire resistive cable system” which is not necessary. According to the UL On-Line Certification Directory Guide Information for fire resistive cables listed to UL 2196 (Category FHJR), they must be used as part of a classified Electrical Circuit Protective System (Category FHIT) so they are already included in existing (1) “be a listed electrical circuit protective system with a minimum 2-hour fire rating”.

Related Item
First Revision No. 3635-NFPA 70-2015 [Section No. 708.10(C)(2)]
Public Input No. 4821-NFPA 70-2014 [Section No. 708.10(C)(2)]

Submitter Information Verification

Submitter Full Name: VINCE BACLAWSKI
Organization: NEMA
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<table>
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**Committee Statement**

**Committee Action:** Rejected but see related SR

**Resolution:** The permission to use 2-inches of concrete was deleted in the first revision stage and is added back in this revision. The absence of a dimension for the depth of concrete would cause serious confusion in practical application.

Listed fire-rated assemblies with a minimum fire rating of 2 hours was deleted in the first revision stage and is added in this second revision. This means to achieve a 2 hour fire rating for COPS systems is time tested and commonly used.

Editorial revisions were made to the parent text and the list items to clarify the 2-hour requirement.
Public Comment No. 752-NFPA 70-2015 [Section No. 708.24(E)]

(E) Documentation:
The short-circuit current rating of the transfer equipment, based on the specific overcurrent protective device type and settings protecting the transfer equipment, shall be field marked on the exterior of the transfer equipment.

Statement of Problem and Substantiation for Public Comment

IEC's position is to delete 708.24(E) - (FR 7521)

The code already requires that equipment be installed according to available fault current, so adding this requirement is redundant. The installer/supplier already has the responsibility/liability to install the proper equipment based on the characteristics of the system. This proposal puts too much liability on the contractor/supplier because after installation various factors can change which will affect the available fault current. Feeders can be reworked, transformers can be changed with different impedance values, motor loads can be added to the existing system and similar factors that can change the available fault current. In the case of a lawsuit, the installer will have the burden of proof that the installation was done according to code and would result in unnecessary costs for defending an installation that was installed correctly, but that had variables change that are out of their control. A better proposal would be to require the owner to relabel the equipment after any alteration to the system.

Related Public Comments for This Document

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Related Item
First Revision No. 7521-NFPA 70-2015 [New Section after 708.24(D)]

Submitter Information Verification

Submitter Full Name: JOHN MASARICK
Organization: Independent Electrical Contractors, Inc.
Affiliation: Independent Electrical Contractors, Inc.
Street Address:                      
City:                                
State:                               
Zip:                                 
Submittal Date: Fri Sep 18 20:44:44 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Typically Automatic Transfer Switches have several overcurrent protection options each with different short-circuit current ratings (analogous to withstand close on ratings) which can cause confusion for AHJ during inspection or for service provider when replacing overcurrent protection after installation. This requirement requires the installer to mark the equipment exterior with the short-circuit current rating of the automatic transfer switch based upon the specific overcurrent protective device type/rating. This clarifies to the inspector and service provider the specifics of the protection scheme, which is vital for safety.
Article 712, Interconnected Direct Current Microgrids (DC) Distribution Systems

Part I. General

712.1 Scope. This article applies to direct current microgrids distribution systems with interconnected direct current sources.

712.2 Definitions.

Interconnected Direct Current Microgrid (DC Microgrid) Distribution System. A direct current microgrid is a power distribution system consisting of one or more interconnected direct current sources, dc-dc converters, dc loads, and ac loads powered by dc-ac inverters. A dc microgrid is typically not directly connected to an ac primary source of electricity, but some dc microgrids interconnected via one or more dc-ac bidirectional converters or dc–ac inverters.

Informational Note: Direct current power sources include ac-dc converters (rectifiers), bidirectional dc-ac inverters/converters, photovoltaic systems, wind generators, energy storage systems (including batteries), and fuel cells. Interconnected Direct Current Distribution Systems are commonly called DC microgrids.

Grounded Two-Wire DC System

A two-wire dc power system is a system that has a direct connection or reference-ground between one of the current carrying conductors and the equipment grounding system.

Grounded Three-Wire DC System.

An interconnected direct current (DC) distribution system is a power distribution system consisting of one or more parallel connected dc power sources, dc-dc converters, dc loads, and ac loads powered by dc-ac inverters. A dc microgrid is typically not directly connected to an ac primary source of electricity, but some dc microgrids interconnected via one or more dc-ac bidirectional converters or dc–ac inverters.

Informational Note: Direct current power sources include ac-dc converters (rectifiers), bidirectional dc-ac inverters/converters, photovoltaic systems, wind generators, energy storage systems (including batteries), and fuel cells. Interconnected Direct Current Distribution Systems are commonly called DC microgrids.

Nominal Voltage.

A nominal value assigned to a circuit or system for the purpose of conveniently designating its dc voltage class (e.g., 24 volts dc, 190/380 volts dc, 380 volts dc).

Informational Note: The actual voltage at which a circuit operates can vary from the nominal voltage within a range that permits satisfactory operation of equipment.

Reference-Grounded DC System.

A microgrid system that is not solidly grounded but has a low-impedance electrical reference that maintains voltage to ground in normal operation. In the faulted state, the system becomes ungrounded or high-impedance grounded in order to limit fault current.

Resistively Grounded.

A dc power system with a high-impedance connection between the current carrying conductors and the equipment grounding system.

Primary DC Source.

A dc power source that supplies the majority of the dc load in a dc microgrid an interconnected dc distribution system.

Ungrounded DC System.

A dc power system that has no direct or resistive connection between the current carrying conductors and the equipment grounding system.

712.3 Other Articles. Wherever the requirements of other articles of this Code and Article 712 differ, the requirements of Article 712 shall apply. DC microgrids interconnected dc distribution systems that are interconnected through an inverter or bi-directional converter with ac electric power production sources shall, the interconnected ac portion of the system shall comply with Article 705.

712.4 Labeling and Listing. Any direct-current equipment used in a direct-current microgrid distribution system shall be listed and labeled for dc use.

(1) Disconnecting means

(2) Overcurrent and Ground Fault Protective devices

(3) Inverters, Converters, Rectifiers and other Power Conversion Equipment

(4) Panelboards, Switchboards, Switchgear, and Motor Control Centers

(5) Utilization Equipment
712.10 Directory.

A permanent directory denoting all dc electric power sources operating to supply the interconnected dc microgrid distribution system shall be installed at each source location capable of acting as the primary dc source.

Part II. Circuit Requirements

712.25 Identification of Circuit Conductors

(A)

Ungrounded circuit conductors in dc microgrid distribution systems shall be identified at termination, connection and splice points, according to the requirements of 210.5(C)(2) for branch circuits and 215.12(C)(2) for feeders. Continuous marking of conductors other than at the termination, connection and splice points shall not be required.

(B)

Ungrounded conductors of 6 AWG or smaller shall be permitted to be identified by polarity at all termination, connection, and splice points by marking, taping, or other approved means.

Exception to (A) and (B): In existing installations, where previous conductor identification exists, it is permissible to mark only the new conductor identification at the termination, connection and splice points.

712.30 System Voltage.

The system voltage of a dc microgrid distribution system shall be defined as follows:

1. The nominal voltage to ground for solidly-grounded systems
2. The nominal voltage to ground for reference-grounded systems where all conductors are disconnected from power sources when the reference ground is in the high-impedance, faulted state
3. The highest nominal voltage between conductors for resistively grounded dc systems and ungrounded dc systems.

Informational Note: Examples of nominal system voltages are 24 volts dc, 190/380 volts dc, 380 volts dc, and etc.

Part III. Disconnecting Means

712.34 DC Source Disconnecting Means.

The output of each dc source shall have a readily accessible, lockable disconnecting means. Disconnecting means shall be located in accordance with 690.13(A) for photovoltaic systems and adjacent to the source for other systems.

712.35 Disconnection of Ungrounded Conductors.

In solidly grounded two- and three-wire DC distribution systems, the disconnecting means shall simultaneously open all ungrounded conductors. In ungrounded, resistively grounded and reference-grounded systems, such devices shall open all current-carrying conductors.

712.37 Directional Current Devices.

Disconnecting means and protective and overcurrent devices that are designed for use in a single current direction shall only be used in the designated current direction.

Informational Note: Examples of directional current devices are magnetically quenched contactors and semiconductor switches in overcurrent devices. Contribution of fault current from multiple sources and selective coordination should be considered in the design of overcurrent protective devices used on interconnected DC distribution systems.

712.38 Loss of Direct Current Source.

Upon loss of primary dc source capacity, all dc electric power sources shall be automatically disconnected or curtailed from all ungrounded conductors of the dc primary source(s) and shall not be reconnected until the primary dc source capacity of the dc source(s) is restored. Individual premises dc sources shall be permitted to reconfigure and operate as a separate DC system(s) to supply loads that have been disconnected.

712.39 Response to Fire. In the event of a fire, the interconnected DC distribution system shall automatically shut down and de-energize the system.

Part IV. Wiring Methods

712.40 Identification for Branch Circuits and Feeder Circuits.

(A)

Wiring methods for dc microgrid distribution systems shall comply with the requirements of 210.5 for branch circuits and 215.12 for feeders.

(B)

DC microgrids operating at voltages greater than 300 volts dc shall be reference-grounded dc systems or resistively grounded dc systems.

Chapter 3.
712.52 System Grounding.
   (A) Direct-current microgrid distribution systems shall be grounded in accordance with 250.162.
   (B) DC microgrid distribution systems operating at voltages greater than 300 volts dc shall be reference-grounded dc systems or resistively grounded dc systems.

712.55 Ground Fault Protection of Equipment.
   (A) DC microgrid distribution systems operating at greater than 60 volts dc shall have ground fault protection that does all of the following:
      (1) Detects the fault
      (2) Indicates that a fault has occurred
      (3) For solidly grounded and reference-grounded systems, disconnects power from the faulted equipment
   (B) Ground fault equipment shall comply with 250.167.

712.57 Arc Fault Protection.
   DC microgrid distribution systems with a system voltage of greater than 60 volts shall be required to have arc fault protection for utilization circuits. Arc fault protection equipment shall be identified and listed for the purpose.
   Informational Note: 90.4 applies when suitable equipment for arc fault protection is not available.

Part VI. Marking

712.62 Panelboards.
Panelboards in dc microgrid systems shall be marked in accordance with 408.3.

712.65 Panelboards.
Panelboards in dc microgrid systems shall be marked in accordance with 408.3.

Available DC Fault Current.
   (A) Field Marking.
   Maximum available dc short-circuit current on the dc microgrid distribution system shall be field marked at the dc source(s). The field marking(s) shall include the date the fault-current calculation was performed and be of sufficient durability to withstand the environment involved.
   (B) Modifications.
   When modifications to the electrical installation occur that affect the maximum available fault current at the dc source(s), the maximum available fault current shall be verified or recalculated as necessary to ensure the equipment ratings are sufficient for the maximum available fault current at the line terminals of the equipment. The required field marking(s) in 712.65(A) shall be adjusted to reflect the new level of maximum available fault current.

Part VII. Systems with Multiple Sources

712.70 Overcurrent Protection.
Equipment and conductors connected to more than one electrical source shall have overcurrent devices located so as to provide protection from all sources.

712.72 Interrupting and Short-Circuit Current Rating.
Consideration shall be given to the contribution of fault currents from all interconnected power sources for the interrupting ratings and short-circuit current ratings of equipment in dc microgrid distribution systems. Overcurrent protective devices and equipment used within a dc microgrid distribution system shall have an interrupting rating at nominal circuit voltage or a short-circuit current rating sufficient for the available fault current at the line terminals of the equipment.

Part VIII. Systems over 1000 Volts

712.80 General.
Systems with a maximum voltage between conductors of over 1000 volts dc shall comply with Article 490 and other requirements applicable. Article 250 applicable to installations rated over 1000 volts.

Statement of Problem and Substantiation for Public Comment

The purpose of this comment is to offer a suggested resolution to the issues brought up in the committee statement and the concerns identified in the affirmative comments during the first revision. New Section 712.39 was added to address the shutdown of sources during fire conditions for first responders. 712.40 was re-written to address two issues with wiring methods. 712.25 was revised to address the identification and marking of DC conductors at accessible points and to address the existing identification of conductors and...
installation of new DC conductors. This identification also considered the color coding and it remains as the same in 210 branch circuits and 215 for feeders. 712.35 was considered, but it remains in 712 as original. The title of the Article was changed to Interconnected Direct Current (DC) Distribution Systems and the term microgrid as removed from the article except for a new information note on the definition of a Direct Current (DC) Distribution System. Use of the terms grounding and bonding were reviewed and corrected as necessary. In addition, the following topics of nominal voltage, disconnecting means and arc fault detection were reviewed and corrected as necessary.

Related Item
First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification
Submitter Full Name: Timothy Croushore
Organization: FirstEnergy
Affiliation: FirstEnergy
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 07:39:14 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution:
SR-3627-NFPA 70-2015; Public Comment 1174: CMP-13 retained the title “Direct Current Microgrids” in lieu of another title because this term is widely used and understood within the electrical industry. This term is used by IEEE, NEMA and the US Department of Energy. CMP-13 considered the proposed requirement to address response to a fire situation and identified that more information is needed. Public Comment 1016: Action on the SR for Article 712 satisfies the intent of the submitter. “Listed or labeled” was changed to “listed and labeled” and the title of 712.4 was changed for proper use of terminology. Public Comment 1017: Action on the SR for Article 712 satisfies the intent of the submitter. The panel did not remove “lockable” because this is a Chapter 7 article which supplements or modifies Chapters 1-4. Public Comment 1019: Action on the SR for Article 712 satisfies the intent of the submitter. Public Comment 1021: Action on the SR for Article 712 satisfies the intent of the submitter.

Statement:
The defined terms “Grounded Two-Wire DC System”, “Grounded Three-Wire DC System,” “Nominal Voltage”, “Reference-Grounded DC System”, “Resistively Grounded”, “Primary DC Source”, “Ungrounded DC System” are editorially modified for clarity, usability and compliance with the NEC style manual.

The definition of “Direct Current Microgrid” is modified to clarify that more than one interconnected source is required.

The last sentence in the defined term, “Reference-Grounded DC System” is deleted because it is a requirement.

712.4 is modified for clarity.

Editorial corrections are made and an Informational Note is added to 712.30 for clarity and usability.

712.34 is modified for clarity. The reference to 690.13(A) is deleted as there are many potential sources.

712.37 is modified for clarity. The listing and marking requirement is added to ensure that directional current devices are approved for the intended use.

Section 712.38 was deleted. The requirements in this section were intended to mirror the anti-islanding requirements for interconnected ac systems, in that distributed sources should not back-feed a de-energized utility grid. As there are presently no dc utility services, 712.38 only adds confusion and is unlikely to be relevant for many years until dc utility distribution systems are again implemented.

712.40 is deleted. First level subdivision (A) was just a reference to identification of DC conductors and the requirements in 210 and 215 apply as per section 90.3. First level subdivision (B) is deleted because it is referenced in 712.52.

712.52 is editorially revised to add first level subdivision titles.

In section 712.55, the term “ground fault protection” was changed to “ground fault detection.” The remainder of the section was editorially revised.

712.57 for arc fault protection of systems was modified to reference other requirements for arc fault protection in the NEC.

Part numbers were editorially revised.
Section 712.62 was modified from panelboards to distribution equipment and conductors.

Section 712.65, Panelboards, is deleted because it was duplicated.

Section 712.65, Available DC Fault Current, is modified for clarity and to specifically address “short circuit current” and to include the date of the marking.

The title of Part VII (now Part VI) is revised to “Protection” for clarity.

Section 712.70 is revised for clarity and usability.

Section 712.72 is modified for clarity to specifically address “short circuit current”.

Section 712.80 is revised for clarity and usability.
Article 712 Direct Current Microgrids

Part I. General

**712.1 Scope.**
This article applies to direct current microgrids.

**712.2 Definitions.**

**Direct Current Microgrid (DC Microgrid).**
A direct current microgrid is a power distribution system consisting of one or more interconnected dc power sources, dc-dc converters, dc loads, and ac loads powered by dc-ac inverters. A dc microgrid is typically not directly connected to an ac primary source of electricity, but some dc microgrids interconnect via one or more dc-ac bidirectional converters or dc–ac inverters.

Informational Note: Direct current power sources include ac-dc converters (rectifiers), bidirectional dc-ac inverters/converters, photovoltaic systems, wind generators, energy storage systems (including batteries), and fuel cells.

**Grounded Two-Wire DC System**
A two-wire dc power system that has a direct connection or reference-ground between one of the current carrying conductors and the equipment grounding system.

**Grounded Three-Wire DC System.**
A dc power system with a solid connection or reference-ground between the center point of a bipolar dc power source and the equipment grounding system.

**Nominal Voltage.**
A nominal value assigned to a circuit or system for the purpose of conveniently designating its dc voltage class (e.g., 24 volts dc, 190/380 volts dc, 380 volts dc). The actual voltage at which a circuit operates can vary from the nominal voltage within a range that permits satisfactory operation of equipment.

**Reference-Grounded DC System.**
A microgrid system that is not solidly grounded but has a low-impedance electrical reference that maintains voltage to ground in normal operation. In the faulted-state, the system becomes ungrounded or high-impedance grounded in order to limit fault current.

**Resistively Grounded.**
A dc power system with a high-impedance connection between the current carrying conductors and the equipment grounding system.

**Primary DC Source.**
A dc power source that supplies the majority of the dc load in a dc microgrid.

**Ungrounded DC System.**
A dc power system that has no direct or resistive connection between the current carrying conductors and the equipment grounding system.

**712.3 Other Articles.**
Wherever the requirements of other articles of this Code and Article 712 differ, the requirements of Article 712 shall apply. DC microgrids interconnected through an inverter or bi-directional converter with ac electric power production sources shall comply with Article 705.

**712.4 Labeling and Listing.**
Any direct-current equipment used in a direct-current microgrid shall be listed or labeled for dc use.

**712.10 Directory.**
A permanent directory denoting all dc electric power sources operating to supply the dc microgrid shall be installed at each source location capable of acting as the primary dc source.

Part II. Circuit Requirements

**712.25 Identification of Circuit Conductors**

**(A)**
Ungrounded circuit conductors in dc microgrids shall be identified according to the requirements of 210.5(C)(2) for branch circuits and 215.12(C)(2) for feeders.
Ungrounded conductors of 6 AWG or smaller shall be permitted to be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means.

**712.30 System Voltage.**
The system voltage of a dc microgrid shall be defined as follows:

1. The nominal voltage to ground for solidly-grounded systems
2. The nominal voltage to ground for reference-grounded systems where all conductors are disconnected from power sources when the reference ground is in the high-impedance, faulted state
3. The highest nominal voltage between conductors for resistively grounded dc systems and ungrounded dc systems.

**Part III. Disconnecting Means**

**712.34 DC Source Disconnecting Means.**
The output of each dc source shall have a readily accessible, lockable disconnecting means. Disconnecting means shall be located in accordance with 690.13(A) for photovoltaic systems and adjacent to the source for other systems.

**712.35 Disconnection of Ungrounded Conductors.**
In solidly grounded two- and three-wire systems, the disconnecting means shall simultaneously open all ungrounded conductors. In ungrounded, resistively grounded and reference-grounded systems, such devices shall open all current-carrying conductors.

**712.37 Directional Current Devices.**
Disconnecting means and protective and overcurrent devices that are designed for use in a single current direction shall only be used in the designated current direction.

Informational Note: Examples of directional current devices are magnetically quenched contactors and semiconductor switches in overcurrent devices.

**712.38 Loss of Direct Current Source.**
Upon loss of primary dc source, all dc electric power sources shall be automatically disconnected from all ungrounded conductors of the dc primary source and shall not be reconnected until the primary dc source is restored. Individual premises dc sources shall be permitted to reconfigure and operate as the primary dc source in a stand-alone system(s) to supply loads that have been disconnected.

**Part IV. Wiring Methods**

**712.40 Identification for Branch Circuits and Feeder Circuits.**

(A) Wiring methods for dc microgrids shall comply with the requirements of 210.5 for branch circuits and 215.12 for feeders.

(B) DC microgrids operating at voltages greater than 300 volts dc shall be reference-grounded dc systems or resistively grounded dc systems.

**712.52 System Grounding.**

(A) Direct-current microgrids shall be grounded in accordance with 250.162.

(B) DC microgrids operating at voltages greater than 300 volts dc shall be reference-grounded dc systems or resistively grounded dc systems.

**712.55 Ground Fault Protection of Equipment.**

(A) DC microgrids operating at greater than 60 volts dc shall have ground fault protection that does all of the following:

1. Detects the fault
2. Indicates that a fault has occurred
3. For solidly grounded and reference-grounded systems, disconnects power from the faulted equipment

(B) Ground fault equipment shall comply with 250.167.

**712.57 Arc Fault Protection.**
DC microgrids with a system voltage of greater than 60 volts shall be required to have arc fault protection for utilization circuits. Arc fault protection equipment shall be identified and listed for the purpose.

Informational Note: 90.4 applies when suitable equipment for arc fault protection is not available.
Part VI. Marking

712.62 Panelboards.
Panelboards in dc microgrid systems shall be marked in accordance with 408.3.

712.65 Panelboards.
Panelboards in dc microgrid systems shall be marked in accordance with 408.3.

712.65 Available DC Fault Current.

(A) Field Marking.
Maximum available dc short-circuit current on the dc microgrid shall be field marked at the dc source. The field marking(s) shall include the date the fault-current calculation was performed and be of sufficient durability to withstand the environment involved.

(B) Modifications.
When modifications to the electrical installation occur that affect the maximum available fault current at the dc source, the maximum available fault current shall be verified or recalculated as necessary to ensure the equipment ratings are sufficient for the maximum available fault current at the line terminals of the equipment. The required field marking(s) in 712.65(A) shall be adjusted to reflect the new level of maximum available fault current.

Part VII. Systems with Multiple Sources

712.70 Overcurrent Protection.
Equipment and conductors connected to more than one electrical source shall have overcurrent devices located so as to provide protection from all sources.

712.72 Interrupting and Short-Circuit Current Rating.
Consideration shall be given to the contribution of fault currents from all interconnected power sources for the interrupting ratings and short-circuit current ratings of equipment in dc microgrid systems. Overcurrent protective devices and equipment used within a dc microgrid shall have an interrupting rating at nominal circuit voltage or a short-circuit current rating sufficient for the available fault current at the line terminals of the equipment.

Part VIII. Systems over 1000 Volts

712.80 General.
Systems with a maximum voltage between conductors of over 1000 volts dc shall comply with Article 490 and other requirements applicable to installations rated over 1000 volts.

Statement of Problem and Substantiation for Public Comment

Article 712 DC Microgrids is a new article that received many comments at ballot time, and will no doubt receive more during this public comment period.
The DC Microgrid Task Group (a sub group of the NEC DC Work Force) will meet and discuss the FD and public comments. It will also work closely with a task group appointed by the CMP13 chair to resolve issues in this new article. Two members of the TG are also principal members of CMP13.

Related Item
First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification

Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
Affiliation: NEC DC Taskforce / DC Microgrid WG
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:14:03 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter provides no proposed revisions. The comment does not comply with Section 4.4.4.4 of the NFPA Regulations Governing The Development of NFPA Standards to include proposed text in the Public Comment including the wording to be added, revised, or deleted.
Public Comment No. 1374-NFPA 70-2015 [ Section No. 712.2 ]

712.2 Definitions.

**Branch Circuit**
In a building containing a Direct Current Microgrid, with a connection to the AC utility grid through AC to DC conversion equipment, the branch circuit shall be defined to be the final point of AC wiring prior to the AC to DC conversion equipment.

**Direct Current Microgrid (DC Microgrid).**
A direct current microgrid is a power distribution system consisting of one or more interconnected dc power sources, dc-dc converters, dc loads, and ac loads powered by dc-ac inverters. A dc microgrid is typically not directly connected to an ac primary source of electricity, but some dc microgrids interconnect via one or more dc-ac bidirectional converters or dc–ac inverters.

Informational Note: Direct current power sources include ac-dc converters (rectifiers), bidirectional dc-ac inverters/converters, photovoltaic systems, wind generators, energy storage systems (including batteries), and fuel cells.

**Grounded Two-Wire DC System**
A two-wire dc power system that has a direct connection or reference-ground between one of the current carrying conductors and the equipment grounding system.

**Grounded Three-Wire DC System.**
A dc power system with a solid connection or reference-ground between the center point of a bipolar dc power source and the equipment grounding system.

**Nominal Voltage.**
A nominal value assigned to a circuit or system for the purpose of conveniently designating its dc voltage class (e.g., 24 volts dc, 190/380 volts dc, 380 volts dc). The actual voltage at which a circuit operates can vary from the nominal voltage within a range that permits satisfactory operation of equipment.

**Reference-Grounded DC System.**
A microgrid system that is not solidly grounded but has a low-impedance electrical reference that maintains voltage to ground in normal operation. In the faulted-state, the system becomes ungrounded or high-impedance grounded in order to limit fault current.

**Resistively Grounded.**
A dc power system with a high-impedance connection between the current carrying conductors and the equipment grounding system.

**Primary DC Source.**
A dc power source that supplies the majority of the dc load in a dc microgrid.

**Ungrounded DC System.**
A dc power system that has no direct or resistive connection between the current carrying conductors and the equipment grounding system.

Statement of Problem and Substantiation for Public Comment

Robert Bosch LLC recommends adding this definition to support the recommended changes to Article 712.70, which has the following justification: The installation of new DC circuits in new construction or the retrofit of specific existing wiring circuits to operate on a dc system, such as lighting circuits in commercial buildings, represents a tremendous improvement in utilization of renewable energy, overall system reliability, and resiliency to power outages with long-term cost savings and no impact to safety and reliability. Conversion to DC circuits also offers the opportunity to utilize high-resistance midpoint grounding schemes, which substantially reduces the chances of electric shock, since both current-carrying conductors have a high-resistance path to ground in this configuration.

Branch circuit overcurrent protective devices are rated for at least 5000 amperes interrupting rating, with the intention that this high level of AC current could theoretically be available from the utility grid on an instantaneous basis, depending on factors such as how far downstream the AC branch circuit is from the building utility service feed, wire gauge of feeders leading up to the AC branch, etc. However, DC building circuits are inherently limited in the amount of instantaneous AC grid current that may be converted to DC by the AC/DC conversion devices themselves. Therefore, utilizing branch circuit overcurrent protection devices on the AC circuits feeding AC/DC conversion electronics and utilizing supplemental overcurrent protection devices on the DC circuits feeding the DC devices within buildings provides a safe environment for DC building systems, since protection from the theoretical 5000 ampere instantaneous current from the utility grid still exists on the AC side of the conversion device. This is similar to overcurrent protection requirements for utilizing DC within machines and equipment, which means appropriate size and cost-effective DC supplemental overcurrent protection devices are already available to enable the introduction of DC Microgrids on a commercially viable scale. “Supplemental overcurrent devices utilized to feed DC load circuits shall be readily accessible” was added as a recommended exception to Article 240.10.
Committee Statement

Committee Action: Rejected

Resolution: The proposed definition would conflict with the definition of "branch circuit" in Article 100. That definition infers a branch circuit ends at the point in the wiring system where power is taken to supply utilization equipment. This is beyond the point in the circuit where the ac to dc conversion occurs.
### Public Comment No. 1016-NFPA 70-2015 [ Section No. 712.4 ]

**712.4 Labeling and Listing.**

Any *direct-current* equipment used in the *dc circuits* of a direct-current micro grid shall be listed or labeled for dc use.

### Statement of Problem and Substantiation for Public Comment

DC Microgrids may include AC inverters and other equipment which are not operating as dc. The requirements for dc listing should be limited to dc circuits

**Related Item**

First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

### Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER  
Organization: OUTBACK POWER TECHNOLOGIES  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Sep 23 00:41:10 EDT 2015

### Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-3627-NFPA 70-2015: Public Comment 1174: CMP-13 retained the title "Direct Current Microgrids" in lieu of another title because this term is widely used and understood within the electrical industry. This term is used by IEEE, NEMA and the US Department of Energy. CMP-13 considered the proposed requirement to address response to a fire situation and identified that more information is needed. Public Comment 1016: Action on the SR for Article 712 satisfies the intent of the submitter. "Listed or labeled" was changed to "listed and labeled" and the title of 712.4 was changed for proper use of terminology. Public Comment 1017: Action on the SR for Article 712 satisfies the intent of the submitter. The panel did not remove "lockable" because this is a Chapter 7 article which supplements or modifies Chapters 1-4. Public Comment 1019: Action on the SR for Article 712 satisfies the intent of the submitter.


The definition of "Direct Current Microgrid" is modified to clarify that more than one interconnected source is required.

The last sentence in the defined term, "Reference-Grounded DC System" is deleted because it is a requirement.

712.4 is modified for clarity.

Editorial corrections are made and an Informational Note is added to 712.30 for clarity and usability.

712.34 is modified for clarity. The reference to 690.13(A) is deleted as there are many potential sources.

712.37 is modified for clarity. The listing and marking requirement is added to ensure that directional current devices are approved for the intended use.

Section 712.38 was deleted. The requirements in this section were intended to mirror the anti-islanding requirements for interconnected ac systems, in that distributed sources should not back-feed a de-energized utility grid. As there are presently no dc utility services, 712.38 only adds confusion and is unlikely to be relevant for many years until dc utility distribution systems are again implemented.

712.40 is deleted. First level subdivision (A) was just a reference to identification of DC conductors and the requirements in 210 and 215 apply as per section 90.3. First level subdivision (B) is deleted because it is referenced in 712.52.

712.52 is editorially revised to add first level subdivision titles.
In section 712.55, the term "ground fault protection" was changed to "ground fault detection." The remainder of the section was editorially revised.

Section 712.57 for arc fault protection of systems was modified to reference other requirements for arc fault protection in the NEC.

Part numbers were editorially revised.

Section 712.62 was modified from panelboards to distribution equipment and conductors.

Section 712.65, Panelboards, is deleted because it was duplicated.

Section 712.65, Available DC Fault Current, is modified for clarity and to specifically address "short circuit current" and to include the date of the marking.

The title of Part VII (now Part VI) is revised to "Protection" for clarity.

Section 712.70 is revised for clarity and usability.

Section 712.72 is modified for clarity to specifically address "short circuit current".

Section 712.80 is revised for clarity and usability.
Public Comment No. 1086-NFPA 70-2015 [Section No. 712.25(A)]

(A) Ungrounded circuit conductors in dc microgrids 4 AWG or larger shall be identified according to the requirements of 210.5(C)(2) for branch circuits and 215.12(C)(2) for feeders.

Statement of Problem and Substantiation for Public Comment

The wording of 712.25(A) needs to be made more clear that it only applies to 4 AWG or larger so it is clear that 712.25(B) applies to 6 AWG and smaller. Otherwise it could be misinterpreted.

Related Item
First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 16:17:19 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The intent of the proposed revision is already covered in 210.5(C)(2) and 215.12(C)(2) and considered unnecessary.
Ungrounded conductors of 6 AWG or smaller shall be permitted to be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means. A permanent, listed marking means such as sleeving or shrink tubing that is suitable for the conductor size, at all termination, connection, and splice points, with durably imprinted plus signs (+) or the word POSITIVE or POS for positive polarity and minus signs (-) or the word NEGATIVE or NEG for negative polarity. Marking tape shall not be permitted.

Statement of Problem and Substantiation for Public Comment

The proposed text allowed marking tape for wires smaller than #6 AWG. This is not considered good practice as tape tends to fall off small wires. This language is similar to that proposed for Articles 210 and 215 for dc system wire marking.

Related Item
First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification

Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
Affiliation: NEC DC Task Force / DC Microgrid WG
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:34:21 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The submitter did not provide adequate substantiation.
Ungrounded conductors of 6 AWG or smaller shall be permitted to be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means for existing wiring circuits in buildings which are being converted to a dc system.

Statement of Problem and Substantiation for Public Comment

Robert Bosch LLC (Bosch) proposes an amendment to Article 712.25(B). This amendment clarifies how existing wiring circuits in buildings being converted to a dc system will be identified.

The reason for this amendment is that existing ungrounded conductors of 6 AWG or smaller in buildings being converted to a dc system can also be safely reused and identified per the same requirements as ungrounded conductors of 4 AWG or larger without any safety or reliability concerns per Article 210.5(C)(2). It is reasonable for the present requirements for 6 AWG or smaller in Article 210.5(C)(2)(a) and (b) to apply to new building construction, however for existing buildings it would in essence require perfectly usable existing wiring to be removed/disposed of and new wiring to be installed. This adds extra unnecessary waste/cost with the potential to create a less reliable and safe wiring environment through the extensive rework necessary, for zero benefit as the existing wiring does not need replacement and can be properly identified. The retrofit of specific existing wiring circuits to operate on a dc system, such as lighting circuits in commercial buildings, rather than having to install new wiring represents a tremendous improvement in utilization of renewable energy, overall system reliability, and resiliency to power outages with long-term cost effective savings and no impact to safety and reliability. Conversion to DC circuits also offers the opportunity to utilize high-resistance midpoint grounding schemes, which substantially reduces the chances of electric shock, since both current-carrying conductors have a high-resistance path to ground in this configuration.

Bosch has also proposed this same clarification to Articles 210.5(C)(2), 215.12(C)(2) and 712.40(B) that have the same requirements.

Related Public Comments for This Document

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<td>Public Comment No. 1372-NFPA 70-2015 [Section No. 215.12(C)(2)]</td>
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Related Item

First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification

Submitter Full Name: Andrew Yip
Organization: Robert Bosch LLC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 11:58:31 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel does not agree that the requirement applies only to existing buildings.
712.34  DC Source Disconnecting Means.

The output of each dc source shall have a readily accessible, lockable disconnecting means. Disconnecting means shall be located in accordance with 690.13(A) for photovoltaic systems and adjacent to the source for other systems.

Statement of Problem and Substantiation for Public Comment

The first sentence addresses the key requirement that all sources must have disconnects at their source. The special requirements for PV system disconnecting means is best addressed in 690, and adding additional, parallel requirements here does not add value but may cause confusion. Disconnecting means for other sources, where they may differ, is similarly best handled in articles specific to those sources. There is no benefit to adding a lockable requirement to all dc sources in this application, that is better and already addressed in the articles pertaining to the specific conditions presented by each dc source.

Related Item

First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address: City: State: Zip:
Submittal Date: Wed Sep 23 00:44:55 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3627-NFPA 70-2015: Public Comment 1174: CMP-13 retained the title “Direct Current Microgrids” in lieu of another title because this term is widely used and understood within the electrical industry. This term is used by IEEE, NEMA and the US Department of Energy. CMP-13 considered the proposed requirement to address response to a fire situation and identified that more information is needed. Public Comment 1016: Action on the SR for Article 712 satisfies the intent of the submitter. “Listed or labeled” was changed to “listed and labeled” and the title of 712.4 was changed for proper use of terminology. Public Comment 1017: Action on the SR for Article 712 satisfies the intent of the submitter. The panel did not remove “lockable” because this is a Chapter 7 article which supplements or modifies Chapters 1-4. Public Comment 1019: Action on the SR for Article 712 satisfies the intent of the submitter. Public Comment 1021: Action on the SR for Article 712 satisfies the intent of the submitter.


The definition of “Direct Current Microgrid” is modified to clarify that more than one interconnected source is required.

The last sentence in the defined term, “Reference-Grounded DC System” is deleted because it is a requirement.

712.4 is modified for clarity.

Editorial corrections are made and an Informational Note is added to 712.30 for clarity and usability.

712.34 is modified for clarity. The reference to 690.13(A) is deleted as there are many potential sources.

712.37 is modified for clarity. The listing and marking requirement is added to ensure that directional current devices are approved for the intended use.

Section 712.38 was deleted. The requirements in this section were intended to mirror the anti-islanding requirements for interconnected ac systems, in that distributed sources should not back-feed a de-energized utility grid. As there are presently no dc utility services, 712.38 only adds confusion and is unlikely to be relevant for many years until dc utility distribution systems are again implemented.
712.40 is deleted. First level subdivision (A) was just a reference to identification of DC conductors and the requirements in 210 and 215 apply as per section 90.3. First level subdivision (B) is deleted because it is referenced in 712.52.

712.52 is editorially revised to add first level subdivision titles.

In section 712.55, the term “ground fault protection” was changed to “ground fault detection.” The remainder of the section was editorially revised.

712.57 for arc fault protection of systems was modified to reference other requirements for arc fault protection in the NEC.

Part numbers were editorially revised.

Section 712.62 was modified from panelboards to distribution equipment and conductors.

Section 712.65, Panelboards, is deleted because it was duplicated.

Section 712.65, Available DC Fault Current, is modified for clarity and to specifically address “short circuit current” and to include the date of the marking.

The title of Part VII (now Part VI) is revised to “Protection” for clarity.

Section 712.70 is revised for clarity and usability.

Section 712.72 is modified for clarity to specifically address “short circuit current”.

Section 712.80 is revised for clarity and usability.
Public Comment No. 1019-NFPA 70-2015 [Section No. 712.37]

712.37 Directional Current Devices.

Disconnecting means and protective and overcurrent devices that are designed listed or marked for use in a single current direction shall only be used in the designated current direction.

Informational Note: Examples of directional current devices are magnetically quenched contactors and semiconductor switches in overcurrent devices.

Statement of Problem and Substantiation for Public Comment

Some DC devices are designed and evaluated to break current only in one direction, and are evaluated or marked as such. The installer and AHJ cannot determine what a specific device may be designed to accommodate, only whether the device is listed and installed according to the manufacturer's instructions and markings.

Related Item

First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 00:50:35 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3627-NFPA 70-2015; Public Comment 1174: CMP-13 retained the title "Direct Current Microgrids" in lieu of another title because this term is widely used and understood within the electrical industry. This term is used by IEEE, NEMA and the US Department of Energy. CMP-13 considered the proposed requirement to address response to a fire situation and identified that more information is needed. Public Comment 1016: Action on the SR for Article 712 satisfies the intent of the submitter. "Listed or labeled" was changed to "listed and labeled" and the title of 712.4 was changed for proper use of terminology. Public Comment 1017: Action on the SR for Article 712 satisfies the intent of the submitter. The panel did not remove "lockable" because this is a Chapter 7 article which supplements or modifies Chapters 1-4. Public Comment 1019: Action on the SR for Article 712 satisfies the intent of the submitter. Public Comment 1021: Action on the SR for Article 712 satisfies the intent of the submitter.

Statement:
The defined terms "Grounded Two-Wire DC System", "Grounded Three-Wire DC System," "Nominal Voltage", "Reference-Grounded DC System", "Resistively Grounded", "Primary DC Source", "Ungrounded DC System" are editorially modified for clarity, usability and compliance with the NEC style manual.

The definition of "Direct Current Microgrid" is modified to clarify that more than one interconnected source is required.

The last sentence in the defined term, "Reference-Grounded DC System" is deleted because it is a requirement.

712.4 is modified for clarity.

Editorial corrections are made and an Informational Note is added to 712.30 for clarity and usability.

712.34 is modified for clarity. The reference to 690.13(A) is deleted as there are many potential sources.

712.37 is modified for clarity. The listing and marking requirement is added to ensure that directional current devices are approved for the intended use.

Section 712.38 was deleted. The requirements in this section were intended to mirror the anti-islanding requirements for interconnected ac systems, in that distributed sources should not back-feed a de-energized utility grid. As there are presently no dc utility services, 712.38 only adds confusion and is unlikely to be relevant for many years until dc utility distribution systems are again implemented.
712.40 is deleted. First level subdivision (A) was just a reference to identification of DC conductors and the requirements in 210 and 215 apply as per section 90.3. First level subdivision (B) is deleted because it is referenced in 712.52.

712.52 is editorially revised to add first level subdivision titles.

In section 712.55, the term “ground fault protection” was changed to “ground fault detection.” The remainder of the section was editorially revised.

712.57 for arc fault protection of systems was modified to reference other requirements for arc fault protection in the NEC.

Part numbers were editorially revised.

Section 712.62 was modified from panelboards to distribution equipment and conductors.

Section 712.65, Panelboards, is deleted because it was duplicated.

Section 712.65, Available DC Fault Current, is modified for clarity and to specifically address “short circuit current” and to include the date of the marking.

The title of Part VII (now Part VI) is revised to “Protection” for clarity.

Section 712.70 is revised for clarity and usability.

Section 712.72 is modified for clarity to specifically address “short circuit current”.

Section 712.80 is revised for clarity and usability.
Loss of External Direct Current Source.

Upon loss of an external primary dc source, all dc microgrid electric power sources shall be automatically disconnected from all ungrounded conductors of the external dc primary source and shall not be reconnected until the external primary dc source is restored. Individual premises dc sources shall be permitted to reconfigure and operate as the primary dc source(s) in a stand-alone system(s) to supply loads that have been disconnected.

Statement of Problem and Substantiation for Public Comment

This section is supposed to be an "anti-islanding" clause for dc microgrids. Without the word "external", it had little meaning. The word microgrid was added to indicate internal sources. The phrase on loads was removed as there is no requirement to disconnect loads.

Related Item

First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification

Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
Affiliation: NEC DC Taskforce / DC Microgrid WG
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:00:00 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Action on the SR for Article 712 deleted 712.38. The deletion of this section makes the proposed revisions unnecessary.
712.40 Identification for Branch Circuits and Feeder Circuits.

(A) Wiring methods for dc microgrids shall comply with the requirements of 210.5 for branch circuits and 215.12 for feeders.

(B) DC microgrids operating at voltages greater than 300 volts dc shall be reference-grounded dc systems or resistively grounded dc systems.

Statement of Problem and Substantiation for Public Comment

The requirement is not related to the heading, identification of circuits, and appears to be an accidental duplication of 712.52.

Related Item

First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification

Submitter Full Name: PHIL UNDERCUFFLER
Organization: OUTBACK POWER TECHNOLOGIES
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 00:54:09 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3627-NFPA 70-2015; Public Comment 1174: CMP-13 retained the title "Direct Current Microgrids" in lieu of another title because this term is widely used and understood within the electrical industry. This term is used by IEEE, NEMA and the US Department of Energy. CMP-13 considered the proposed requirement to address response to a fire situation and identified that more information is needed. Public Comment 1016: Action on the SR for Article 712 satisfies the intent of the submitter. "Listed or labeled" was changed to "listed and labeled" and the title of 712.4 was changed for proper use of terminology. Public Comment 1017: Action on the SR for Article 712 satisfies the intent of the submitter. The panel did not remove "lockable" because this is a Chapter 7 article which supplements or modifies Chapters 1-4. Public Comment 1019: Action on the SR for Article 712 satisfies the intent of the submitter. Public Comment 1021: Action on the SR for Article 712 satisfies the intent of the submitter.

Statement: The defined terms “Grounded Two-Wire DC System”, “Grounded Three-Wire DC System,” “Nominal Voltage”, “Reference-Grounded DC System”, “Resistively Grounded”, “Primary DC Source”, “Ungrounded DC System” are editorially modified for clarity, usability and compliance with the NEC style manual. The definition of “Direct Current Microgrid” is modified to clarify that more than one interconnected source is required.

The last sentence in the defined term, “Reference-Grounded DC System” is deleted because it is a requirement.

712.4 is modified for clarity.

Editorial corrections are made and an Informational Note is added to 712.30 for clarity and usability.

712.34 is modified for clarity. The reference to 690.13(A) is deleted as there are many potential sources.

712.37 is modified for clarity. The listing and marking requirement is added to ensure that directional current devices are approved for the intended use.

Section 712.38 was deleted. The requirements in this section were intended to mirror the anti-islanding requirements for interconnected ac systems, in that distributed sources should not back-feed a de-energized utility grid. As there are presently no dc utility services, 712.38 only adds confusion and is unlikely to be relevant for many years until dc utility distribution systems are again implemented.
712.40 is deleted. First level subdivision (A) was just a reference to identification of DC conductors and the requirements in 210 and 215 apply as per section 90.3. First level subdivision (B) is deleted because it is referenced in 712.52.

712.52 is editorially revised to add first level subdivision titles.

In section 712.55, the term “ground fault protection” was changed to “ground fault detection.” The remainder of the section was editorially revised.

712.57 for arc fault protection of systems was modified to reference other requirements for arc fault protection in the NEC. Part numbers were editorially revised.

Section 712.62 was modified from panelboards to distribution equipment and conductors.

Section 712.65, Panelboards, is deleted because it was duplicated.

Section 712.65, Available DC Fault Current, is modified for clarity and to specifically address “short circuit current” and to include the date of the marking.

The title of Part VII (now Part VI) is revised to “Protection” for clarity.

Section 712.70 is revised for clarity and usability.

Section 712.72 is modified for clarity to specifically address “short circuit current”.

Section 712.80 is revised for clarity and usability.
(B)

DC microgrids operating at voltages greater than 300 volts dc shall be reference grounded dc systems or resistively grounded dc systems.

Ungrounded conductors of 6 AWG or smaller shall be permitted to be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means for existing wiring circuits in buildings which are being converted to a dc system.

Statement of Problem and Substantiation for Public Comment

Robert Bosch LLC (Bosch) proposes an amendment to Article 712.40(B). This amendment first corrects the requirements in Article 712.40(B) to reflect the language in the first draft meeting minutes of the NEC Code-Making Panel 13 that took place on January 12-17, 2015 (http://www.nfpa.org/Assets/files/AboutTheCodes/70/70_A2016_NEC-P13_FDagenda_1-15.pdf - Page 311) and also further clarifies how existing wiring circuits in buildings being converted to a dc system will be identified.

It seems as if the first draft of Article 712.40(B) accidentally replicated Article 712.52(B) instead of the language agreed upon in the meeting minutes. This should be corrected to reflect the meeting minutes.

The reason for the additional amendment is that existing ungrounded conductors of 6 AWG or smaller in buildings being converted to a dc system can also be safely reused and identified per the same requirements as ungrounded conductors of 4 AWG or larger without any safety or reliability concerns per Article 210.5(C)(2). It is reasonable for the present requirements for 6 AWG or smaller in Article 210.5(C)(2)(a) and (b) to apply to new building construction, however for existing buildings it would in essence require perfectly usable existing wiring to be removed/disposed of and new wiring to be installed. This adds extra unnecessary waste/cost with the potential to create a less reliable and safe wiring environment through the extensive rework necessary, for zero benefit as the existing wiring does not need replacement and can be properly identified. The retrofit of specific existing wiring circuits to operate on a dc system, such as lighting circuits in commercial buildings, rather than having to install new wiring represents a tremendous improvement in utilization of renewable energy, overall system reliability, and resiliency to power outages with long-term cost effective savings and no impact to safety and reliability. Conversion to DC circuits also offers the opportunity to utilize high-resistance midpoint grounding schemes, which substantially reduces the chances of electric shock, since both current-carrying conductors have a high-resistance path to ground in this configuration.

Bosch has also proposed this clarification to Articles 210.5(C)(2), 215.12(C)(2), and 712.25(B) that have the same requirements.

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Submitter Information Verification

Submitter Full Name: Andrew Yip
Organization: Robert Bosch LLC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 12:12:38 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The requirement in 712.40(B) is not related to the heading, "identification of circuits", and appears to be an accidental duplication of 712.52. Therefore, the proposed text replacing this section is unnecessary.
Public Comment No. 1022-NFPA 70-2015 [Section No. 712.55(A)]

(A) DC microgrids operating at greater than 60 volts dc shall have ground fault protection that does all of the following:

1. Detects the fault
2. Indicates that a fault has occurred
3. For solidly grounded and reference-grounded systems, disconnects power from the faulted circuit or equipment

Statement of Problem and Substantiation for Public Comment

Faults can occur in circuits as well as equipment, and language is revised more in keeping with NEC style guide.

Related Item
First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification

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Submittal Date: Wed Sep 23 00:59:51 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The action on the SR for Article 712 deleted 712.55(A)(3) making these revisions unnecessary.
712.57 Arc Fault Protection.
DC microgrids with a system voltage of greater than 60 volts shall be required to have arc fault protection for utilization circuits. Arc fault protection equipment shall be identified and listed for the purpose.

Informational Note: 90.4 applies when suitable equipment for arc fault protection is not available.

Statement of Problem and Substantiation for Public Comment

Bosch supports utilizing reliable arc fault protection equipment as it becomes available, and recommends to keep the specific comment in this section “Informational Note: 90.4 applies when suitable equipment for arc fault protection is not available.” This comment would allow beneficial DC systems to still be constructed as appropriate arc fault technology progresses, even if suitable arc fault technology is not initially available for every circuit application related to the DC systems.

Related Item
First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification
Submitter Full Name: John Saussele
Organization: Robert Bosch LLC
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City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 16:25:20 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The submitter provides no proposed revisions. The comment does not comply with Section 4.4.4.4 of the NFPA Regulations Governing The Development of NFPA Standards to include proposed text in the Public Comment including the wording to be added, revised, or deleted.
712.70 Overcurrent Protection.

Equipment and conductors connected to more than one electrical source shall have overcurrent devices located so as to provide protection from all sources.

In a building containing a Direct Current Microgrid with a connection to the AC utility grid through AC to DC conversion equipment, the branch circuit shall be defined to be the final point of AC wiring prior to the AC to DC conversion equipment. Branch circuit overcurrent protection shall apply to the AC side of the circuit. The DC wiring shall be protected by appropriate supplemental overcurrent protection. Supplemental overcurrent devices utilized to feed DC load circuits shall be readily accessible.

Statement of Problem and Substantiation for Public Comment

Robert Bosch LLC (Bosch) proposes an amendment to Article 712.70 clarifying the appropriate overcurrent protection for DC circuits within buildings. The installation of new DC circuits in new construction or the retrofit of specific existing wiring circuits to operate on a dc system, such as lighting circuits in commercial buildings, represents a tremendous improvement in utilization of renewable energy, overall system reliability, and resiliency to power outages with long-term cost savings and no impact to safety and reliability. Conversion to DC circuits also offers the opportunity to utilize high-resistance midpoint grounding schemes, which substantially reduces the chances of electric shock, since both current-carrying conductors have a high-resistance path to ground in this configuration.

Branch circuit overcurrent protective devices are rated for at least 5000 amperes interrupting rating, with the intention that this high level of AC current could theoretically be available from the utility grid on an instantaneous basis, depending on factors such as how far downstream the AC branch circuit is from the building utility service feed, wire gauge of feeders leading up to the AC branch, etc. However, DC building circuits are inherently limited in the amount of instantaneous AC grid current that may be converted to DC by the AC/DC conversion devices themselves. Therefore, utilizing branch circuit overcurrent protection devices on the AC circuits feeding AC/DC conversion electronics and utilizing supplemental overcurrent protection devices on the DC circuits feeding the DC devices within buildings provides a safe environment for DC building systems, since protection from the theoretical 5000 ampere instantaneous current from the utility grid still exists on the AC side of the conversion device. This is similar to overcurrent protection requirements for utilizing DC within machines and equipment, which means appropriate size and cost-effective DC supplemental overcurrent protection devices are already available to enable the introduction of DC Microgrids on a commercially viable scale. “Supplemental overcurrent devices utilized to feed DC load circuits shall be readily accessible” was added as a recommended exception to Article 240.10.

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Submitter Information Verification

Submitter Full Name: Andrew Yip
Organization: Robert Bosch LLC
Street Address: City: State: Zip:
Submittal Date: Fri Sep 25 02:11:27 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Companion PC 1374 to revise the definition of branch circuit was rejected, and therefore the proposed revisions relative to the reference to branch circuit overcurrent protection and the allowable use of supplemental overcurrent devices are not supported.
712.72 Intermuting and Short-Circuit Current Rating.

Consideration shall be given to the contribution of fault currents from all interconnected power sources for the interrupting ratings and short-circuit current ratings of equipment in dc microgrid systems. Overcurrent protective devices and equipment used within a dc microgrid shall have an interrupting rating at nominal circuit voltage or a short-circuit current rating sufficient for the available fault current at the line terminals of the equipment.

Supplemental-type overcurrent devices shall be permitted to be used for branch circuit protection if the available fault current is less than the supplemental overcurrent device rating.

Statement of Problem and Substantiation for Public Comment

Branch circuit breakers fed with ac power from the utility grid must be rated for the available fault current which is often greater than 5000A. On dc microgrids however, the source of dc power is often ac-dc rectifiers and PV arrays with very limited peak current ability. This change states the opposite of the first paragraph - that in limited fault current cases, supplemental breakers rather than branch-circuit rated breakers can be used. Supplemental dc breakers are significantly smaller and less expensive than dc branch-rated breakers. They are still NRTL certified for the application.

Related Item

First Revision No. 3663-NFPA 70-2015 [New Section after 708.64]

Submitter Information Verification

Submitter Full Name: Robert Wills
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Affiliation: NEC DC Task Group / DC Microgrid WG
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Submittal Date: Fri Sep 25 15:47:41 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The substantiation that in limited fault (short circuit) current cases, supplemental breakers rather than branch circuit rated breakers can be used is not supported. The requirement for branch circuit protective devices is not based solely on the available short circuit current.
Scope.

This article covers remote-control, signaling, and power-limited circuits that are not an integral part of a device- or electric sign or of utilization equipment.

Informational Note: The circuits described herein are characterized by usage and electrical power limitations that differentiate them from electric light and power circuits; therefore, alternative requirements to those of Chapters 1 through 4, and Chapter 6 Article 600, are given with regard to minimum wire sizes, ampacity adjustment and correction factors, overcurrent protection, insulation requirements, and wiring methods and materials.

Statement of Problem and Substantiation for Public Comment

The sign industry has gone to great lengths to formalize their wiring methods for Class 2 wiring and power sources in Article 600 to be specific to signs and outline lighting and not to further confuse sign requirements from other wiring systems.

Related Item

First Revision No. 619-NFPA 70-2015 [Section No. 725.1]

Submitter Information Verification

Submitter Full Name: Randall Wright
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Submittal Date: Tue Sep 22 16:33:08 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The definition of “utilization equipment” is “equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes.” Signs are utilization equipment, based on the definition in Article 100, so Class 2 and Class 3 power sources for signs already are covered in the scope of Article 725. Scope statements are under the authority of the NEC Correlating Committee and Panel 3 rejects this change.
Public Comment No. 460-NFPA 70-2015 [Section No. 725.3(C)]

(C) Ducts, Plenums, and Other Air-Handling Spaces.

Class 1, Class 2, and Class 3 circuits installed in ducts, plenums, or other space used for environmental air shall comply with 300.22.

Exception: As permitted in No. 1: Class 2 and Class 3 cables selected in accordance with Table 725.154 and installed in accordance with 725.135(B) shall be permitted to be installed in ducts specifically fabricated for environmental air.

Exception No. 2: Class 2 and Class 3 cables selected in accordance with Table 725.154 and installed in accordance with 725.135(C) shall be permitted to be installed in other spaces used for environmental air (plenums).

Statement of Problem and Substantiation for Public Comment

The recommended text clarifies that 725.135 has explicit rules for ducts [725.135(B)] and other spaces used for environmental air (plenums) [725.135(C)].

The current text does not comply with section 3.1.4.1 of the NEC Style Manual which requires that exceptions shall be written in complete sentences. Acceptance of the recommended text will result in compliance with the NEC Style manual.

Related Item

Public Input No. 1604-NFPA 70-2014 [Section No. 725.3(C)]

Submitter Information Verification

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Submittal Date: Fri Aug 28 15:37:43 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-609-NFPA 70-2015
Statement: The First Revision FR 614 modified 300.22(B) by adding a new Exception indicating Class 2 and Class 3 cables are permitted in ducts specifically fabricated for environmental air with two conditions (a) The wiring methods or cabling systems shall be permitted only if necessary to connect to equipment or devices associated with the direct action upon, or sensing of the contained air and (b) The total length of such wiring methods or cabling systems shall not exceed 1.2 m (4 ft). These two conditions correspond to Section 4.3.4.2 in NFPA 90A—2015. The 2017 First Revision FR 614 in 300.22(B) reads as follows:

Exception: Wiring methods and cabling systems, listed for use in other spaces used for environmental air (plenums), shall be permitted to be installed in ducts specifically fabricated for environmental air-handling purposes under the following conditions:

(a) The wiring methods or cabling systems shall be permitted only if necessary to connect to equipment or devices associated with the direct action upon, or sensing of the contained air and

(b) The total length of such wiring methods or cabling systems shall not exceed 1.2 m (4 ft).

Class 2 or Class 3 plenum rated cable is acceptable in ducts specifically fabricated for environmental air but only where connecting to equipment used to sense or has direction action on the contained air and limited to a maximum of 4foot length based on NFPA 90A.
Public Comment No. 1397-NFPA 70-2015 [Section No. 725.3(K)]

(K) Installation of Conductors with Other Systems.
Installations shall comply with 300.8.
Installations for electric signs shall comply with 600.33

Statement of Problem and Substantiation for Public Comment

The clarify that Class 2 wiring for electric signs are controlled in Article 600 section 600.33 for their specific use. To again end the confusion with wiring between these articles.

Related Item

First Revision No. 619-NFPA 70-2015 [Section No. 725.1]
First Revision No. 5139-NFPA 70-2015 [Section No. 600.33]
Public Input No. 3556-NFPA 70-2014 [Section No. 600.12(C)]
Public Input No. 4595-NFPA 70-2014 [Section No. 600.12(C)]

Submitter Information Verification

Submitter Full Name: Randall Wright
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Submittal Date: Fri Sep 25 09:48:48 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The reference for installations for signs in 725.3(K) is new information that has not had public review and the information in 600.33 should be reviewed to determine if Part I and Part III of Article 725 should be covered instead of just Part III.
Statement of Problem and Substantiation for Public Comment

Emergency responders and building occupant safety is at risk during building fires because people can become entangled and trapped in cable which has fallen out of molten or failing plastic supports/raceway. Even if people can free themselves from fallen cabling, this takes time which is otherwise needed to exit the building or fulfill the objectives of emergency personnel. The frequency of emergency responders becoming trapped in fallen cabling has become so common that firefighters have created and publicly distributed training videos on how to escape in these situations (http://www.fireengineering.com/topics/m/video/36928837/the-quick-release-method.htm?q=cable+entanglement) [1].

There have been documented fatalities due to cable entrapment both in the U.S. and England. In Memphis, Tennessee, in 1994, a fireman was entangled in cables that had fallen after the nonmetallic raceway collapsed due to the heat (http://www.fireengineering.com/articles/print/volume-148/issue-3/features/tragedy-in-a-residential-high-rise-memphis-tennessee.html [2]). More recently in England two firemen died due in part to being tangled in cabling that had fallen from plastic raceway in the ceiling of a Southampton residential building (http://www.bbc.co.uk/news/uk-england-hampshire-22126431 [3]). An article [4] in Electrical Contracting News identifies another recent incident in which a fireman died in Stevenage, Hertfordshire, after he became entangled in electrical cables which "had fallen after plastic trunking, the only support for the cables, melted and failed." Article [4] goes on to report that changes are in process to Great Britain’s Wiring Regulations (BS 7671 [5]) to ensure that “wiring systems in any escape route should be supported so that they are not subject to premature failure in a fire.” Revisions have already been made in a standard for fire alarm system cabling, BS 5839-1 [6], to require cable supports/raceway which will not collapse in a fire.

While the documented incidents involve firefighters, it is not even known how many building occupants may have died in the past either becoming entangled in fallen cabling, overcome by smoke/heat trying to remove a cabling obstruction, or forced to seek an alternate exit due to a significant amount of cabling obstruction.

NFPA 101 (Life Safety Code, 2012) [7] already addresses the requirement to maintain egress free from obstruction. Sections 7.1.10 and 7.1.10.1 (Means of Egress Reliability) state,

7.1.10.1 General. Means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in case of fire or other emergency.

Sections 12.2.5.4, 12.2.5.4.2, and 12.2.5.4.3 (New Assembly Occupancies) and 13.2.5.4, 13.2.5.4.2, and 13.2.5.4.3 (Existing Assembly Occupancies) also emphasize this requirement.

12.2.5.4 General Requirements for Access and Egress Routes Within Assembly Areas.

12.2.5.4.2 Access and egress routes shall be maintained so that any individual is able to move without undue hindrance, on personal initiative and at any time, from an occupied position to the exits.

12.2.5.4.3 Access and egress routes shall be maintained so that crowd management, security, and emergency medical personnel are able to reach any individual at any time, without undue hindrance.

The solution that is easy to understand and enforce is a straightforward requirement regarding the allowable materials of a cable
support used above egress.

Melting temperatures of metallic and non-metallic materials are significantly different – compare the low carbon steel melting temperature of approximately 1450 °C versus 200-400 °C for many typical thermoplastics used in cable supports. This difference translates to a greater resistance to heat for steel which enables a metallic support to survive and carry load significantly longer than nonmetallic supports. The intent is not to eliminate the use of non-metallic supports/raceway in all applications, as they provide an appropriate and cost-effective option in other locations. The objective is to focus on egress which causes the highest risk to life safety.

In conclusion, there have been verifiable incidents in which firefighters have died due to entanglement from cabling fallen from plastic raceway that was weakened due to fire. This is not just a theoretical discussion or anecdotal evidence. In addition, NFPA 101 already emphasizes the need to maintain egress free from obstruction at all times, including during a fire. There is a clear opportunity in the NEC to improve consistency within NFPA Codes and save further loss of life.

Bibliography:

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Related Item

Public Input No. 4649-NFPA 70-2014 [New Section after 300.11]

Submitter Information Verification

Submitter Full Name: WARD JUDSON
Organization: ERICO INTERNATIONAL CORP
Street Address: 
City: 
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Submittal Date: Fri Sep 25 16:17:19 EDT 2015

Committee Statement

Committee Action: Rejected but held
Resolution: This should be addressed as a global issue within the NEC since it will affect many different articles throughout the NEC, such as many of the raceway and cable requirements in Chapter 3, Chapter 7, and Chapter 8 so it can only be dealt with initially by the NEC Correlating Committee. Panel 3 requests that the NEC Correlating Committee appoint a task group to address this issue before the next NEC cycle and also refer this to the Fire Protection Research Foundation for further research.
725.24 Mechanical Execution of Work.

Class 1, Class 2, and Class 3 circuits shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D).

Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of Class 2, Class 3 and PLTC cable properties.

Statement of Problem and Substantiation for Public Comment

Mr. Tim West of Superior Cable submitted PIs dealing with painting or contaminating cables for the following mechanical execution of work sections, 725.24, 760.24, 770.24, 800.24, and 820.24. CMP 3 resolved PI 4717 with the statement that section 110.12(B) applies and an additional reference is not substantiated. Section 110.12 applies to equipment:

110.12 Mechanical Execution of Work. Electrical equipment shall be installed in a neat and workmanlike manner.

The definition of equipment does not include cable.

Equipment. A general term, including fittings, devices, appliances, luminaires, apparatus, machinery, and the like used as a part of, or in connection with, an electrical installation.

We agree that painting or otherwise contaminating cables can change their properties, especially the fire protection properties of plenum cables. We prefer an informational note rather than mandatory text because the mandatory text recommended in the PIs is vague and unenforceable.

The informational note recommended by this Public Comment is based on the informational notes that were adopted by FR-4552 for 820.24 and FR-4592 for 830.24.

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Submitter Information Verification

Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address: 
City: 
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Submittal Date: Thu Jun 25 22:59:16 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Section 110.12(B) does apply to internal parts of equipment and directly refers to busbars which are conductors. In addition, 110.11 states no conductors or equipment shall be installed where exposed to deteriorating agents so inserting an informational note is unnecessary.
Public Comment No. 1351-NFPA 70-2015 [New Section after 725.121]

Revise 725.122 to support Public Comment on Public Input 1837

725.121(C) The power supplies indentified in 725.121(A)(1),(A)(2),(A)(3), and (A)(4) shall have a nameplate with the voltage and current for each output connection.

Statement of Problem and Substantiation for Public Comment

Substantiation
The lack of nameplates on equipment listed to UL 60950 makes is difficult for specifiers, designers, installers, and inspectors to determine if the connected cable is robust enough to handle the required current without overheating.
The original intent of PI 3066 was to insure that new technologies being driven by Information Technology (IT) and video equipment that is sometimes refreshed in 18 month intervals and delivers power up to 100 watts can be installed on an existing cable plant. No name plate information for this refreshed equipment will prevent timely field validation that the existing cable is suitable.
This Public Comment adds a new requirement to 725.121 and supports the Public Comment on Public Input 1837.
The Panel Statement is correct that Chapter 9, Tables 11(A) & (B) require nameplates. However, the power sources listed to UL 60950 do not have a requirement for nameplates: voltage, VA, & current.
Section 725.121 has a list of what sources of power are permitted to power a Class 2 or 3 circuit, and Class 2 & 3 power supplies are required to comply with Chapter 9, Tables 11(A) & (B).

Related Item
Public Input No. 3066-NFPA 70-2014 [New Section after 725.121]

Submitter Information Verification

Submitter Full Name: FREDERICK FOSTER
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Submittal Date: Thu Sep 24 21:56:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-610-NFPA 70-2015
Statement: This new section addresses labeling of limited power circuit output connection points on listed IT equipment and listed industrial control panels and equipment. Bundling of large numbers of Class 2 conductors from IT servers and other similar IT and industrial equipment can create safety issues with very small current levels so having the output ports identified with the current and voltage rating is critical so the installer can connect the proper cable types. Labeling the output connections will permit the installer to have ready access to the current and voltage levels at the point of connection at the equipment, rather than internally within the equipment. The effective date was inserted to allow the manufacturers to comply with this requirement.
Public Comment No. 602-NFPA 70-2015 [Section No. 725.121(A)]

(A) Power Source.

The power source for a Class 2 or a Class 3 circuit shall be as specified in 725.121(A)(1), (A)(2), (A)(3), (A)(4), or (A)(5):

Informational Note No. 1: Informational Note Figure 725.121, No. 1 illustrates the relationships between Class 2 or Class 3 power sources, their supply, and the Class 2 or Class 3 circuits.

Informational Note No. 2: Table 11(A) and Table 11(B) in Chapter 9 provide the requirements for listed Class 2 and Class 3 power sources.

(1) A listed Class 2 or Class 3 transformer
(2) A listed Class 2 or Class 3 power supply
(3) Other listed equipment marked to identify the Class 2 or Class 3 power source

Exception No. 1 to (3): Thermocouples shall not require listing as a Class 2 power source.

Exception No. 2 to (3): Limited power circuits of listed equipment where these circuits have energy levels rated at or below the limits established in Chapter 9, Table 11(A) and Table 11(B).

Informational Note: Examples of other listed equipment are as follows:

(4) A circuit card listed for use as a Class 2 or Class 3 power source where used as part of a listed assembly
(5) A current-limiting impedance, listed for the purpose, or part of a listed product, used in conjunction with a non-power-limited transformer or a stored energy source, for example, storage battery, to limit the output current
(6) A thermocouple
(7) Limited voltage/current or limited impedance secondary communications circuits of listed industrial control equipment
(8) Listed audio/video information technology (computer), communications, and industrial equipment limited-power circuits.

Informational Note: One way to determine applicable requirements for listing of information technology (computer) equipment is to refer to UL 60950-1-2011, Standard for Safety of Information Technology Equipment. Another way to determine applicable requirements for listing of audio/video, information and communication technology equipment is to refer to UL 62368-1-2014, Safety of audio/video, information and communication technology equipment. Typically such circuits are used to interconnect data circuits for the purpose of exchanging information data. One way to determine applicable requirements for listing of industrial equipment is to refer to UL 61010-2-201, Safety requirements for electrical equipment for measurement, control, and laboratory use –Part 2-201: Particular requirements for control equipment, and/or UL 61800-5-1, Adjustable speed electrical power drive systems –Part 5-1: Safety requirements –Electrical, thermal and energy.

(9) A dry cell battery shall be considered an inherently limited Class 2 power source, provided the voltage is 30 volts or less and the capacity is equal to or less than that available from series connected No. 6 carbon zinc cells.

Statement of Problem and Substantiation for Public Comment

Including communications equipment as the source of a Class 2 circuit will cause confusion. The installation of communications equipment is covered in Chapter 8. Without a reference to this section from Chapter 8, the inclusion of communications equipment violates 90.3 which states:

"Chapter 8 covers communications systems and is not subject to the requirements of Chapters 1 through 7 except where the requirements are specifically referenced in Chapter 8."

The sole purpose of this Public Comment is to delete "communications". All the underlining was done by Terra View.

Related Item
First Revision No. 620-NFPA 70-2015 [Section No. 725.121(A)]

Submitter Information Verification

Submitter Full Name: Stanley Kaufman
Organization: CableSafe, Inc./OFS
Committee Statement

Committee Action: Rejected

Resolution: The word “communications” is a generic term that is not linked to Chapter 8 but is part of UL 62368-1-2014, Safety of Audio/video, Information and Communication Technology Equipment, the UL standard on this type of equipment, that has just been added to 725.121(A)(4).
725.133 Installation of Conductors and Equipment in Cables, Compartments, Cable Trays, Enclosures, Manholes, Outlet Boxes, Device Boxes, Raceways, and Cable Routing Assemblies for Class 2 and Class 3 Circuits.

Conductors and equipment for Class 2 and Class 3 circuits shall be installed in accordance with 725.135 through 725.144.

Statement of Problem and Substantiation for Public Comment

This Public Comment is editorial to accommodate adding 725.144 in support of the Public Comment on Public Input 1837. Presently, 725.133 has installation requirements for Class 2/3 circuits. This proposed revision to 725.133 accommodates acceptance of 725.144, which was proposed by Public input 1837.

Related Public Comments for This Document

<table>
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<td>Public Comment No. 688-NFPA 70-2015 [Section No. 725.179]</td>
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<tr>
<td>Public Comment No. 691-NFPA 70-2015 [Part IV.]</td>
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<tr>
<td>Public Comment No. 692-NFPA 70-2015 [Section No. 725.143]</td>
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Related Item

Public Input No. 3066-NFPA 70-2014 [New Section after 725.121]

Submitter Information Verification

Submitter Full Name: Terry Peters
Organization: SPI
Affiliation: SPI
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 11:23:26 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-612-NFPA 70-2015
Statement: The addition of 725.144 requires modification of 725.133.
(A) Listing.
Class 2, Class 3, and PLTC cables installed in buildings shall be listed and labeled.

Additional Proposed Changes

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<tr>
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<th>Description</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term “and labeled” was added after “listed” during the First Revision Stage, the words “and labeled” after “listed” be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms “listed” and “labeled,” most importantly, to clarify and establish a distinction between the terms “listed” and “labeled” which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of “listed and labeled.” As such, UL is submitting comments to request that the words “and labeled” be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. NRTL’s conduct factory surveillance of products, surveillance is one method to validate the manufacturer’s attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the “Listing” is not impacted, as the “listing” is created at the completion of the “original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards. The requirements for the UL Mark provide a requirement that the product is labeled, and the label contains the appropriate information. The NRTLs not meeting this requirement are not Safety Standard requirements, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Public Comments for This Document

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<tr>
<td>Public Comment No. 532-NFPA 70-2015</td>
<td>Provides information that a label may be permitted on a container in which the product is packaged.</td>
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<td>Public Input No. 1072-NFPA 70-2014 [Definition: Labeled. ]</td>
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Committee Statement

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<td>SR-613-NFPA 70-2015</td>
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<tr>
<td>Statement:</td>
<td>FR 638 already accepted this text. The panel reaffirms its stance on this topic: By adding the word &quot;labeled,&quot; it will identify that listed products also need to be labeled. Both terms &quot;listed&quot; and &quot;labeled&quot; are defined in Article 100, but are not used consistently throughout the NEC.</td>
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Public Comment No. 223-NFPA 70-2015 [Section No. 725.135(K)]

(K) Other Building Locations.

The following wires and cables shall be permitted to be installed in building locations other than the locations covered in 725.135(B) through (I):

2. A maximum of 3 m (10 ft) of exposed Type CL2X wires and cables in nonconcealed spaces
3. A maximum of 3 m (10 ft) of exposed Type CL3X wires and cables in nonconcealed spaces
4. Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables installed in the following:
   5. Plenum communications raceways
   6. Plenum cable routing assemblies
   7. Riser communications raceways
   8. Riser cable routing assemblies
   9. General-purpose communications raceways
  10. General-purpose cable routing assemblies

12. Type CMUC undercarpet communications wires and cables installed under carpet, floor covering, modular tiles, or planks. Carpet, floor covering, modular tiles, or planks shall be free-floating and shall use interlocking means to attach to each other or shall be adhered to the floor and shall be attached with release-type adhesives, but shall not be attached to the floor using grout, nails, or screws. modular flooring and planks.

Statement of Problem and Substantiation for Public Comment

This is a two-part Public Comment. The first part is an editorial clarification. The submitter of PI 621 also submitted PI 2623 to change the name of Type CMUC from “Undercarpet communications wire and cable” to “Under-floor Covering communications wire and cable”. CMP-16 resolved PI 2623 with the statement: “There is no need to change the section title and table and alter the listing requirements in order to accommodate the use of these cables under modular flooring and planks.” Accordingly, this Public Comment recommends text that permits the installation of Type CMUC “under carpet, modular flooring and planks”. Companion Public Comments have been submitted to make the same editorial change in 800.113.

The wording of the Resolution statement for PI 2623 is clear that the intent is to permit installation “under modular flooring and planks” in addition to installation under carpet. Therefore, it is hard to justify more stringent installation rules for communications under carpet wire and cable when used for Class 2 and Class 3 applications than when it is used for communications applications.

Note that this input has apparently been afflicted with the random underlining bug in the TerraWare software, and is not within the control of the submitter. This comment only deals with the installation of Type CMUC.

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Submitter Information Verification

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<td><strong>Statement:</strong></td>
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Public Comment No. 447-NFPA 70-2015 [Sections 725.135(K), 725.135(L), 725.135(M)]

Sections 725.135(K), 725.135(L), 725.135(M)

(K) Other Building Locations.

The following wires and cables shall be permitted to be installed in building locations other than the locations covered in 725.135(B) through (I):

2. A maximum of 3 m (10 ft) of exposed Type CL2X wires and cables in nonconcealed spaces
3. A maximum of 3 m (10 ft) of exposed Type CL3X wires and cables in nonconcealed spaces
4. Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables installed in the following:
   5. Plenum communications raceways
   6. Plenum cable routing assemblies
   7. Riser communications raceways
   8. Riser cable routing assemblies
   9. General-purpose communications raceways
   10. General-purpose cable routing assemblies

12. Type CMUC undercarpet communications wires and cables installed under carpet, floor covering, modular tiles, or planks. Carpet, floor covering, modular tiles, or planks shall be free-floating and shall use interlocking means to attach to each other or shall be adhered to the floor and shall be attached with release-type adhesives, but shall not be attached to the floor using grout, nails, or screws.

(L) Multifamily Dwellings.

The following wires and cables shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 725.135(B) through (I):

1. Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC wires and cables
2. Type CL2X wires and cables less than 6 mm (1/4 in.) in diameter in nonconcealed spaces
3. Type CL3X wires and cables less than 6 mm (1/4 in.) in diameter in nonconcealed spaces
4. Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC wires and cables installed in the following:
   5. Plenum communications raceways
   6. Plenum cable routing assemblies
   7. Riser communications raceways
   8. Riser cable routing assemblies
   9. General-purpose communications raceways
   10. General-purpose cable routing assemblies

12. Type CMUC undercarpet communications wires and cables installed under carpet, floor covering, modular tiles, or planks. Carpet, floor covering, modular tiles, or planks shall be free-floating and shall use interlocking means to attach to each other or shall be adhered to the floor and shall be attached with release-type adhesives, but shall not be attached to the floor using grout, nails, or screws.
One- and Two-Family Dwellings.

The following wires and cables shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 725.135(B) through (I):

1. Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC wires and cables
2. Type CL2X wires and cables less than 6 mm (1/4 in.) in diameter
3. Type CL3X wires and cables less than 6 mm (1/4 in.) in diameter

(4) Communications wires and Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables installed in the following:

5. Plenum communications raceways
6. Plenum cable routing assemblies
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Statement of Problem and Substantiation for Public Comment

The second sentence should be deleted because the National Electrical Code is not an installation code for flooring. It is outside the scope of the NEC to have mandatory installation requirements (shall, shall not) for flooring.

Related Item

First Revision No. 621-NFPA 70-2015 [Sections 725.135(K), 725.135(L), 725.135(M)]

Submitter Information Verification

Submitter Full Name: ROBERT JENSEN
Organization: DBI-TELECOMMUNICATION INFRASTR
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 27 16:22:28 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: See SRs 620, 621, and 622 on these sections, which fulfill the intent of this comment. Type CMUC under carpet communication wire and cables are permitted to be installed under carpet with an installation expansion for modular flooring and planks. The installation instructions for free floating and interlocking does not necessarily apply to all kinds of modular flooring and planks and could be overly restrictive.
(L) Multifamily Dwellings.

The following wires and cables shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 725.135(B) through (I):

1. Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC wires and cables
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4. Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC wires and cables installed in the following:
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   6. Plenum cable routing assemblies
   7. Riser communications raceways
   8. Riser cable routing assemblies
   9. General-purpose communications raceways
   10. General-purpose cable routing assemblies

6. Type CMUC undercarpet communications wires and cables installed under carpet, floor covering, modular tiles, or planks. Carpet, floor covering, modular tiles, or planks shall be free-floating and shall use interlocking means to attach to each other or shall be adhered to the floor and shall be attached with release-type adhesives, but shall not be attached to the floor using grout, nails, or screws. Modular flooring and planks.

Statement of Problem and Substantiation for Public Comment

This is a two-part Public Comment. The first part is an editorial clarification. The submitter of PI 621 also submitted PI 2623 to change the name of Type CMUC from “Undercarpet communications wire and cable” to “Under-floor Covering communications wire and cable”. CMP-16 resolved PI 2623 with the statement: “There is no need to change the section title and table and alter the listing requirements in order to accommodate the use of these cables under modular flooring and planks.”

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The second part is the deletion of the installation requirements. Class 2 and Class 3 circuits do not have any greater safety risk than a communications circuit. Therefore, it is hard to justify more stringent installation rules for communications under carpet wire and cable when used for Class 2 and Class 3 applications than when it is used for communications applications.

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The following wires and cables shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 725.135(B) through (I):

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2. Type CL2X wires and cables less than 6 mm (1/4 in.) in diameter
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   5. Plenum communications raceways
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Statement of Problem and Substantiation for Public Comment

This is a two-part Public Comment. The first part is an editorial clarification.

The submitter of PI 621 also submitted PI 2623 to change the name of Type CMUC from “Undercarpet communications wire and cable” to “Under-floor Covering communications wire and cable”. CMP-16 resolved PI 2623 with the statement:

“There is no need to change the section title and table and alter the listing requirements in order to accommodate the use of these cables under modular flooring and planks.”

The wording of the Resolution statement for PI 2623 is clear that the intent is to permit installation “under modular flooring and planks” in addition to installation under carpet. Accordingly, this Public Comment recommends text that permits the installation of Type CMUC “under carpet, modular flooring and planks”. Companion Public Comments have been submitted to make the same editorial change in 800.113.

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| Related Item |  |
|--------------|  |
| First Revision No. 621-NFPA 70-2015 [Sections 725.135(K), 725.135(L), 725.135(M)] |  |

Submitter Information Verification
Committee Statement

Committee Action: Accepted
Resolution: SR-622-NFPA 70-2015
Statement: Type CMUC under carpet communication wire and cables are permitted to be installed under carpet with an installation expansion for modular flooring and planks. The installation instructions for free floating and interlocking does not necessarily apply to all kinds of modular flooring and planks and could be overly restrictive.
Section 725.143: Support of Conductors.

Class 2 or Class 3 circuit conductors shall not be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support. These conductors shall be permitted to be installed as permitted by 300.11(B)(2).

Section 725.144: Transmission of Power and Data.

The requirements of (A) and (B) shall apply to circuits that transmit power and data. The requirements in other Sections of Parts I and III shall apply, and 300.11 shall apply. The conductors that carry power shall be copper. The current in the power circuit shall not be permitted to exceed the current limit of the connectors.


(1) The ampacity ratings in Table 725.144 shall apply at an ambient temperature of 30°C (86°F).

(2) For ambient temperatures above 30°C (86°F), the correction factors of 310.15(B)(2) shall apply.

Informational Note: One example of the use of Class 2 (Type CL2R) cables is a network of closed circuit TV cameras using 24 AWG, 60°C, Type CL2R, Category 5e LAN (local area network) cables.

(B) Types CL3P-LP(xxA), CL2P-LP(xxA), CL3R-LP(xxA), CL2R-LP(xxA), CL3-LP(xxA), or CL2-LP(xxA). Types CL3P-LP(xxA), CL2P-LP(xxA), CL3R-LP(xxA), CL2R-LP(xxA), CL3-LP(xxA), or CL2-LP(xxA) shall be permitted to supply power to equipment at a current level up to the marked ampere limit(xxA) and to transmit data to the equipment. The cables shall comply with (1) through (3), as applicable.

Informational Note No. 1: The "(xxA)" in the text is the ampacity of each conductor in a cable based on the listing requirements in 725.179.

Informational Note No. 2: One installation example of a limited power cable is a cable listed and marked Type CL2-LP(0.5A), 23 AWG. Type CL2-LP(0.5), 23 AWG can be used in any location where a Type CL2 can be used and the cable would be suitable for carrying up to 0.5 A per conductor regardless of bundle size. If used in a 7 cable group, Table 725.144 indicates that the same cable could carry up to 1.2 amperes per conductor, because it is 23 AWG.

(1) Cables with the "-LP" suffix shall be permitted to installed in bundles, raceways, cable trays, communications raceways, or cable routing assemblies.

(2) Cables with the suffix "-LP(xxA)" shall follow the substitution hierarchy of Table 725.154(A) and Figure 725.154(A) for the type without the "-LP(xxA) suffix.

(3) System design shall be permitted by qualified persons under engineering supervision.

TABLE 724.144 (SEE ATTACHMENT FOR TABLE 724.144)
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725.143 Support of Conductors.

Class 2 or Class 3 circuit conductors shall not be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support. These conductors shall be permitted to be installed as permitted by 300.11(B)(2).

RECOMMENDED TEXT AND SUBSTANTIATION FOR A NEW SECTION 725.144 ARE IN THE ATTACHMENT

Additional Proposed Changes

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<td>Recommended text and substantiation for new section 725.144</td>
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Statement of Problem and Substantiation for Public Comment

RECOMMENDED TEXT AND SUBSTANTIATION FOR A NEW SECTION 725.144 ARE IN THE ATTACHMENT

See the attached UL Fact Finding Report on Power over Local Area Network Type Cables (4-Pair Data / Communications Cables) for supporting data.

Related Public Comments for This Document

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<thead>
<tr>
<th>Related Comment</th>
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<tbody>
<tr>
<td>Public Comment No. 688-NFPA 70-2015 [Section No. 725.179]</td>
<td>Listing requirements for &quot;Limited Power&quot; -LP cables</td>
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<tr>
<td>Public Comment No. 689-NFPA 70-2015 [Section No. 725.133]</td>
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</tr>
<tr>
<td>Public Comment No. 691-NFPA 70-2015 [Part IV.]</td>
<td>Listing requirements for equipment</td>
</tr>
</tbody>
</table>

Related Item

| Related Item                                                                 | |
|-----------------------------------------------------------------------------| |
| Public Input No. 1837-NFPA 70-2014 [New Section after 725.154(C)]           | |

Submitter Information Verification

Submitter Full Name: Terry Peters
Organization: SPI
Affiliation: SPI

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-611-NFPA 70-2015
Statement: The new section 725.144 and the accompanying table has been added based upon the Fact Finding Report on Power over Local Area Network type cables with additionally an introduction to new cable type LP that provides the current limitation due to cable bundling and some other installation considerations for power over Ethernet.
Public Comment No. 688-NFPA 70-2015 [Section No. 725.179]

725.179 Listing and Marking of Class 2, Class 3, and Type PLTC Cables.

Class 2, Class 3, and Type PLTC cables, installed as wiring methods within buildings, shall be listed as resistant to the spread of fire and other criteria in accordance with 725.179(A) through (J) and shall be marked in accordance with 725.179(A) through (J).

(A) Types CL2P and CL3P.

Types CL2P and CL3P plenum cable shall be listed as suitable for use in ducts, plenums, and other space for environmental air and shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing and fire-resistant is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2015, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

(B) Types CL2R and CL3R.

Types CL2R and CL3R riser cables shall be marked as Type CL2R or CL3R, respectively, and be listed as suitable for use in a vertical run in a shaft or from floor to floor and shall be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.

(C) Types CL2 and CL3.

Types CL2 and CL3 cables shall be marked as Type CL2 or CL3, respectively, and be listed as suitable for general-purpose use, with the exception of risers, ducts, plenums, and other space used for environmental air, and shall be listed as resistant to the spread of fire.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable.

Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test for—cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, Test Methods for Electrical Wires and Cables.

(D) Types CL2X and CL3X.

Types CL2X and CL3X limited-use cables shall be marked as Type CL2X or CL3X, and be listed as suitable for use in dwellings and raceways and shall be listed as resistant to flame spread.

Informational Note: One method of determining that cable is resistant to flame spread is by testing the cable to the VW-1 (vertical wire) flame test in ANSI/UL 1581-2011, Reference Standard for Electrical Wires, Cables and Flexible Cords.

(E) Type PLTC.

Type PLTC nonmetallic-sheathed, power-limited tray cable shall be listed as being suitable for cable trays and shall consist of a factory assembly of two or more insulated conductors under a nonmetallic jacket. The insulated conductors shall be 22 AWG through 12 AWG. The conductor material shall be copper (solid or stranded). Insulation on conductors shall be rated for 300 volts. The cable core shall be two or more parallel conductors, one or more group assemblies of twisted or parallel conductors, or a combination thereof. A metallic shield or a metallized foil shield with drain wire(s) shall be permitted to be applied over the cable core, over groups of conductors, or both. The cable shall be listed as resistant to the spread of fire. The outer jacket shall be a sunlight- and moisture-resistant nonmetallic material. Type PLTC cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath.

Exception No. 1: Where a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor is applied over the nonmetallic jacket, an overall nonmetallic jacket shall not be required. On metallic-sheathed cable without an overall metallic sheath, the information required in 310.120 shall be located on the nonmetallic jacket under the sheath.

Exception No. 2: Conductors in PLTC cables used for Class 2 thermocouple circuits shall be permitted to be any of the materials used for thermocouple extension wire.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable.

Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test for—cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, Test Methods for Electrical Wires and Cables.

(F) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.
Cables that are used for survivability of critical circuits under fire conditions shall meet either 725.179(F)(1) or (F)(2) as follows:

(1) Circuit Integrity (CI) Cables.

Circuit Integrity (CI) cables, specified in 725.179(A), (B), (C), and (E), and used for survivability of critical circuits, shall have the additional classification using the suffix “CI.” Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of an electrical circuit protective system as covered in 725.179(F)(2).

(2) Electrical Circuit Protective System.

Cables specified in 725.179(A), (B), (C), (E), and (F)(1) that are part of an electrical circuit protective system shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining circuit integrity (CI) cable or an electrical circuit protective system is by establishing a minimum 2-hour fire-resistive rating when tested in accordance with UL 2196-2012, Standard for Tests of Fire Resistive Cables.

Informational Note No. 2: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements to maintain the fire rating.

(G) Class 2 and Class 3 Cable Voltage Ratings.

Class 2 cables shall have a voltage rating of not less than 150 volts. Class 3 cables shall have a voltage rating of not less than 300 volts. Class 2 and Class 3 cables shall have temperature rating of not less than 60°C (140°F).

(H) Class 3 Single Conductors.

Class 3 single conductors used as other wiring within buildings shall not be smaller than 18 AWG and shall be Type CL3. Conductor types described in 725.49(B) that are also listed as Type CL3 shall be permitted.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the UL flameexposure, verticaltray flame test in ANSI/UL 1685-2010, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable.

Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA verticalflame test for—cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, Test Methods for Electrical Wires and Cables.

(I) Limited Power Cables.

Limited power (LP) cables shall be listed as suitable for carrying power and data circuits up to a specified current limit for each conductor without exceeding the temperature rating of the cable where the cable is installed in cable bundles in free air or enclosed. The cables shall be marked with the suffix “-LP(xxA), where the xx is the current limit in amperes per conductor.

Informational Note: The “(xxA)” in the text is the ampacity (in Amperes) of each conductor in a cable. For example, 1 ampere Class 2 limited-power cables shall be marked CL2-LP (1.0), CL2R-LP (1.0A), or CL2-LP (1.0A), as applicable.

(J) Marking.

Cables shall be marked in accordance with 310.120(A)(2), (A)(3), (A)(4), (A)(5), and Table 725.179(K). Voltage ratings shall not be marked on the cables. Temperature rating shall be marked on the jacket of Class 2 and Class 3 cables that have a temperature rating exceeding 60°C (140°F).

Informational Note: Voltage markings on cables may be misinterpreted to suggest that the cables may be suitable for Class 1 electric light and power applications.

Exception: Voltage markings shall be permitted where the cable has multiple listings and a voltage marking is required for one or more of the listings.

Table 725.179(K) Cable Marking

<table>
<thead>
<tr>
<th>Cable Marking</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL3P</td>
<td>Class 3 plenum cable</td>
</tr>
<tr>
<td>CL2P</td>
<td>Class 2 plenum cable</td>
</tr>
<tr>
<td>CL3R</td>
<td>Class 3 riser cable</td>
</tr>
<tr>
<td>CL2R</td>
<td>Class 2 riser cable</td>
</tr>
<tr>
<td>PLTC</td>
<td>Power-limited tray cable</td>
</tr>
<tr>
<td>CL3</td>
<td>Class 3 cable</td>
</tr>
<tr>
<td>CL2</td>
<td>Class 2 cable</td>
</tr>
<tr>
<td>CL3X</td>
<td>Class 3 cable, limited use</td>
</tr>
<tr>
<td>CL2X</td>
<td>Class 2 cable, limited use</td>
</tr>
</tbody>
</table>

Informational Note: Class 2 and Class 3 cable types are listed in descending order of fire resistance rating, and Class 3 cables are listed above Class 2 cables because Class 3 cables can substitute for Class 2 cables.

Additional Proposed Changes
Statement of Problem and Substantiation for Public Comment

This Public Comment is one of a series on cable heating due to the transmission of power and data using cables that are typically installed in bundles, raceways, cable trays, or cable routing assemblies.

To aid the panel in evaluation this Public Comment, the resolved Public Input 1838 is show at the end of the substantiation.  Note: References to other PI's are omitted.

Where there is an accumulation of cables are used for the transmission of power and data and are in open air or enclosed, the current in the conductors generate heat. The temperature may increase a sufficient amount to cause degradation of the cable insulation. The listing and marking is based on an extensive fact finding investigation by Underwriter’s Laboratories. The fact finding report is included for reference.

The UL fact finding investigation shows that the ampacities listed in Table 725.144 are accurate for 4-pair cables without the “-LP” suffix. However, in actual installations the quantity of cables routed together are often greater than 192 cables. The “LP” suffix provides a safety margin for installation in any quantity. In addition, it is important that the current rating of the cable is equal to or less than the nameplate rating of the power source.

Further, 20 AWG was not tested as, presently, 22 AWG is the largest conductor that will fit into a RJ 45 connector. Extensive testing at UL LLC has shown that large bundles of 4-pair cables with 22 AWG or smaller conductors may exceed their temperature rating with all conductors carrying 1 ampere, which is well below the 1.67 ampere maximum current permitted in a 60 volt, 100 VA circuit.

See the attached UL Fact Finding Report on Power over Local Area Network Type Cables (4-Pair Data / Communications Cables) for supporting data.

Related Public Comments for This Document

<table>
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<tr>
<td>Public Comment No. 689-NFPA 70-2015 [Section No. 725.133]</td>
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<tr>
<td>Public Comment No. 691-NFPA 70-2015 [Part IV.]</td>
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<tr>
<td>Public Comment No. 692-NFPA 70-2015 [Section No. 725.143]</td>
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</tbody>
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<tr>
<th>Related Item</th>
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<tbody>
<tr>
<td>Public Input No. 2366-NFPA 70-2014 [New Section after 725.179(K)]</td>
</tr>
</tbody>
</table>

Submitter Information Verification

Submitter Full Name: Terry Peters
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Affiliation: SPI
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City: 
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Submittal Date: Thu Sep 17 11:09:26 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-615-NFPA 70-2015
Statement: Information on limited power cables is being added to the Code.
(B) Types CL2R and CL3R.

Types CL2R and CL3R riser cables shall be marked as Type CL2R or CL3R, respectively, and be listed as suitable for use in a vertical run in a shaft or from floor to floor and shall be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. Optionally, Types CL2R and CL3R riser cables shall be permitted to be marked as Type CL2R ST1 or CL3R ST1, respectively, if they are listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor and also listed as exhibiting limited smoke characteristics.

Informational Note 1: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.

Informational Note 2: One method of defining optional limited smoke characteristics for riser cables is that the cables exhibit a peak smoke release rate not exceeding 0.40 m²/s and a total smoke released not exceeding 150 m² when tested in accordance with the requirements of CSA "Vertical Flame Test - Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M-2009, Test Methods for Wires and Cables.

Statement of Problem and Substantiation for Public Comment

Please reconsider the action on this public input and accept the public comment. Smoke obscuration is a key fire safety problem.

The reason that this additional optional listing and informational note are important is that there is no information in any of the test methods for fire propagation of cables how to test for smoke in riser cables. Such information is neither included in UL 1666 nor in CSA FT4 nor in UL 1685. Therefore there can be no standardized way for a manufacturer to demonstrate that a specific type of riser cables has lower smoke than typical riser cables. This is very different from the case of general purpose (or cable tray) cables. Both UL 1685 and CSA FT4 contain information on how to obtain "limited smoke" (meaning reduced smoke) cables that are general purpose cables. Therefore I understand the panel's objections to include optional markings for these cables. However, unless the code provides a systematic and standard way to determine what is a "limited smoke riser cable" the optional markings will not be able to be generated adequately.

A key aspect of wire and cable fire performance is smoke emission since it is well known that lack of visibility and smoke are serious problems in fire. In the NEC there is a designation for "low smoke cables", which are plenum-rated cables. There is also an optional designation of limited smoke cables, which is not required but applies to cable tray cables (tested to UL 1685 or CSA FT4). Riser cables are cables that are usually found in concealed spaces and it would be important to offer an optional marking for limited smoke riser cables, to distinguish them from standard riser cables. This is particularly useful for riser cables because, typically, riser cables are made with insulation and jacket materials that are very similar to CSA FT4 cables and also with materials that do not quite exhibit the flame and smoke characteristics of plenum cables. Therefore, manufacturers of materials who try to achieve a plenum cable rating, and can't quite make it, will often make their material slightly less safe from the point of view of smoke emission, in order to be able to save costs. This new optional marking would permit manufacturers to provide cables with both limited smoke and the flame spread characteristics of riser cable. The choice of criterion for the limited smoke riser cables (and the choice of designation) is based on the ST1 designation associated with the CSA FT4 test, when smoke emission is assessed.

This public comment is being proposed for all instances of riser cables and not public comment is proposed for optional markings of general purpose cables.

Related Item

Public Input No. 1720-NFPA 70-2014 [Section No. 725.179(B)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
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Submittal Date: Mon Sep 21 15:21:47 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CL2R ST1 and CL3R ST1 are optional markings that are permitted to be used but are not required. CL2R or CL3R riser cables have not been required to have limited smoke characteristics in the NEC and there wasn’t any technical substantiation provided in either the Public Input or the Comment to require limited smoke characteristics. This is an option that is available but not covered by the mandatory text in 725.179 and could confuse the user into thinking it is mandatory.
Public Comment No. 454-NFPA 70-2015 [Section No. 760.3(B)]

(B) Ducts, Plenums, and Other Air-Handling Spaces.

Section 300.22. Where power-limited and non-power-limited fire alarm cables installed in ducts, or plenums or other spaces used for environmental air shall comply with 300.22.

Exception: As permitted in 760.53(B)(1) and (B)(2) and Table 760.154. No. 1: Power-limited fire alarm cables selected in accordance with Table 760.154 and installed in accordance with 760.135(B) shall be permitted to be installed in ducts specifically fabricated for environmental air.

Exception No. 2: Power-limited fire alarm cables selected in accordance with Table 760.154 and installed in accordance with 760.135(C) shall be permitted to be installed in other spaces used for environmental air (plenums).

Statement of Problem and Substantiation for Public Comment

The recommended text clarifies that 760.135 has explicit rules for power-limited fire alarm cables installed inducts (760.135(B)] and other spaces used for environmental air (plenums) [760.135(C)].

The current text does not comply with section 3.1.4.1 of the NEC Style Manual which requires that exceptions shall be written in complete sentences. Acceptance of the recommended text will result in compliance with the NEC Style manual.

Related Item

Public Input No. 1605-NFPA 70-2014 [Section No. 760.3(B)]

Submitter Information Verification

Submitter Full Name: ROBERT JENSEN
Organization: DBI-TELECOMMUNICATION INFRASTR
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State:
Zip:
Submittal Date: Fri Aug 28 14:21:25 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-616-NFPA 70-2015
Statement: The existing exception was not in compliance with the NEC Style manual. The second exception was inserted to deal with power-limited fire alarm cables installed in other spaces used for environmental air (plenums). The reference to 300.22(B), Exception was inserted to ensure correlation with the requirements in NFPA 90A.
Public Comment No. 1685-NFPA 70-2015 [Section No. 760.24(A)]

(A) General.
Fire alarm circuits shall be installed in a neat workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D). Metallic means of support for flexible conduit and conductors shall be used in spaces above egress, which includes doorways, hallways, stairways, corridors, passageways, lobbies, landings, and equivalent spaces.

Informational note: Nonmetallic supports exhibit significant weakening and failure during fires which can affect the safety of occupants and emergency personnel entering and exiting buildings due to entanglement in fallen cable.

Statement of Problem and Substantiation for Public Comment

Emergency responders and building occupant safety is at risk during building fires because people can become entangled and trapped in cabling which has fallen out of molten or failing plastic supports/raceway. Even if people can free themselves from fallen cabling, this takes time which is otherwise needed to exit the building or fulfill the objectives of emergency personnel. The frequency of emergency responders becoming trapped in fallen cabling has become so common that firefighters have created and publicly distributed training videos on how to escape in these situations (http://www.fireengineering.com/topics/m/video/36928837/the-quick-release-method.htm?q=cable+entanglement) [1].

There have been documented fatalities due to cable entrapment both in the U.S. and England. In Memphis, Tennessee, in 1994, a fireman was entangled in cables that had fallen after the nonmetallic raceway collapsed due to the heat (http://www.fireengineering.com/articles/print/volume-148/issue-3/features/tragedy-in-a-residential-high-rise-memphis-tennessee.html [2]). More recently in England two firemen died due in part to being tangled in cabling that had fallen from plastic raceway in the ceiling of a Southampton residential building (http://www.bbc.co.uk/news/uk-england-hampshire-22126431 [3]). An article [4] in Electrical Contracting News identifies another recent incident in which a fireman died in Stevenage, Hertfordshire, after he became entangled in electrical cables which "had fallen after plastic trunking, the only support for the cables, melted and failed." Article [4] goes on to report that changes are in process to Great Britain's Wiring Regulations (BS 7671 [5]) to ensure that "wiring systems in any escape route should be supported so that they are not subject to premature failure in a fire." Revisions have already been made in a standard for fire alarm system cabling, BS 5839-1 [6], to require cable supports/raceway which will not collapse in a fire. While the documented incidents involve firefighters, it is not even known how many building occupants may have died in the past either becoming entangled in fallen cabling, overcome by smoke/heat trying to remove a cabling obstruction, or forced to seek an alternate exit due to a significant amount of cabling obstruction.

NFPA 101 (Life Safety Code, 2012) [7] already addresses the requirement to maintain egress free from obstruction. Sections 7.1.10 and 7.1.10.1 (Means of Egress Reliability) state,

7.1.10.1 General. Means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in case of fire or other emergency.

Sections 12.2.5.4, 12.2.5.4.2, and 12.2.5.4.3 (New Assembly Occupancies) and 13.2.5.4, 13.2.5.4.2, and 13.2.5.4.3 (Existing Assembly Occupancies) also emphasize this requirement.

12.2.5.4 General Requirements for Access and Egress Routes Within Assembly Areas.
12.2.5.4.2 Access and egress routes shall be maintained so that any individual is able to move without undue hindrance, on personal initiative and at any time, from an occupied position to the exits.
12.2.5.4.3 Access and egress routes shall be maintained so that crowd management, security, and emergency medical personnel are able to reach any individual at any time, without undue hindrance.

13.2.5.4 General Requirements for Access and Egress Routes Within Assembly Areas.
13.2.5.4.2 Access and egress routes shall be maintained so that any individual is able to move without undue hindrance, on personal initiative and at any time, from an occupied position to the exits.
13.2.5.4.3 Access and egress routes shall be maintained so that crowd management, security, and emergency medical personnel are able to reach any individual at any time, without undue hindrance.

The solution that is easy to understand and enforce is a straightforward requirement regarding the allowable materials of a cable.
support used above egress.

Melting temperatures of metallic and non-metallic materials are significantly different – compare the low carbon steel melting temperature of approximately 1450 °C versus 200-400 °C for many typical thermoplastics used in cable supports. This difference translates to a greater resistance to heat for steel which enables a metallic support to survive and carry load significantly longer than nonmetallic supports. The intent is not to eliminate the use of non-metallic supports/raceway in all applications, as they provide an appropriate and cost-effective option in other locations. The objective is to focus on egress which causes the highest risk to life safety.

In conclusion, there have been verifiable incidents in which firefighters have died due to entanglement from cabling fallen from plastic raceway that was weakened due to fire. This is not just a theoretical discussion or anecdotal evidence. In addition, NFPA 101 already emphasizes the need to maintain egress free from obstruction at all times, including during a fire. There is a clear opportunity in the NEC to improve consistency within NFPA Codes and save further loss of life.

Bibliography:
Public Comment No. 75-NFPA 70-2015 [Section No. 760.24(A)]

(A) General.

Fire alarm circuits shall be installed in a neat workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D).

Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of NPLFA and PLFA cable properties.

Statement of Problem and Substantiation for Public Comment

Mr. Tim West of Superior Cable submitted PIs dealing with painting or contaminating cables for the following mechanical execution of work sections, 725.24, 760.24, 770.24, 800.24, and 820.24.

CMP 3 resolved PI 4721 with the statement that section 110.12(B) addresses the problem as stated in the substantiation for the PI. Section 110.12 applies to equipment:

110.12 Mechanical Execution of Work. Electrical equipment shall be installed in a neat and workmanlike manner.

The definition of equipment does not include cable.

Equipment. A general term, including fittings, devices, appliances, luminaires, apparatus, machinery, and the like used as a part of, or in connection with, an electrical installation.

We agree that painting or otherwise contaminating cables can change their properties, especially the fire protection properties of plenum cables. We prefer an informational note rather than mandatory text because the mandatory text recommended in the PIs is vague and unenforceable.

The informational note recommended by this Public Comment is based on the informational notes that were adopted by FR-4552 for 820.24 and FR-4592 for 830.24.

Related Public Comments for This Document

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<tr>
<th>Related Comment</th>
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<tr>
<td>Public Comment No. 73-NFPA 70-2015 [Section No. 770.24]</td>
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<tr>
<td>Public Comment No. 72-NFPA 70-2015 [Section No. 800.24]</td>
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<td>Public Comment No. 74-NFPA 70-2015 [Section No. 725.24]</td>
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<tr>
<td>Public Input No. 4721-NFPA 70-2014 [Section No. 760.24(A)]</td>
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Submitter Information Verification

Submitter Full Name: DAVID KIDDOO
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Affiliation: CCCA
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Zip: 
Submittal Date: Thu Jun 25 23:04:02 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Section 110.12(B) does apply to internal parts of equipment and directly refers to busbars which are conductors. In addition, 110.11 states no conductors or equipment shall be installed where exposed to deteriorating agents so inserting an informational note is unnecessary.
Public Comment No. 1429-NFPA 70-2015 [Section No. 760.135(A)]

(A) Listing.
PLFA cables installed in buildings shall be listed and labeled.

Additional Proposed Changes

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<tr>
<th>File Name</th>
<th>Description</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
<td></td>
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</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

UL recognizes the Correlating Committee created a global First Correlating Revision (FCR) which directed that in all locations where the term "and labeled" was added after "listed" during the First Revision Stage, the words "and labeled" after "listed" be deleted, returning to previous text. UL understands that the Correlating Committee appointed a task group to address several issues involving the use of the terms "listed" and "labeled," most importantly, to clarify and establish a distinction between the terms "listed" and "labeled" which are often used interchangeably. UL supports the need for this task group. However, UL does not expect the work of this task group to affect the 2017 NEC regarding the issue of "listed and labeled." As such, UL is submitting comments to request that the words "and labeled" be added in various locations throughout the Code for the reasons expressed in the public inputs UL submitted on this issue. UL believes that these revisions will address an ongoing problem that should not wait until the 2020 NEC for resolution.

Subsequent to the Public Input Code Panel Meetings, UL has discussed this issue with its Electrical Council whose membership includes many AHJs. The proposed revisions to the NEC received general support from the membership. This issue was also discussed at a NEMA – NRTLs Forum held on August 14, 2015 at NEMA Headquarters. UL reiterated its support for the proposed revisions. The NRTLs represented at the meeting voiced no objection to the proposals.

The rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter. The mark on the product is the manufacturer's attestation that the product is in compliance with the appropriate standard. NRTL's conduct factory surveillance of products, surveillance is one method to validate the manufacturer's attestation. Should a product be found not to be compliant the manufacturer has the option of removing the mark and shipping the product without the mark, or holding the shipment and bringing the product into compliance. In either case the "listing" is not impacted, as the "listing" is created at the completion of the "original" certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a "listing" has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL's do not consider a product as being listed unless it is also labeled. The UL White Book states that "Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards." Again the requirements for the UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards. UL states that "Only those products bearing the appropriate UL Mark and the company's name, trade name, trademark or other authorized identification should be considered as being covered by UL's Certification, Listing, Classification and Follow-Up Service." The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards. The UL Mark requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL's have similar requirements.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
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<tr>
<td>Public Comment No. 532-NFPA 70-2015</td>
<td>Provides information that the label may be permitted on the container in which on the product is packaged.</td>
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<td>Public Input No. 953-NFPA 70-2014 [Section No. 760.135(A)]</td>
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<td>Public Input No. 1072-NFPA 70-2014 [Definition: Labeled.]</td>
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Submitter Information Verification
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<td><strong>Committee Action:</strong></td>
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<td><strong>Statement:</strong></td>
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</table>
Non–power-limited fire alarm cables installed as wiring within buildings shall be listed in accordance with 760.176(A) and (B) and as being resistant to the spread of fire in accordance with 760.176(C) through (F), and shall be marked in accordance with 760.176(G). Cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath. Non–power-limited fire alarm cables shall have a temperature rating of not less than 60°C (140°F).

Statement of Problem and Substantiation for Public Comment

The panel resolution statement “The Panel maintains that 60°C is established and is a listing requirement” is quite puzzling. We agree that it is the UL listing document since we stated in the PI “Requiring a temperature rating of 60°C (140°F) is consistent with the UL listing requirements for these cables.”

The temperature rating for these cables needs to be in the code. While we know it is in the UL listing, UL is not the only listing agency. Other listing agencies can choose a different temperature rating or not have one at all. The NEC is published in Spanish for use South and Central America. Can CMP 3 be sure that every country that uses the NEC has a 60°C rating?

Committee Statement

<table>
<thead>
<tr>
<th>Committee Action:</th>
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<tr>
<td>Resolution:</td>
<td>SR-618-NFPA 70-2015</td>
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<tr>
<td>Statement:</td>
<td>The temperature rating of these cables is required to provide pertinent information so the installer is aware of the temperature limitation of the conductors.</td>
</tr>
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</table>
Statement of Problem and Substantiation for Public Comment

Please reconsider the action on this public input and accept the public comment. Smoke obscuration is a key fire safety problem.

The reason that this additional optional listing and informational note are important is that there is no information in any of the test methods for fire propagation of cables how to test for smoke in riser cables. Such information is neither included in UL 1666 nor in CSA FT4 nor in UL 1685. Therefore there can be no standardized way for a manufacturer to demonstrate that a specific type of riser cables has lower smoke than typical riser cables. This is very different from the case of general purpose (or cable tray) cables. Both UL 1685 and CSA FT4 contain information on how to obtain “limited smoke” (meaning reduced smoke) cables that are general purpose cables. Therefore I understand the panel's objections to include optional markings for these cables. However, unless the code provides a systematic and standard way to determine what is a "limited smoke riser cable" the optional markings will not be able to be generated adequately.

A key aspect of wire and cable fire performance is smoke emission since it is well known that lack of visibility and smoke are serious problems in fire. In the NEC there is a designation for "low smoke cables", which are plenum-rated cables. There is also an optional designation of limited smoke cables, which is not required but applies to cable tray cables (tested to UL 1685 or CSA FT4). Riser cables are cables that usually are found in concealed spaces and it would be important to offer an optional marking for limited smoke riser cables, to distinguish them from standard riser cables. This is particularly useful for riser cables because, typically, riser cables are made with insulation and jacket materials that are very similar to CSA FT4 cables and also with materials that do not quite exhibit the flame and smoke characteristics of plenum cables. Therefore, manufacturers of materials who try to achieve a plenum cable rating, and can't quite make it, will often make their material slightly less safe from the point of view of smoke emission, in order to be able to save costs. This new optional marking would permit manufacturers to provide cables with both limited smoke and the flame spread characteristics of riser cable. The choice of criterion for the limited smoke riser cables (and the choice of designation) is based on the ST1 designation associated with the CSA FT4 test, when smoke emission is assessed.

This public comment is being proposed for all instances of riser cables and not public comment is proposed for optional markings of general purpose cables.

Related Item
Public Input No. 1721-NFPA 70-2014 [Section No. 760.176(D)]

Submitter Information Verification
Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Sep 21 15:37:52 EDT 2015

Committee Statement
Committee Action: Rejected
**Resolution:** NPLFR ST1 is an optional marking that is permitted to be used but are not required. NPLFR (riser) cables have not been required to have limited smoke characteristic in the NEC and there wasn't any technical substantiation provided in either the Public Input or the Comment to require limited smoke characteristics. This is an option that is available but not covered by the mandatory text in 760.176(D) and could confuse the user into thinking it is mandatory.
Public Comment No. 450-NFPA 70-2015 [Section No. 760.179(C)]

(C) Ratings.
The cable shall have a voltage rating of not less than 300 volts. The cable shall have a temperature rating of not less than 60°C (140°F).

Statement of Problem and Substantiation for Public Comment

PI 1609 was for 760.179(C). The title of 760.179 is Listing and Marking of PLFA Cables and Insulated Continuous Line-Type Fire Detectors. The panel resolution statement "The 60°C temperature rating is a listing requirement." is quite puzzling. It is a listing requirement; that's why it was proposed for the listing section, right next to the voltage rating. Cables have voltage ratings and temperature ratings; both of these listing requirements should be in the Code. Why include one, the voltage rating, and exclude the other, the temperature rating?
The temperature rating for these cables needs to be in the code. While we know it is in the UL listing, UL is not the only listing agency. Other listing agencies can choose a different temperature rating or not have one at all. The NEC is published in Spanish for use South and Central America. Can CMP 3 be sure that every country that uses the NEC has a 60°C rating?

Related Item
Public Input No. 1609-NFPA 70-2014 [Section No. 760.179(C)]

Submitter Information Verification

Submitter Full Name: ROBERT JENSEN
Organization: DBI-TELECOMMUNICATION INFRASTR
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 27 16:36:15 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-619-NFPA 70-2015
Statement: The temperature rating of these cables is required to provide pertinent information so the installer is aware of the temperature limitation of the conductors.
Type FPLR power-limited fire alarm riser cable shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. Optionally, Type FPLR riser cables shall be permitted to be marked as Type FPLR ST1 if they are listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor and also listed as exhibiting limited smoke characteristics.

Informational Note 1: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.

Informational Note 2: One method of defining optional limited smoke characteristics for riser cables is that the cables exhibit a peak smoke release rate not exceeding 0.40 m$^2$/s and a total smoke released not exceeding 150 m$^2$ when tested in accordance with the requirements of CSA, “Vertical Flame Test - Cables in Cable Trays,” as described in CSA C22.2 No. 0.3-M-2009, Test Methods for Wires and Cables.

Statement of Problem and Substantiation for Public Comment

Please reconsider the action on this public input and accept the public comment. Smoke obscuration is a key fire safety problem.

The reason that this additional optional listing and informational note are important is that there is no information in any of the test methods for fire propagation of cables how to test for smoke in riser cables. Such information is neither included in UL 1666 nor in CSA FT4 nor in UL 1685. Therefore there can be no standardized way for a manufacturer to demonstrate that a specific type of riser cables has lower smoke than typical riser cables. This is very different from the case of general purpose (or cable tray) cables. Both UL 1685 and CSA FT4 contain information on how to obtain "limited smoke" (meaning reduced smoke) cables that are general purpose cables. Therefore I understand the panel's objections to include optional markings for these cables. However, unless the code provides a systematic and standard way to determine what is a "limited smoke riser cable" the optional markings will not be able to be generated adequately.

A key aspect of wire and cable fire performance is smoke emission since it is well known that lack of visibility and smoke are serious problems in fire. In the NEC there is a designation for "low smoke cables", which are plenum-rated cables. There is also an optional designation of limited smoke cables, which is not required but applies to cable tray cables (tested to UL 1685 or CSA FT4). Riser cables are cables that usually are found in concealed spaces and it would be important to offer an optional marking for limited smoke riser cables, to distinguish them from standard riser cables. This is particularly useful for riser cables because, typically, riser cables are made with insulation and jacket materials that are very similar to CSA FT4 cables and also with materials that do not quite exhibit the flame and smoke characteristics of plenum cables. Therefore, manufacturers of materials who try to achieve a plenum cable rating, and can't quite make it, will often make their material slightly less safe from the point of view of smoke emission, in order to be able to save costs. This new optional marking would permit manufacturers to provide cables with both limited smoke and the flame spread characteristics of riser cable. The choice of criterion for the limited smoke riser cables (and the choice of designation) is based on the ST1 designation associated with the CSA FT4 test, when smoke emission is assessed.

This public comment is being proposed for all instances of riser cables and not public comment is proposed for optional markings of general purpose cables.

Related Item

Public Input No. 1722-NFPA 70-2014 [Section No. 760.179(E)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 15:40:43 EDT 2015

Committee Statement

Committee Action: Rejected

Committee Report
Resolution:  FPLR ST1 is an optional marking that is permitted to be used but are not required. FPLR (riser) cables have not been required to have limited smoke characteristic in the NEC and there wasn’t any technical substantiation provided in either the Public Input or the Comment to require limited smoke characteristics. This is an option that is available but not covered by the mandatory text in 760.179(E) and could confuse the user into thinking it is mandatory.
Exposed (to Accidental Contact):
A conductive optical fiber cable in such a position that, in case of failure of supports or insulation, contact between the cable's non-current-carrying conductive members and an electrical circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed.

Statement of Problem and Substantiation for Public Comment

The term “Exposed” has multiple meanings throughout the NEC: uncovered and capable of being touched by persons, susceptible to physical damage, e.g., wiring attached to a surface, susceptible to power influences such as contact or induction, and susceptible to lightning influences, either a direct ‘hit’, induction or ground potential rise. Hence, the Informational Note provides clarity and should be maintained.

Related Item
First Revision No. 4512-NFPA 70-2015 [Definition: Exposed (to Accidental Contact).]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 08 16:44:11 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4507-NFPA 70-2015
Statement: The term “exposed” has multiple meanings throughout the NEC: uncovered and capable of being touched by persons, susceptible to physical damage, e.g., wiring attached to a surface, susceptible to power influences such as contact or induction, and susceptible to lightning influences, either a direct ‘hit’, induction or ground potential rise. Hence, the informational note provides clarity and has been maintained.
**Public Comment No. 444-NFPA 70-2015 [ Definition: Point of Entrance. ]**

**Point of Entrance.**
The point within a building at which the optical fiber cable emerges from an external wall, or from a concrete floor slab, from rigid metal conduit (RMC), or from intermediate metal conduit (IMC).

**Statement of Problem and Substantiation for Public Comment**

Panel action on FR 4521 for 770.48 added “The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).”

This action is confusing unless the definition of point of entrance is modified to remove the text about the point of entrance being the point where the cable emerges from the RMC or the IMC.

This PC is offered as an alternative to PC 455. Similar PC are made for Article 800 sections and Article 820 sections.

**Related Item**
First Revision No. 4521-NFPA 70-2015 [Section No. 770.48]

**Submitter Information Verification**

Submitter Full Name: ROBERT JENSEN
Organization: DBI-TELECOMMUNICATION INFRASTR
Affiliation: BICSI
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Aug 27 15:06:12 EDT 2015

**Committee Statement**

Committee Action: Accepted
Resolution: SR-4508-NFPA 70-2015
Statement: The definition of “point of entrance” is simplified and potential confusion is avoided by locating the information regarding the application of rigid metal conduit (RMC) and intermediate metal conduit (IMC) in 770.48(A), Conductive and Nonconductive Cable.
Public Comment No. 173-NFPA 70-2015 [Section No. 770.24]

770.24  Mechanical Execution of Work.
Optical fiber cables shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4(D) and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 800.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling; ANSI/NECA/FOA 301-2015, Standard for Installing and Testing Fiber Optic Cables; and other ANSI-approved installation standards.

Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: For additional information regarding overhead wires and cables, see ANSI C2-2012, National Electric Safety Code, Part 2, Safety Rules for Overhead Lines.

Statement of Problem and Substantiation for Public Comment

Make no changes to the text of 770.24 with respect to the reference to 300.4(D) as contained in the First Draft Report. We do not agree with the Committee Statement to revise the text “… to reference 300.4 in its entirety as optical fiber cables need to be protected from all sources of damage”. No technical substantiation has been presented to support the additional requirements. The Committee Statement “optical fiber cables need to be protected from all sources of damage” does not constitute adequate technical substantiation. The requirements of 300.4 are appropriate for power wiring, not optical fiber cables. Neither a fire nor electrical safety hazard has been identified to justify expanding the requirements of 770.24. Optical fiber cables carry no power and pose neither a fire nor electrical safety hazard.

Note that Sections 725.24 and 760.24 under the purview of Code-making Panel 3 and addressing low voltage signaling and fire alarm systems, respectively, do not contain the additional requirements and continue to reference only 300.4(D). These systems also utilize optical fiber cables. Applying the full requirements of 300.4 in 770.24 will create a correlation issue not only with 725.24 and 760.24, but also with 90.1 (Purpose) – “… safeguarding of persons and property from hazards arising from the use of electricity”. There is no electricity, hence no electrical hazard. Finally, we believe there is an error in the 2014 NEC with respect to 770.24. The Correlating Committee, in reviewing the formal Panel 16 ballot on Comments 16-16 and 16-18, directed that “… this Comment and Proposal 16-40 be reported as “Reject” because less than two-thirds of the members eligible to vote have voted in the affirmative”. This action by the Correlating Committee should have restored the NEC to the 2011 text that referenced only 300.4(D).

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4509-NFPA 70-2015
Statement: Article 770 deals with all types of optical fiber cable installations and not just installations dealing with communications systems, then the installation requirements for optical fiber cables should comply with all of Section 300.4. Optical fiber cables is used for life safety applications such as for fire alarm systems, some building system controls and industrial process controls.

Informational Note No. 1 was revised to eliminate the word “accepted” because it is generally thought of being associated with the authority having jurisdiction.
New Informational Note No. 3 identifies possible contamination of optical fiber cables during the construction process by paint or other foreign materials, potentially altering the fire resistance, smoke generating or other properties that are part of the cable listing requirements.
770.24  Mechanical Execution of Work.

Optical fiber cables shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4(D) and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 800.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling; ANSI/NECA/FOA 301-2015, Standard for Installing and Testing Fiber Optic Cables; and other ANSI-approved installation standards.

Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: For additional information regarding overhead wires and cables, see ANSI C2-2012, National Electric Safety Code, Part 2, Safety Rules for Overhead Lines.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4518.

Related Item

First Revision No. 4518-NFPA 70-2015 [Section No. 770.24]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:32:20 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4509-NFPA 70-2015
Statement: Article 770 deals with all types of optical fiber cable installations and not just installations dealing with communications systems, then the installation requirements for optical fiber cables should comply with all of Section 300.4. Optical fiber cables is used for life safety applications such as for fire alarm systems, some building system controls and industrial process controls.

Informational Note No. 1 was revised to eliminate the word “accepted” because it is generally thought of being associated with the authority having jurisdiction.

New Informational Note No. 3 identifies possible contamination of optical fiber cables during the construction process by paint or other foreign materials, potentially altering the fire resistance, smoke generating or other properties that are part of the cable listing requirements.
770.24 Mechanical Execution of Work.

Optical fiber cables shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4(D) and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 800.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling; ANSI/NECA/FOA 301-2015, Standard for Installing and Testing Fiber Optic Cables; and other ANSI-approved installation standards.

Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: For additional information regarding overhead wires and cables, see ANSI C2-2012, National Electric Safety Code, Part 2, Safety Rules for Overhead Lines. Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

Statement of Problem and Substantiation for Public Comment

Informational Note No. 3 appears to be in error. Per Panel Action on PI No. 563, Informational Note No. 3 should address contamination from paints, cleaners, etc. similar to what was done in 800.24, 820.24 and 830.24.

Related Item
First Revision No. 4518-NFPA 70-2015 [Section No. 770.24]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City: 
State: 
Zip: 
Submittal Date: Thu Jul 09 08:18:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4509-NFPA 70-2015
Statement: Article 770 deals with all types of optical fiber cable installations and not just installations dealing with communications systems, then the installation requirements for optical fiber cables should comply with all of Section 300.4. Optical fiber cables is used for life safety applications such as for fire alarm systems, some building system controls and industrial process controls.

Informational Note No. 1 was revised to eliminate the word "accepted" because it is generally thought of being associated with the authority having jurisdiction.

New Informational Note No. 3 identifies possible contamination of optical fiber cables during the construction process by paint or other foreign materials, potentially altering the fire resistance, smoke generating or other properties that are part of the cable listing requirements.
Public Comment No. 270-NFPA 70-2015 [Section No. 770.24]

770.24 Mechanical Execution of Work.

Optical fiber cables shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4(D) and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 800.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling; ANSI/NECA/FOA 301-2015, Standard for Installing and Testing Fiber Optic Cables; and other ANSI-approved installation standards.

Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: For additional information regarding overhead wires and cables, see ANSI C2-2012, National Electric Safety Code, Part 2, Safety Rules for Overhead Lines.

Statement of Problem and Substantiation for Public Comment

Just because optical fiber cable is not carrying any current the circuits being fed by this cable in a number of situations are critical. Therefore, the installation of these optical fiber cables should conform to all of 300.4.

Related Item

First Revision No. 4518-NFPA 70-2015 [Section No. 770.24]

Submitter Information Verification

Submitter Full Name: WILLIAM MCCOY
Organization: TELCO SALES INC
Affiliation: IEEE
Street Address:
City:
State:
Zip:
Submittal Date: Sun Jul 19 15:13:42 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4509-NFPA 70-2015
Statement: Article 770 deals with all types of optical fiber cable installations and not just installations dealing with communications systems, then the installation requirements for optical fiber cables should comply with all of Section 300.4. Optical fiber cables is used for life safety applications such as for fire alarm systems, some building system controls and industrial process controls.

Informational Note No. 1 was revised to eliminate the word "accepted" because it is generally thought of being associated with the authority having jurisdiction.

New Informational Note No. 3 identifies possible contamination of optical fiber cables during the construction process by paint or other foreign materials, potentially altering the fire resistance, smoke generating or other properties that are part of the cable listing requirements.
770.24 Mechanical Execution of Work.

Optical fiber cables shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4(D) and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 800.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling; ANSI/NECA/FOA 301-2015, Standard for Installing and Testing Fiber Optic Cables; and other ANSI-approved installation standards.

Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: For additional information regarding overhead wires and cables, see ANSI C2-2012, National Electric Safety Code, Part 2, Safety Rules for Overhead Lines. Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

Statement of Problem and Substantiation for Public Comment

The Committee Statement includes:

“Added Informational Note No. 3 that identifies possible contamination of optical fiber cables during the construction process by paint or other foreign materials, potentially altering the fire resistance, smoke generating or other properties that are part of the cable listing requirements. This information is of an informative nature and the Panel adds an Informational Note.”

The recommended text of this Public Comment corrects an apparent copy and paste error.

Related Public Comments for This Document

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Submitter Information Verification

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Committee Statement

| Committee Action: | Rejected but see related SR |
| Resolution:       | SR-4509-NFPA 70-2015       |
| Statement:        | Article 770 deals with all types of optical fiber cable installations and not just installations dealing with communications systems, then the installation requirements for optical fiber cables should comply with all of Section 300.4. Optical fiber cables is used for life safety applications such as for fire alarm systems, some building system controls and industrial process controls. Informational Note No. 1 was revised to eliminate the word "accepted" because it is generally thought of being |

2033 of 2282 11/19/2015 12:04 PM
associated with the authority having jurisdiction.

New Informational Note No. 3 identifies possible contamination of optical fiber cables during the construction process by paint or other foreign materials, potentially altering the fire resistance, smoke generating or other properties that are part of the cable listing requirements.
Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]

(B) Above Roofs.

Outside plant optical fiber cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

Exception No. 1: The requirement of 770.44(B) shall not apply to auxiliary buildings such as garages and the like.

Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (a) not more than 1.2 m (4 ft) of optical fiber cable service drop cable passes above the roof overhang, and (b) the cable is terminated at a through- or above-the-roof raceway or approved support.

Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.

Informational Note: For additional information regarding overhead wires and cables, see ANSI C2-2012, National Electric Safety Code, Part 2, Safety Rules for Overhead Lines.

Statement of Problem and Substantiation for Public Comment

Corrected SDO reference in the informational note for exception #3.

Related Public Comments for This Document

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**Related Item**

First Revision No. 4519-NFPA 70-2015 [New Section after 770.26]

### Submitter Information Verification

- **Submitter Full Name:** Aaron Adamczyk
- **Organization:** [Not Specified]
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Thu Jun 25 00:57:33 EDT 2015

### Committee Statement

- **Committee Action:** Rejected but see related SR
- **Resolution:** SR-4510-NFPA 70-2015
- **Statement:** C2-2012 was approved by ANSI on June 3, 2011 and is referenced to IEEE. The 2017 edition of the NESC has not yet been adopted.
Public Comment No. 177-NFPA 70-2015 [Section No. 770.48(A)]

(A) Conductive and Nonconductive Cables.

Unlisted conductive and nonconductive outside plant optical fiber cables shall be permitted to be installed in building spaces, other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure.

The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, typically are used as enclosures for splicing or terminating optical fiber cables.

Informational Note No. 2: The point of entrance may be extended further into the building by continuing to enclose the entrance cable in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Statement of Problem and Substantiation for Public Comment

The proposed added text “The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).” is a cumbersome and run-on sentence that is both confusing and redundant. The definition, “point of entrance”, currently and adequately defines RMC and IMC as acceptable vehicles establishing the point of entrance. If the Panel feels it is necessary to further clarify the use of RMC and IMC, greater clarity is provided by a simple Informational Note such as “The point of entrance may be extended further into the building by continuing to enclose the entrance cable in rigid metal conduit (RMC) or intermediate metal conduit (IMC).”

Related Item

First Revision No. 4521-NFPA 70-2015 [Section No. 770.48]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Jul 08 16:55:22 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4511-NFPA 70-2015
Statement: The text is appropriate as a requirement. According to the NEC Style Manual Section 3.1.3, informational notes shall not be written in mandatory language and shall not contain requirements, make interpretations, or make recommendations.
Public Comment No. 1870-NFPA 70-2015 [Section No. 770.48(A)]

(A) Conductive and Nonconductive Cables.

Unlisted conductive and nonconductive outside plant optical fiber cables shall be permitted to be installed in building spaces, other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure.

The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Informational Note: Splice cases or terminal boxes, both metallic and plastic types, typically are used as enclosures for splicing or terminating optical fiber cables.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that the panel reconsider the text relative to adding the words "optical fiber" before "cables."

Related Item

First Revision No. 4521-NFPA 70-2015 [Section No. 770.48]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:33:35 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4511-NFPA 70-2015
Statement: The text is appropriate as a requirement. According to the NEC Style Manual Section 3.1.3, informational notes shall not be written in mandatory language and shall not contain requirements, make interpretations, or make recommendations.
Public Comment No. 455-NFPA 70-2015 [Section No. 770.48(A)]

(A) Conductive and Nonconductive Cables.

Unlisted conductive and nonconductive outside plant optical fiber cables shall be permitted to be installed in building spaces, other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure. The point of entrance shall be permitted to be extended from the

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, typically are used as enclosures for splicing or terminating optical fiber cables.

Informational Note No. 2: Continuously enclosing entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) extends the point of entrance from penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Informational Note: Splice cases or terminal boxes, both metallic and plastic types, typically are used as enclosures for splicing or terminating optical fiber cables.

Statement of Problem and Substantiation for Public Comment

The added text about extending the point of entrance was recommended to be an informational note in PI 1561. If the panel had adopted that recommendation, it would have avoided the confusion of permitting the extension of the point of entrance by using RMC or IMC when the point of entrance is already defined as the point emergence from RMC or IMC.

This PC is offered as an alternative to PC 444. Similar PC are made for Article 800 sections and Article 820 sections.

Related Item
First Revision No. 4521-NFPA 70-2015 [Section No. 770.48]

Submitter Information Verification

Submitter Full Name: ROBERT JENSEN
Organization: DBI-TELECOMMUNICATION INFRASTR
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 28 14:34:51 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4511-NFPA 70-2015
Statement: The text is appropriate as a requirement. According to the NEC Style Manual Section 3.1.3, informational notes shall not be written in mandatory language and shall not contain requirements, make interpretations, or make recommendations.
Metallic conduit. Rigid metal conduit (RMC) or intermediate metal conduit (IMC), containing optical fiber entrance cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode in accordance with 770.100(B).

Statement of Problem and Substantiation for Public Comment

Section 770.49 is specific to metallic entrance conduit grounding. The only types of metallic entrance conduit permitted are RMC and IMC. Hence, in this section we are dealing only with RMC and IMC. While it is true that all metallic conduit should be grounded, such a general statement here may mislead the reader to incorrectly conclude that other types of metallic conduit may be used as entrance conduit.

Related Item
First Revision No. 4522-NFPA 70-2015 [Section No. 770.49]

Submitter Information Verification
Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jul 08 17:10:03 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: Section 770.48(B) includes EMT therefore, RMC and IMC are not the only metallic conduits that can be used.
Communications Raceways.

Optical fiber cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b) and listed in accordance with 800.113 and installed in accordance with 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

Statement of Problem and Substantiation for Public Comment

The text “installed in accordance with” was inadvertently omitted. There is also a superfluous “and” prior to “listed in accordance with 800.113”.

Related Item

First Revision No. 4528-NFPA 70-2015 [Section No. 770.110(A)(2)]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 08 19:20:42 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4513-NFPA 70-2015
Statement: The text “installed in accordance with” was inadvertently omitted in the first draft. There was also a superfluous “and” prior to “listed in accordance with 800.113”.

National Fire Protection Association Report

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
Optical fiber cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b), and listed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4528 with regards to the deletion of “Installed in accordance with.”

Related Item
First Revision No. 4528-NFPA 70-2015 [Section No. 770.110(A)(2)]

Committee Statement
Rejected but see related SR

Resolution: SR-4513-NFPA 70-2015

Statement: The text “installed in accordance with” was inadvertently omitted in the first draft. There was also a superfluous “and” prior to “listed in accordance with 800.113.”
### Public Comment No. 1435-NFPA 70-2015 [Section No. 770.113(A)]

(A) Listing.

Optical fiber cables installed in buildings shall be listed in accordance with 770.179.

*Exception: Optical fiber cables that are installed in compliance with 770.48 shall not be required to be listed.*

### Statement of Problem and Substantiation for Public Comment

This will provide direction as to where the listing and marking requirements are located.

#### Related Item

Public Input No. 954-NFPA 70-2014 [Section No. 770.113(A)]

### Submitter Information Verification

- **Submitter Full Name:** JEFFREY FECTEAU
- **Organization:** UNDERWRITERS LABORATORIES LLC
- **Affiliation:** UL
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Fri Sep 25 11:17:14 EDT 2015

### Committee Statement

- **Committee Action:** Accepted
- **Resolution:** SR-4514-NFPA 70-2015
- **Statement:** The addition of the wording “in accordance with 770.179” provides direction as to where the listing and marking requirements are located.
770.179 Optical Fiber Cables.

Optical fiber cables shall be listed, labeled and identified in accordance with 770.179(A) through (F) and shall be marked in accordance with Table 770.179. Optical fiber cables shall have a temperature rating of not less than 60°C (140°F). Temperature rating shall be marked on the jacket of optical fiber cables that have a temperature rating exceeding 60°C (140°F).

(A) Types OFNP and OFCP.

Types OFNP and OFCP nonconductive and conductive optical fiber plenum cables shall be listed as being suitable for use in ducts, plenums, and other space used for environmental air and shall also be listed as having adequate fire resistant and low smoke producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing cable and fire-resistant cable is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2015, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

(B) Types OFNR and OFCR.

Types OFNR and OFCR nonconductive and conductive optical fiber riser cables shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having the fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2011, Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.

(C) Types OFNG and OFCG.

Types OFNG and OFCG nonconductive and conductive general-purpose optical fiber cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, and shall also be listed as being resistant to the spread of fire.

Informational Note: One method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test — cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, Test Methods for Electrical Wires and Cables.

Informational Note No. 1: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable.

Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test — cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, Test Methods for Electrical Wires and Cables.

Informational Note No. 2: Cable types are listed in descending order of fire resistance rating. Within each fire resistance rating, nonconductive cable is listed first because it may substitute for the conductive cable.

Table 770.179 Cable Markings

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<thead>
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<tr>
<td>OFNR</td>
<td>Nonconductive optical fiber riser cable</td>
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<td>OFCR</td>
<td>Conductive optical fiber riser cable</td>
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<td>OFNG</td>
<td>Nonconductive optical fiber general-purpose cable</td>
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<tr>
<td>OFCG</td>
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<tr>
<td>OFN</td>
<td>Nonconductive optical fiber general-purpose cable</td>
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<tr>
<td>OFC</td>
<td>Conductive optical fiber general-purpose cable</td>
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</table>

(E) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.
Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 770.179(E)(1) or (E)(2).

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements necessary to maintain the fire rating.

(1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 770.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix “CI.” In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2006, Standard for Tests of Fire-Resistive Cable.

(2) Fire-Resistive Cables.

Cables specified in 770.179(A) through (D) and 770.179(E)(1), that are part of an electrical circuit protective system, shall be fire-resistive cable and identified with the protective system number on the product or on the smallest unit container in which the product is packaged and installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

(F) Field-Assembled Optical Fiber Cables.

Field-assembled optical fiber cable shall comply with 770.179(F)(1) through (4).

1) The specific combination of jacket and optical fibers intended to be installed as a field-assembled optical fiber cable shall be listed in accordance with one of the types identified by 770.179(A), (B), or (D) and shall be marked in accordance with Table 770.179.

2) The jacket of a field-assembled optical fiber cable shall have a surface marking indicating the specific optical fibers with which it is listed for, identified for use.

3) The optical fibers shall have a permanent marking, such as a marker tape, indicating the jacket with which they are listed for, identified for use.

4) The jacket without fibers shall meet the listing requirements for communications raceways in 800.182(A), (B), or (C) in accordance with the cable marking.

Additional Proposed Changes

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<th>Description</th>
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<tr>
<td>Essential_Guide_to_Product_Testing_and_Certification_NOV_2014.pdf</td>
<td>ETL Essential Guide to Product Testing &amp; Certification 2014/2015 North American Edition. Please review document page numbers 5, 8 and 10 to see that ETL has requirements similar to UL, that products that do not bear their certification (listed) mark are not considered by ETL as being listed.</td>
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“original” certification of the product and indicates the authorization but not the mandate to label products. So the only true way an AHJ can determine whether the product he is seeing is compliant with the applicable standard is via a label on the product. Taking it one step further, listings change with time. It is quite possible that a “listing” has been withdrawn; however labeled product may still be available for sale. Should equipment that is labeled, but not listed, be deemed acceptable? Based on the NEC definitions, it is possible to have a product that meets the Article 100 definition of listed but the testing organization made the manufacture remove the label for a non-compliance issue.

As for the concerns of products that are too small to be labeled, the definition of labeled is not limited to an actual label, it also includes symbols, or other identifying marks. The Safety Standards which define the listing requirements do not address labeling of products as defined by Article 100. As a general rule, NRTL’s do not consider a product as being listed unless it is also labeled. The UL White Book states that “Only those products bearing the appropriate UL Mark and the company’s name, trade name, trademark or other authorized identification should be considered as being covered by UL’s Certification, Listing, Classification and Follow-Up Service. The UL Mark provides evidence of listing or labeling, which may be required by installation codes or standards.” Again the requirements for the UL Mark are not a Safety Standard requirement, they are a UL requirement and the only way to show that a product is UL Certified (Listed); other NRTL’s have similar requirements.

Related Public Comments for This Document

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<tr>
<td>Public Input No. 954-NFPA 70-2014 [Section No. 770.113(A)]</td>
<td>This provides information that the label may be permitted to be on the smallest unit container in which the product is packaged.</td>
</tr>
<tr>
<td>Public Input No. 1072-NFPA 70-2014 [Definition: Labeled]</td>
<td></td>
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Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name: JEFFREY FECTEAU</th>
</tr>
</thead>
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<tr>
<td>Organization: UNDERWRITERS LABORATORIES LLC</td>
</tr>
<tr>
<td>Affiliation: UL</td>
</tr>
<tr>
<td>Street Address:</td>
</tr>
<tr>
<td>City:</td>
</tr>
<tr>
<td>State:</td>
</tr>
<tr>
<td>Zip:</td>
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<td>Submittal Date: Fri Sep 25 11:21:46 EDT 2015</td>
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Committee Statement

<table>
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<tbody>
<tr>
<td>Resolution: S-4515-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement: The label on the product is the manufacturer’s attestation that the product is in compliance with the appropriate standard. The lead paragraph establishes a requirement for listing and it is not necessary to repeat throughout the section.</td>
</tr>
</tbody>
</table>
(B) Types OFNR and OFCR.

Types OFNR and OFCR nonconductive and conductive optical fiber riser cables shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having the fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. Optionally, Types OFNR and OFCR riser cables shall be permitted to be marked as Type OFNR ST1 or OFCR ST1, respectively, if they are listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor and also listed as exhibiting limited smoke characteristics.

Informational Note 1: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2011, Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.

Informational Note 2: One method of defining optional limited smoke characteristics for riser cables is that the cables exhibit a peak smoke release rate not exceeding 0.40 m$^2$/s and a total smoke released not exceeding 150 m$^2$ when tested in accordance with the requirements of CSA "Vertical Flame Test - Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M-2009, Test Methods for Wires and Cables.

Statement of Problem and Substantiation for Public Comment

Please reconsider the action on this public input and accept the public comment. Smoke obscuration is a key fire safety problem. The reason that this additional optional listing and informational note are important is that there is no information in any of the test methods for fire propagation of cables how to test for smoke in riser cables. Such information is neither included in UL 1666 nor in CSA FT4 nor in UL 1685. Therefore there can be no standardized way for a manufacturer to demonstrate that a specific type of riser cables has lower smoke than typical riser cables. This is very different from the case of general purpose (or cable tray) cables. Both UL 1685 and CSA FT4 contain information on how to obtain "limited smoke" (meaning reduced smoke) cables that are general purpose cables. Therefore I understand the panel's objections to include optional markings for these cables. However, unless the code provides a systematic and standard way to determine what is a "limited smoke riser cable" the optional markings will not be able to be generated adequately.

A key aspect of wire and cable fire performance is smoke emission since it is well known that lack of visibility and smoke are serious problems in fire. In the NEC there is a designation for "low smoke cables", which are plenum-rated cables. There is also an optional designation of limited smoke cables, which is not required but applies to cable tray cables (tested to UL 1685 or CSA FT4). Riser cables are cables that usually are found in concealed spaces and it would be important to offer an optional marking for limited smoke riser cables, to distinguish them from standard riser cables. This is particularly useful for riser cables because, typically, riser cables are made with insulation and jacket materials that are very similar to CSA FT4 cables and also with materials that do not quite exhibit the flame and smoke characteristics of plenum cables. Therefore, manufacturers of materials who try to achieve a plenum cable rating, and can't quite make it, will often make their material slightly less safe from the point of view of smoke emission, in order to be able to save costs. This new optional marking would permit manufacturers to provide cables with both limited smoke and the flame spread characteristics of riser cable. The choice of criterion for the limited smoke riser cables (and the choice of designation) is based on the ST1 designation associated with the CSA FT4 test, when smoke emission is assessed.

This public comment is being proposed for all instances of riser cables and not public comment is proposed for optional markings of general purpose cables.

Related Item
Public Input No. 3984-NFPA 70-2014 [Section No. 770.179(B)]

Submitter Information Verification
Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 15:44:10 EDT 2015

Committee Statement
Committee Action: Rejected
Optional marking is permitted. Including references to products that do not have a need for specific application rules or products that are permitted but not required by the NEC is in appropriate. Therefore, this additional reference is not needed.
Public Comment No. 243-NFPA 70-2015 [Article 800 [Excluding any Sub-Sections]]

Informational Note: See Informational Note Figure 800(a) and Informational Note Figure 800(b), that illustrate the application of bonding and grounding electrode conductors in communications installations.

Informational Note Figure 800(a). Illustration of a Bonding Conductor in a Communications Installation.

Informational Note Figure 800(b). Illustration of a Grounding Electrode Conductor in a Communications Installation.

Statement of Problem and Substantiation for Public Comment

The words "see" and "that" are superfluous in the Informational Note. The caption for Informational Note Figure 800(a) is revised to provide punctuation. The caption for Informational Note Figure 800(b) is incorrect and should state: "Informational Note Figure 800(b). Illustration of a Grounding Electrode Conductor in a Communications Installation."

Related Item
First Revision No. 7504-NFPA 70-2015 [Detail]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 14 15:57:19 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4563-NFPA 70-2015
Statement: Superfluous text is removed and the caption for Informational Note Figure 800(b) is revised to state: "Informational Note Figure 800(b). Illustration of a Grounding Electrode Conductor in a Communications Installation."
Public Comment No. 181-NFPA 70-2015 [Section No. 800.1]

800.1  Scope.
This article covers communications circuits and equipment.

Informational Note No. 1: For further information for installations of communications circuits and equipment that are not covered.

Informational Note No. 2: For further information for remote-control, signaling, and power-limited circuits, see Article 725.

Informational Note No. 23: For further information for fire alarm systems, see Article 760.

Statement of Problem and Substantiation for Public Comment

Informational Note No. 1 referencing 90.2(B)(4) should not be deleted. It is extremely important, from a communications-provider point of view, that the reader and user of the Code be reminded that there are circumstances under which Article 800 does not apply. The presence of Informational Note No. 1 as contained in this Public Comment will help ensure that AHJs do not erroneously apply the requirements of Article 800 to facilities under the exclusive control of the communications utility.

Related Item
First Revision No. 4647-NFPA 70-2015 [Section No. 800.1]

Submitter Information Verification
Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jul 08 19:37:17 EDT 2015

Committee Statement
Committee Action: Accepted
Resolution: SR-4517-NFPA 70-2015
Statement: Informational Note No. 1 referencing 90.2(B)(4) is not to be deleted. It is extremely important, from a communications-provider point of view, that the reader and user of the Code be reminded that there are circumstances under which Article 800 does not apply.
Exposed (to Accidental Contact).
A circuit that is in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed.

Statement of Problem and Substantiation for Public Comment

The Panel acted on PI 4562 to delete the Informational Note following 800.2, "Exposed (to Accidental Contact)" that passed ballot. This action is covered in FR 4512 that is not addressed in the First Draft Report. However, we do NOT agree that the Informational Note should be deleted. The term "Exposed" has multiple meanings throughout the NEC: uncovered and capable of being touched by persons, susceptible to physical damage, e.g., wiring attached to a surface, susceptible to power influences such as contact or induction, and susceptible to lightning influences, either a direct ‘hit’, induction or ground potential rise. Hence, the Informational Note provides clarity and should be maintained.

Related Item
First Revision No. 4512-NFPA 70-2015 [Definition: Exposed (to Accidental Contact)]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Jul 14 10:36:52 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4562-NFPA 70-2015
Statement: The term “Exposed” has multiple meanings throughout the NEC: uncovered and capable of being touched by persons, susceptible to physical damage, e.g., wiring attached to a surface, susceptible to power influences such as contact or induction, and susceptible to lightning influences, either a direct ‘hit’, induction or ground potential rise. Hence, the informational note provides clarity and should be maintained.
**Public Comment No. 448-NFPA 70-2015 [ Definition: Innerduct. ]**

<table>
<thead>
<tr>
<th>Innerduct</th>
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<tbody>
<tr>
<td>A nonmetallic raceway placed within a larger raceway.</td>
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</tbody>
</table>

**Statement of Problem and Substantiation for Public Comment**

The definition of innerduct has been relocated to Article 100. It should have been deleted from 800.2. It was deleted from 770.2.

**Related Item**

First Revision No. 4511-NFPA 70-2015 [Definition: Innerduct]

**Submitter Information Verification**

<table>
<thead>
<tr>
<th>Submitter Full Name:</th>
<th>ROBERT JENSEN</th>
</tr>
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<tr>
<td>Organization:</td>
<td>DBI-TELECOMMUNICATION INFRASTR</td>
</tr>
<tr>
<td>Affiliation:</td>
<td>BICSI</td>
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**Committee Statement**

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<tr>
<td>Resolution:</td>
<td>SR-4504-NFPA 70-2015</td>
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<tr>
<td>Statement:</td>
<td>The definition of “Innerduct” was relocated to Article 100 in the first revision. Hence, it has been deleted in Section 800.2.</td>
</tr>
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</table>
Public Comment No. 456-NFPA 70-2015 [ Definition: Point of Entrance. ]

Point of Entrance.
The point within a building at which the communications wire or cable emerges from an external wall, or from a concrete floor slab, from rigid metal conduit (RMC), or from intermediate metal conduit (IMC).

Statement of Problem and Substantiation for Public Comment

Panel action on FR 4654 for 800.48 added “The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).”

This action is confusing unless the definition of point of entrance is modified to remove the text about the point of entrance being the point where the cable emerges from the RMC or the IMC.

This PC is offered as an alternative to PC 457. Similar PC are made for Article 770 sections and Article 820 sections.

Related Item
First Revision No. 4654-NFPA 70-2015 [Section No. 800.48]

Submitter Information Verification

Submitter Full Name: ROBERT JENSEN
Organization: DBI-TELECOMMUNICATION INFRASTR
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 28 14:52:48 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-4519-NFPA 70-2015
Statement: A first revision for 800.48 added “The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).” The definition of point of entrance is modified to remove the text about the point of entrance being the point where the cable emerges from the RMC or the IMC.
Public Comment No. 1872-NFPA 70-2015 [Section No. 800.3(F)]

(F) Premises-Powered Broadband Communications Systems.

Article 840 shall apply to premises-powered broadband communications systems. Part VI of Article 840 shall apply to communications equipment and cables that provide both power and communications signals to communications equipment.

Informational Note: Article 840 does not cover circuits such as those providing plain old telephone services (POTS) and similar legacy telecommunications services.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the need for the revisions in 800.3(F) (excluding the addition of the Informational Note). The original sentence already points to the entire article and the additional sentence that points to Part VI is covered in that language. Further consideration should also be given to the need for the Informational Note.

Related Item

First Revision No. 4684-NFPA 70-2015 [Section No. 800.182 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 12:36:03 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4520-NFPA 70-2015
Statement: The second sentence is deleted to conform with NEC Style Manual Section 4.1.1.

The informational note does not provide additional clarity.
(G) Optical Fiber Cable. Where optical fiber cable is used, either in whole or in part, to provide a communications circuit within a building, Article 770 shall apply to the installation of the optical fiber portion of the communications circuit.

(H) Temperature Limitation of Conductors. Section 310.15(A)(3) shall apply.

Statement of Problem and Substantiation for Public Comment

CCCA submitted PI 193 to require temperature marking on cables for the obvious purpose of preventing the overheating of cables. Because Chapter 8 is independent, a reference to 310.15(A)(3) is needed. That section states:

(3) Temperature Limitation of Conductors. No conductor shall be used in such a manner that its operating temperature exceeds that designated for the type of insulated conductor involved. In no case shall conductors be associated together in such a way, with respect to type of circuit, the wiring method employed, or the number of conductors, that the limiting temperature of any conductor is exceeded.

Related Item

Public Input No. 193-NFPA 70-2014 [Section No. 800.179 [Excluding any Sub-Sections]]

Submitter Information Verification

Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 22 14:30:06 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4566-NFPA 70-2015 The PC could not be a straight Accept since it was submitted as a revision to subsection (G).
Statement: A reference to 310.15(A)(3) is necessary to ensure proper temperature limitations of conductors.
800.24 Mechanical Execution of Work.

Communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings, designed and installed so as not to damage the cable. The installation shall also conform to 300.4(D) and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 800.170(C).


Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber communications wire and cable properties.

Statement of Problem and Substantiation for Public Comment

The reference to optical fiber cables in Informational Note No.3 is applicable to 770.24. The appropriate text for 800.24 is “communications wire and cable”.

Related Item
First Revision No. 4651-NFPA 70-2015 [Section No. 800.24]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jul 09 08:54:26 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4522-NFPA 70-2015
Statement: Section 800.24 and Informational Note No. 3 deals with communications cables and wire, not optical fiber cables.
800.24  Mechanical Execution of Work.

Communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings, designed and installed so as not to damage the cable. The installation shall also conform to 300.4(D) and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 800.170(C).


Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2015, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

Statement of Problem and Substantiation for Public Comment

Referenced current editions in informational note 1.

Related Public Comments for This Document

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<td>Public Comment No. 195-NFPA 70-2015 [Section No. 830.24]</td>
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<td>Public Comment No. 196-NFPA 70-2015 [Global Input]</td>
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<tr>
<td>First Revision No. 4651-NFPA 70-2015 [Section No. 800.24]</td>
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<td>First Revision No. 4552-NFPA 70-2015 [Section No. 820.24]</td>
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<tr>
<td>First Revision No. 4594-NFPA 70-2015 [Section No. 830.24]</td>
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Submitter Information Verification

Submitter Full Name: Aaron Adamczyk  
Organization: [Not Specified]  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu Jul 09 11:26:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4503-NFPA 70-2015
Statement: Telecommunications Industry Association (TIA) in its revision process corrected an error in their numbering scheme. Hence the two new parts are ANSI/TIA-568.0-D (generic) and ANSI/TIA-568.1-D (commercial buildings). Current editions of the documents are also provided. Additional TIA standards are added for completeness. The ANSI designation for TIA standards is retained as these standards utilize the ANSI standards development process and should be so designated.
Public Comment No. 72-NFPA 70-2015 [Section No. 800.24]

800.24 Mechanical Execution of Work.

Communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings, designed and installed so as not to damage the cable. The installation shall also conform to 300.4(D) and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 800.170(C).


Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of communications cable properties.

Statement of Problem and Substantiation for Public Comment

This is an editorial Public Comment. The recommended text corrects an apparent copy and paste error. This section deals with communications cables, not optical fiber cables.

Related Public Comments for This Document

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Related Item

First Revision No. 4651-NFPA 70-2015 [Section No. 800.24]

Submitter Information Verification

Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jun 25 22:48:21 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4522-NFPA 70-2015
Statement: Section 800.24 and Informational Note No. 3 deals with communications cables and wire, not optical fiber cables.
(B) Above Roofs.
Communications wires and cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

Exception No. 1: Communications wires and cables shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.

Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (a) not more than 1.2 m (4 ft) of communications service-drop conductors pass above the roof overhang and (b) they are terminated at a through- or above-the-roof raceway or approved support.

Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2012, National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines.
Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]  
Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]  

Related Item  
First Revision No. 4652-NFPA 70-2015 [Section No. 800.44(B)]  

Submitter Information Verification  

Submitter Full Name: Aaron Adamczyk  
Organization: [ Not Specified ]  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu Jun 25 01:26:44 EDT 2015  

Committee Statement  

Committee Action: Rejected but see related SR  
Resolution: SR-4523-NFPA 70-2015  
Statement: C2-2012 was approved by ANSI on June 3, 2011 and is referenced to IEEE. The 2017 edition of the NESC has not yet been adopted.
Underground communications wires and cables entering buildings shall comply with 800.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables.

**Statement of Problem and Substantiation for Public Comment**

I reach out to the inspector members article 800 which is intended to be a stand alone article and not be associated with other articles such as 725 and others. As you define Communication as "the circuit that extends voice, video, data, interactive services, telegraph, outside wiring for "fire alarm and burglar alarm from the communication utility to the "customers communications equipment up to and including terminal equipment. Try and explain to a contractor what this does and does not include. Actually being an inspector for 15 years I personally cannot distinguish the difference from communication circuits which is a class 2 and 3 supply and what only is a circuit from NEC 725. I do know that data is more and more important as the codes reflect. Not requiring a wet location listing because Belden doesn't list theirs appears to be a lapse in judgment. Please reconsider

Communication wires can be as important if not more important for the safe guarding of persons and property that line voltage. In today's world of technology it is so obvious that communication cables carry critical information and needs to be protected. The language that was added in the 2011 was to exclude the wiring from having to have a "wet location" listing. I would hope that the committee would listen to an electrical inspector for 14 years in stating that this was an ill advised change with compounding consequences. Reading the scope of article 800 Communication is a very broad area. In the definitions for Communication Circuit = the circuit that extends voice, audio, video, data, interactive services, outside wiring for fire alarm and burglar alarm from the communication utility to the customers communication equipment up to and including terminal equipment such as telephone, fax or answering machine. With today's technology, state of the art equipment is very dependent on low voltage communication circuits. Health care is so concerned about the communication rooms that they are treated like an island, NFPA 99 mandates that no other piping can be located under the slab or ran through the room unless it is terminated for that room. Data centers that control the worlds financing, electrical grid ,water , gas and oil piping is all communicated with low voltage communication wiring.

As a code making panel member you can try to justify that fire alarm and other low volt systems have their own article, but I am here to state with certainty that article 800 can be argued for all these cables and to justify not having to install 'wet location cable” Removing the language for the 2017 code that was inserted in 2011 will give all manufacturers plenty of time to have their cables listed for a wet location. If you were to question 100 active electricians and asked them to identify the cable going from a UPS or information technology room they would reply a communication cable” Low voltage cables is too important in today's industry to have this language excluding the requirements for the cable to be listed “wet location”. I inspect data centers that control finances, satellite dishes that control much more than your tv, hospitals that communicate blood type and water treatment plants that rely on data. When 800.47 inserted the words 310.10(C) shall not apply installers have taken that as a free pass. Please correct this wrong. This same code panel felt justified to insert “circuit integrity cables” into this article. It appears troublesome to have the original proposal stating that because they did not have a cable listed for wet location there should be an exception for it. Best Regards, I do have actual data of cables failing because of water immersion in a pipe underground and causing major down time for satellite dishes communications on a very large level. Feel free to contact me for specifics.

**Related Item**

Public Input No. 2661-NFPA 70-2014 [Section No. 800.47 [Excluding any Sub-Sections]]

Submitter Information Verification

**Submitter Full Name:** James Dorsey
**Organization:** Douglas county
**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Fri Sep 25 10:37:16 EDT 2015

Committee Statement
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<tr>
<td>Resolution:</td>
<td>Section 310.10(C) addresses conductors other than communications. The section is not applicable to communications circuits.</td>
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</table>
800.48 Unlisted Cables Entering Buildings.

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 800.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4654.

Related Item

First Revision No. 4654-NFPA 70-2015 [Section No. 800.48]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 12:37:06 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4524-NFPA 70-2015
Statement: The text is appropriate as a requirement. According to the NEC Style Manual Section 3.1.3, informational notes shall not be written in mandatory language and shall not contain requirements, make interpretations, or make recommendations. The proposed informational Note 3 is superfluous based on changes made to the mandatory text.

This second revision reflects the CC concerns on the ballot comments and PC-190 concerns regarding the committee statement for FR-4654.
800.48 Unlisted Cables Entering Buildings.

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 800.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

Informational Note No. 3: The point of entrance may be extended further into the building by continuing to enclose the entrance cable in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Statement of Problem and Substantiation for Public Comment

The proposed added text “The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC)” is a cumbersome and run-on sentence that is both confusing and redundant. The definition, “point of entrance”, currently and adequately defines RMC and IMC as acceptable vehicles establishing the point of entrance. If the Panel feels it is necessary to further clarify the use of RMC and IMC, greater clarity is provided by a simple Informational Note.

Related Item
First Revision No. 4654-NFPA 70-2015 [Section No. 800.48]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 09 09:02:42 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4524-NFPA 70-2015
Statement: The text is appropriate as a requirement. According to the NEC Style Manual Section 3.1.3, informational notes shall not be written in mandatory language and shall not contain requirements, make interpretations, or make recommendations. The proposed informational Note 3 is superfluous based on changes made to the mandatory text.

This second revision reflects the CC concerns on the ballot comments and PC-190 concerns regarding the committee statement for FR-4654.
800.48  Unlisted Cables Entering Buildings.

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 800.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

Statement of Problem and Substantiation for Public Comment

FR 4654 and the First Draft Report text doesn’t agree with the Committee Statement. There is no text providing clarification that rigid polyvinyl chloride conduit and electrical metallic tubing containing unlisted outside plant cable are not permitted to be installed in risers, air ducts or plenums.

Related Item
First Revision No. 4654-NFPA 70-2015 [Section No. 800.48]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN  
Organization: TELCORDIA TECHNOLOGIES ERICSSON  
Affiliation: ATIS  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu Jul 09 09:12:19 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR  
Resolution: SR-4524-NFPA 70-2015  
Statement: The text is appropriate as a requirement. According to the NEC Style Manual Section 3.1.3, informational notes shall not be written in mandatory language and shall not contain requirements, make interpretations, or make recommendations. The proposed Informational Note 3 is superfluous based on changes made to the mandatory text.

This second revision reflects the CC concerns on the ballot comments and PC-190 concerns regarding the committee statement for FR-4654.
800.48 Unlisted Cables Entering Buildings.

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 800.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

Informational Note No. 3: Continuously enclosing entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) extends the point of entrance from penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Statement of Problem and Substantiation for Public Comment

The added text about extending the point of entrance was recommended to be an informational note in PI 1566. If the panel had adopted that recommendation, it would have avoided the confusion of permitting the extension of the point of entrance by using RMC or IMC when the point of entrance is already defined as the point emergence from RMC or IMC.

This PC is offered as an alternative to PC 456. Similar PC are made for Article 770 sections and Article 820 sections.

Related Item

First Revision No. 4654-NFPA 70-2015 [Section No. 800.48]

Submitter Information Verification

Submitter Full Name: ROBERT JENSEN
Organization: DBI-TELECOMMUNICATION INFRASTR
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 28 14:57:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4524-NFPA 70-2015
Statement: The text is appropriate as a requirement. According to the NEC Style Manual Section 3.1.3, informational notes shall not be written in mandatory language and shall not contain requirements, make interpretations, or make recommendations. The proposed informational Note 3 is superfluous based on changes made to the mandatory text.

This second revision reflects the CC concerns on the ballot comments and PC-190 concerns regarding the committee statement for FR-4654.
800.49 Metallic Entrance Conduit Grounding.

Metallic conduit containing Rigid metal conduit (RMC) or intermediate metal conduit (IMC) containing communications entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode in accordance with 800.100(B).

Statement of Problem and Substantiation for Public Comment

Section 800.49 is specific to metallic entrance conduit grounding. The only types of metallic entrance conduit permitted are RMC and IMC. Hence, in this section we are dealing only with RMC and IMC. While it is true that all metallic conduit should be grounded, such a general statement here may mislead the reader to incorrectly conclude that other types of metallic conduit may be used as entrance conduit.

Related Item

First Revision No. 4655-NFPA 70-2015 [Section No. 800.49]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 09 09:18:19 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Other types of metal conduit besides RMC and IMC are permitted to be used as entrance conduit. All metal conduit is required to be bonded and grounded.
Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]

(A) Application.
A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block. Also, a listed primary protector shall be provided on each circuit, aerial or underground, located within the block containing the building served so as to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground. In addition, where there exists a lightning exposure, each interbuilding circuit on a premises shall be protected by a listed primary protector at each end of the interbuilding circuit. Installation of primary protectors shall also comply with 110.3(B).

Informational Note No. 1: On a circuit not exposed to accidental contact with power conductors, providing a listed primary protector in accordance with this article helps protect against other hazards, such as lightning and above-normal voltages induced by fault currents on power circuits in proximity to the communications circuit.

Informational Note No. 2: Interbuilding circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Interbuilding cable runs of 42 m (140 ft) or less, directly buried or in underground conduit, where a continuous metallic cable shield or a continuous metallic conduit containing the cable is connected to each building grounding electrode system.
3. Areas having an average of five or fewer thunderstorm days per year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note: For information on lightning protection systems, see NFPA 780-2014, Standard for the Installation of Lightning Protection Systems.

(i) Fuseless Primary Protectors.
Fuseless-type primary protectors shall be permitted under any of the conditions given in (A)(1)(a) through (A)(1)(e).

(a) Where conductors enter a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safety fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

(b) Where insulated conductors in accordance with 800.50(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground, safety fuse on all currents greater than the current-carrying capacity of the primary protector, or the associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(c) Where insulated conductors in accordance with 800.50(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where (1) the primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members, and (2) the connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safety fuse on all currents greater than the current-carrying capacity of the primary protector, or associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(d) Where insulated conductors in accordance with 800.50(A) are used to extend circuits to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground

(e) Where insulated conductors in accordance with 800.50(A) are used to extend circuits to a building from cable with an effectively grounded metallic sheath member(s), and where (1) the combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s), and (2) the insulated conductors safety fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

Informational Note: Section 9 of ANSI of IEEE, C2-2012, National Electrical Safety Code, provides an example of methods of protective grounding that can achieve effective grounding of communications cable sheaths for cables from which communications circuits are extended.

(2) Fused Primary Protectors.
Where the requirements listed under 800.90(A)(1) (a) through (A)(1)(e) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each line conductor and ground, a fuse in series with each line conductor, and an appropriate mounting arrangement. Primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.
Referenced correct SDO in informational note for (1) (e).

Related Public Comments for This Document

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Related Item

First Revision No. 4657-NFPA 70-2015 [Section No. 800.90(A)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: Not Specified
Street Address: [ Not Specified ]
City:
State:
Zip:
Submittal Date: Thu Jun 25 01:32:47 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4525-NFPA 70-2015
| Statement: | C2-2012 was approved by ANSI on June 3, 2011 and is referenced to IEEE. |
Public Comment No. 379-NFPA 70-2015 [Section No. 800.110(A)(2)]

(2) Communications Raceways.
Communications wires and cables shall be permitted to be installed in plenum communications raceways, riser communications raceways and general-purpose communications raceways selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

Statement of Problem and Substantiation for Public Comment

This is an editorial Public Comment. The recommended text deletes a superfluous comma after “riser communications raceways”.

Related Public Comments for This Document

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<thead>
<tr>
<th>Related Comment</th>
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<td>Public Comment No. 380-NFPA 70-2015 [Section No. 800.110(C)] [Excluding any Sub-Sections]</td>
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<td>First Revision No. 4664-NFPA 70-2015 [Section No. 800.110(A)(2)]</td>
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Submitter Information Verification

Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 05 08:49:23 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The serial commas are editorially correct.
Public Comment No. 380-NFPA 70-2015 [Section No. 800.110(C) [Excluding any Sub-Sections]]

Communications wires and cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.110(C)(1) and (C)(2) and 800.113.

Statement of Problem and Substantiation for Public Comment

This is an editorial Public Comment. The recommended text deletes a superfluous comma after “riser cable routing assemblies”.

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Submitter Information Verification

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<tr>
<th>Submitter Full Name</th>
<th>DAVID KIDDOO</th>
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<tr>
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<td>Wed Aug 05 08:52:39 EDT 2015</td>
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Committee Statement

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<td>Resolution</td>
<td>The serial commas are editorially correct.</td>
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</table>
(C) Other Spaces Used for Environmental Air (Plenums).

The following wires, cables, raceways, and cable routing assemblies shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Type CMP cables
2. Plenum communications raceways
3. Plenum cable routing assemblies
4. Type CMP cables installed in plenum communications raceways
5. Type CMP cables installed in plenum cable routing assemblies
6. Type CMP cables and plenum communications raceways supported by open metallic cable trays or cable tray systems
7. Types CMP, CMR, CMG, CM, and CMX cables and communications wires installed in raceways that are installed in compliance with 300.22(C)
8. Types CMP, CMR, CMG, CM, and CMX cables, plenum communications raceways, riser communications raceways, and general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)
9. Types CMP, CMR, CMG, CM, and CMX cables installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

Informational Note: For information on fire protection of wiring installed in other spaces used for environmental air, see 4.3.11.2, 4.3.11.4, and 4.3.11.5 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems.

Statement of Problem and Substantiation for Public Comment

This is an editorial Public Comment. The recommended text deletes a superfluous comma after "raceways" twice.

Related Public Comments for This Document

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Related Item

First Revision No. 4668-NFPA 70-2015 [Section No. 800.113(C)]

Submitter Information Verification

Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Aug 05 08:59:53 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The serial commas are editorially correct.
Public Comment No. 382-NFPA 70-2015 [Section No. 800.113(D)]

(D) Risers — Cables, Raceways, and Cable Routing Assemblies in Vertical Runs.

The following cables, raceways, and cable routing assemblies shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

1. Types CMP and CMR cables
2. Plenum and riser communications raceways
3. Plenum and riser cable routing assemblies
4. Types CMP and CMR cables installed in:
   5. Plenum communications raceways
   6. Riser communications raceways
   7. Plenum cable routing assemblies
   8. Riser cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

Statement of Problem and Substantiation for Public Comment

This is an editorial Public Comment. The recommended text deletes a superfluous comma after “raceways”.

Related Public Comments for This Document

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<td>Public Comment No. 380-NFPA 70-2015 [Section No. 800.110(C) [Excluding any Sub-Sections]]</td>
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<td>Public Comment No. 381-NFPA 70-2015 [Section No. 800.113(C)]</td>
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Related Item
First Revision No. 4669-NFPA 70-2015 [Section No. 800.113(D)]

Submitter Information Verification

Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Aug 05 09:03:37 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The serial commas are editorially correct.
Risers — Cables and Innerducts in Metal Raceways.

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

1. Types CMP, CMR, CMG, CM, and CMX cables
2. Plenum, riser, and general-purpose communications raceways
3. Types CMP, CMR, CMG, CM, and CMX cables installed in:
   a. Plenum communications raceways (innerduct)
   b. Riser communications raceways (innerduct)
   c. General-purpose communications raceways (innerduct)

Informational Note: See 800.26 for firestop requirements for floor penetrations.

Statement of Problem and Substantiation for Public Comment

The Committee Statement for FR 4670 does not agree with the text of the First Draft Report. The text "used as innerduct" was not added to the title.

Related Item

First Revision No. 4670-NFPA 70-2015 [Section No. 800.113(E)]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 09 13:25:03 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: While the exact text “used as innerduct” is not incorporated in the title, the First Revision text meets the objective of addressing cables and innerduct in metallic raceways. Hence, no text change is necessary to 800.113(E) title.
Other Building Locations.

The following wires, cables, raceways, and cable routing assemblies shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

1. Types CMP, CMR, CMG, and CM cables

2. A maximum of 3 m (10 ft) of exposed Type CMX in nonconcealed spaces

3. Plenum, riser, and general-purpose communications raceways

4. Plenum, riser, and general-purpose cable routing assemblies

5. Communications wires and Types CMP, CMR, CMG, and CM cables installed in:
   6. Plenum communications raceways
   7. Riser communications raceways
   8. General-purpose communications raceways

9. Types CMP, CMR, CMG, and CM cables installed in:
   10. Plenum cable routing assemblies
   11. Riser cable routing assemblies
   12. General-purpose cable routing assemblies

13. Communications wires and Types CMP, CMR, CMG, CM, and CMX cables installed in raceways recognized in Chapter 3

14. Type CMUC under-carpet communications wires and cables installed under carpet, or under floor covering, modular tiles, flooring, and planks.

Statement of Problem and Substantiation for Public Comment

This Public Comment is an editorial clarification. The submitter of PI 2616 also submitted PI 2623 to change the name of Type CMUC from “Undercarpet communications wire and cable” to “Under-floor Covering communications wire and cable”. CMP-16 resolved PI 2623 with the statement: “There is no need to change the section title and table and alter the listing requirements in order to accommodate the use of these cables under modular flooring and planks.”

The wording of the Resolution statement for PI 2623 is clear that the intent is to permit installation “under modular flooring and planks” in addition to installation under carpet. Accordingly, this Public Comment recommends text that permits the installation of Type CMUC “under carpet, modular flooring and planks.”

Note that this input has apparently been afflicted with the random underlining bug in the TerraWare software, and is not within the control of the submitter. This comment only deals with the installation of Type CMUC.

Related Public Comments for This Document

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<tr>
<th>Related Comment</th>
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<td>Related Public Comment</td>
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<td>Public Comment No. 222-NFPA 70-2015 [Section No. 800.113(L)]</td>
<td>Related Public Comment</td>
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<td>Public Comment No. 223-NFPA 70-2015 [Section No. 725.135(K)]</td>
<td>Related Public Comment</td>
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<tr>
<td>Public Comment No. 224-NFPA 70-2015 [Section No. 725.135(L)]</td>
<td>Related Public Comment</td>
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Submitter Information Verification
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<tr>
<th><strong>Submitter Full Name:</strong></th>
<th>DAVID KIDDOO</th>
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<tr>
<td><strong>Organization:</strong></td>
<td>CCCA</td>
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<td>Mon Jul 13 20:23:01 EDT 2015</td>
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**Committee Statement**

- **Committee Action:** Accepted
- **Resolution:** SR-4567-NFPA 70-2015
- **Statement:** Modular flooring which is removable is a more appropriate application of under-carpet cables.
<table>
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<tr>
<th>Related Comment</th>
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Submitter Information Verification

Submitter Full Name: DAVID KIDDOO
### Committee Statement

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<td>Statement</td>
<td>Modular flooring which is removable is a more appropriate application of under-carpet cables.</td>
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One- and Two-Family Dwellings.

The following cables, raceways, and cable routing assemblies shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through 800.113(F):

1. Types CMP, CMR, CMG, and CM cables
2. Type CMX cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires and Types CMP, CMR, CMG, and CM cables installed in:
   6. Plenum communications raceways
   7. Riser communications raceways
   8. General-purpose communications raceways
9. Types CMP, CMR, CMG, and CM cables installed in:
   10. Plenum cable routing assemblies
    11. Riser cable routing assemblies
    12. General-purpose cable routing assemblies
13. Communications wires and Types CMP, CMR, CMG, CM, and CMX cables installed in raceways recognized in Chapter 3
14. Type CMUC under-carpet communications wires and cables installed under carpet, modular tiles, flooring, and planks
15. Hybrid power and communications cable listed in accordance with 800.179(I)

Statement of Problem and Substantiation for Public Comment

This Public Comment is an editorial clarification. The submitter of PI 2616 also submitted PI 2623 to change the name of Type CMUC from “Undercarpet communications wire and cable” to “Under-floor Covering communications wire and cable”. CMP-16 resolved PI 2623 with the statement: “There is no need to change the section title and table and alter the listing requirements in order to accommodate the use of these cables under modular flooring and planks.”

The wording of the Resolution statement for PI 2623 is clear that the intent is to permit installation “under modular flooring and planks” in addition to installation under carpet. Accordingly, this Public Comment recommends text that permits the installation of Type CMUC “under carpet, modular flooring and planks”.

Note that this input has apparently been afflicted with the random underlining bug in the TerraWare software, and is not within the control of the submitter. This comment only deals with the installation of Type CMUC.

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**Committee Statement**

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<td><strong>Resolution:</strong></td>
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<tr>
<td><strong>Statement:</strong></td>
<td>Modular flooring which is removable is a more appropriate application of under-carpet cables.</td>
</tr>
</tbody>
</table>
Public Comment No. 378-NFPA 70-2015 [Section No. 800.133(A)(1)]

(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.
(a) Optical Fiber and Communications Cables. Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables of any of the following:
- Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
- Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820
- Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830
(b) Other Circuits. Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables of any of the following:
1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Article 645 or Parts I and III of Article 725
2. Power-limited fire alarm systems in compliance with Parts I and III of Article 760
3. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
4. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820
5. Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830
(c) Class 2 and Class 3 Circuits. Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same cable with communications circuits, in which case the Class 2 and Class 3 circuits shall be classified as communications circuits and shall meet the requirements of this article. The cables shall be listed as communications cables.

Exception: Cables constructed of individually listed Class 2, Class 3, and communications cables under a common jacket shall not be required to be classified as communications cable. The fire-resistance rating of the composite cable shall be determined by the performance of the composite cable.
(d) Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications in Raceways, Compartment, and Boxes. Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

Exception No. 1: Section 800.133(A)(1) shall not apply if all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are separated from all of the conductors of communications circuits by a permanent barrier or listed divider.

Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (1/4 in.) separation from the communications circuit conductors.

Exception No. 3: As permitted by 620.36.

Statement of Problem and Substantiation for Public Comment

This section was separated into two parts in the 2011 NEC because cable routing assemblies were not recognized in Articles 725 and 760. Now that there are consistent provisions for cable routing assemblies in Articles 725, 760, 800, 820 & 830, it is no longer necessary to subdivide the section. CMP 16 created similar First Revisions in Articles 770 (FR 4540), 820 (FR4578) and 830 (FR4645).

This Public Comment basically recommends acceptance of PI 190.

Related Item
Public Input No. 190-NFPA 70-2014 [Section No. 800.133(A)(1)]

Submitter Information Verification
Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address: City: State: Zip:
Submittal Date: Wed Aug 05 08:42:25 EDT 2015
<table>
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<td><strong>Resolution:</strong></td>
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<td><strong>Statement:</strong></td>
</tr>
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</table>
800.154 Applications of Listed Communications Wires, Cables and Raceways, and Listed Cable Routing Assemblies.
Permitted and nonpermitted applications of listed communications wires, cables, and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

1. Listed communications wires and cables as indicated in Table 800.154(a)
2. Listed communications raceways as indicated in Table 800.154(b)
3. Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113. The substitutions for communications cables listed in Table 800.154(d) and illustrated in Figure 800.154 shall be permitted.

Table 800.154(a) Applications of Listed Communications Wires and Cables in Buildings

<table>
<thead>
<tr>
<th>Applications</th>
<th>Wire and Cable Type</th>
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</thead>
<tbody>
<tr>
<td>In ducts specifically fabricated for environmental air as described in 300.22(B)</td>
<td></td>
</tr>
<tr>
<td>In fabricated ducts</td>
<td>CMP N N N N N N N N</td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(B)</td>
<td>Y* Y* Y* Y* N N N Y*</td>
</tr>
<tr>
<td>In other spaces used for environmental air as (plenums) described in 300.22(C)</td>
<td></td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(C)</td>
<td>Y* Y* Y* Y* N N N Y*</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>Y* N N N N N N N</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>Y* N N N N N N Y</td>
</tr>
<tr>
<td>Supported by open metal cable trays</td>
<td>Y* N N N N Y N Y</td>
</tr>
<tr>
<td>Supported by solid bottom metal cable trays with solid metal covers</td>
<td>Y* Y* Y* Y* N N N Y</td>
</tr>
<tr>
<td>In risers</td>
<td></td>
</tr>
<tr>
<td>In vertical runs</td>
<td>Y* Y* Y* N N N N N Y</td>
</tr>
<tr>
<td>In metal raceways</td>
<td>Y* Y* Y* Y* Y* Y* Y* Y</td>
</tr>
<tr>
<td>In fireproof shafts</td>
<td>Y* Y* Y* Y* N N N Y</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>Y* Y* N N N N Y N Y</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>Y* Y* N N N N Y N Y</td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td>Y* Y* N N N N Y N Y</td>
</tr>
<tr>
<td>In riser cable routing assemblies</td>
<td>Y* Y* N N N N N N Y</td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td>Y* Y* Y* Y* N N N Y</td>
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<tr>
<td>Within buildings in other than air-handling spaces and risers</td>
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<tr>
<td>General</td>
<td>Y* Y* Y* Y* Y* Y* Y* Y* Y</td>
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<tr>
<td>In one- and two-family dwellings</td>
<td>Y* Y* Y* Y* Y* Y* Y* Y* Y</td>
</tr>
<tr>
<td>In multifamily dwellings</td>
<td>Y* Y* Y* Y* Y* Y* Y* Y</td>
</tr>
<tr>
<td>In nonconcealed spaces</td>
<td>Y* Y* Y* Y* Y* Y* Y* Y</td>
</tr>
<tr>
<td>Supported by cable trays</td>
<td>Y* Y* Y* N N N N Y</td>
</tr>
<tr>
<td>Under carpet or under floor covering, modular tiles, and planks</td>
<td>N N N Y N Y N Y N</td>
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### Applications of Listed Communications Raceways in Buildings

<table>
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<tr>
<th>Applications</th>
<th>Wire and Cable Type</th>
<th>Communications wires</th>
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<tr>
<td>In distributing frames and cross-connect arrays</td>
<td>CMP, CMR, CMG, CMX</td>
<td>N, N, N</td>
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<tr>
<td>In any raceway recognized in Chapter 3</td>
<td>Y*, Y*, Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>Y*, Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>Y*, Y*, N</td>
<td>Y*</td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td>Y*, Y*, N</td>
<td>Y*</td>
</tr>
<tr>
<td>In riser cable routing assemblies</td>
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<td>Y*</td>
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<tr>
<td>In general-purpose communications raceways</td>
<td>Y*, Y*, N</td>
<td>Y*</td>
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<tr>
<td>In general-purpose cable routing assemblies</td>
<td>Y*, Y*, N</td>
<td>Y*</td>
</tr>
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</table>

Note: An "N" in the table indicates that the cable type is not permitted to be installed in the application. A "Y*" indicates that the cable type is permitted to be installed in the application subject to the limitations described in 800.113.

Informational Note No. 1: Part V of Article 800 covers installation methods within buildings. This table covers the applications of listed communications wires, cables, and raceways in buildings.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

<table>
<thead>
<tr>
<th>Applications</th>
<th>Listed Communications Raceway Type</th>
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<tbody>
<tr>
<td>In ducts specifically fabricated for environmental air as described in 300.22(B)</td>
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<tr>
<td>In fabricated ducts</td>
<td>N</td>
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<tr>
<td>In metal raceway that complies with 300.22(B)</td>
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</tr>
<tr>
<td>In other spaces used for environmental air (plenums) as described in 300.22(C)</td>
<td>Y*</td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(C)</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>N</td>
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<tr>
<td>Supported by open metal cable trays</td>
<td>Y*</td>
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<tr>
<td>Supported by solid bottom metal cable trays with solid metal covers</td>
<td>Y*</td>
</tr>
<tr>
<td>In vertical runs</td>
<td>Y*</td>
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<tr>
<td>In metal raceways</td>
<td>Y*</td>
</tr>
<tr>
<td>In fireproof shafts</td>
<td>Y*</td>
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<tr>
<td>In plenum cable routing assemblies</td>
<td>N</td>
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<td>In riser cable routing assemblies</td>
<td>N</td>
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<td>In one- and two-family dwellings</td>
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<td>Within buildings in other than air-handling spaces and risers</td>
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<td>In one- and two-family dwellings</td>
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<td>In multifamily dwellings</td>
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<tr>
<td>In nonconcealed spaces</td>
<td>Y*</td>
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<tr>
<td>Supported by cable trays</td>
<td>Y*</td>
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<tr>
<td>Under carpet or under floor covering, modular tiles, and planks</td>
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<tr>
<td>In distributing frames and cross-connect arrays</td>
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<td>In any raceway recognized in Chapter 3</td>
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<td>In plenum cable routing assemblies</td>
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</tr>
<tr>
<td>In general-purpose cable routing assemblies</td>
<td>N</td>
</tr>
</tbody>
</table>

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y*” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

<table>
<thead>
<tr>
<th>Applications</th>
<th>Listed Cable Routing Assembly Type</th>
<th>Plenum</th>
<th>Riser</th>
<th>General-Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>In ducts specifically fabricated for environmental air as described in 300.22(B)</td>
<td>In fabricated ducts</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(B)</td>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In other spaces used for environmental air (plenums) as described in 300.22(C)</td>
<td>In metal raceway that complies with 300.22(C)</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Supported by open metal cable trays</td>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Supported by solid bottom metal cable trays with solid metal covers</td>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In vertical runs</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>In metal raceways</td>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In fireproof shafts</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td></td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td></td>
</tr>
</tbody>
</table>

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y*” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the...
Table 800.154(d) Cable Substitutions

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Permitted Substitutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMR</td>
<td>CMP</td>
</tr>
<tr>
<td>CMG, CM</td>
<td>CMP, CMR</td>
</tr>
<tr>
<td>CMX</td>
<td>CMP, CMR, CMG, CM</td>
</tr>
</tbody>
</table>

Figure 800.154 Cable Substitution Hierarchy.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4676.

Related Item
First Revision No. 4676-NFPA 70-2015 [Section No. 800.154]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:38:08 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-4535-NFPA 70-2015
Statement: The sentence "The definition of Point of Entrance is in 800.2." of Informational Note No. 1 to Table 800.154(a) was incorrectly deleted in the First Revision. It is only the third sentence that should be deleted as indicated in the Committee Statement to FR 4676 where it is stated: "It is sufficient that Informational Note No. 1 direct the reader to the definition in 800.2 thus avoiding potential confusion."
Applications of Listed Communications Wires, Cables and Raceways, and Listed Cable Routing Assemblies.
Permitted and nonpermitted applications of listed communications wires, cables, and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

1. Listed communications wires and cables as indicated in Table 800.154(a)
2. Listed communications raceways as indicated in Table 800.154(b)
3. Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113. The substitutions for communications cables listed in Table 800.154(d) and illustrated in Figure 800.154 shall be permitted.

### Table 800.154(a) Applications of Listed Communications Wires and Cables in Buildings

<table>
<thead>
<tr>
<th>Applications</th>
<th>CMP</th>
<th>CMR</th>
<th>CMG</th>
<th>CMX</th>
<th>CMUC</th>
<th>Hybrid power and Communications cables</th>
<th>Communications wires</th>
</tr>
</thead>
<tbody>
<tr>
<td>In ducts specifically fabricated for environmental air as described in 300.22(B)</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(B)</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>In fabricated ducts</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In other spaces used for environmental air as (plenums) described in 300.22(C)</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(C)</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Supported by open metal cable trays</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Supported by solid bottom metal cable trays with solid metal covers</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In risers</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In vertical runs</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In metal raceways</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In fireproof shafts</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In riser cable routing assemblies</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
</tr>
<tr>
<td>General</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
</tr>
<tr>
<td>In multifamily dwellings</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In nonconcealed spaces</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Supported by cable trays</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>
### Applications

<table>
<thead>
<tr>
<th>Applications</th>
<th>CMP</th>
<th>CMR</th>
<th>CMG</th>
<th>CMX</th>
<th>CMUC</th>
<th>Hybrid power and Communications cables</th>
<th>Communications wires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under carpet or under floor covering, modular tiles, and planks</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y*</td>
<td></td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In distributing frames and cross-connect arrays</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>In any raceway recognized in Chapter 3</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>In riser cable routing assemblies</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>In general-purpose communications raceways</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>In general-purpose cable routing assemblies</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y*</td>
</tr>
</tbody>
</table>

Note: An “N” in the table indicates that the cable type is not permitted to be installed in the application. A “Y*” indicates that the cable type is permitted to be installed in the application subject to the limitations described in 800.113.

Informational Note No. 1: Part V of Article 800 covers installation methods within buildings. This table covers the applications of listed communications wires, cables, and raceways in buildings. The definition of **Point of Entrance** is in 800.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

**Table 800.154(b) Applications of Listed Communications Raceways in Buildings**

<table>
<thead>
<tr>
<th>Applications</th>
<th>Listed Communications Raceway Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>In ducts specifically fabricated for environmental air</td>
<td></td>
</tr>
<tr>
<td>as described in 300.22(B)</td>
<td>Plenum</td>
</tr>
<tr>
<td>In fabricated ducts</td>
<td>N</td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(B)</td>
<td>N</td>
</tr>
<tr>
<td>In other spaces used for environmental air</td>
<td></td>
</tr>
<tr>
<td>as described in 300.22(C)</td>
<td></td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(C)</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>Y*</td>
</tr>
<tr>
<td>Supported by open metal cable trays</td>
<td>Y*</td>
</tr>
<tr>
<td>Supported by solid bottom metal cable trays with solid metal covers</td>
<td>Y*</td>
</tr>
<tr>
<td>In vertical runs</td>
<td>Y*</td>
</tr>
<tr>
<td>In metal raceways</td>
<td>Y*</td>
</tr>
<tr>
<td>In fireproof shafts</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>N</td>
</tr>
<tr>
<td>In riser cable routing assemblies</td>
<td>N</td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td>Y*</td>
</tr>
</tbody>
</table>
### Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

<table>
<thead>
<tr>
<th>Applications</th>
<th>Listed Communications Raceway Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plenum</td>
</tr>
<tr>
<td>General</td>
<td>Y*</td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td>Y*</td>
</tr>
<tr>
<td>In multifamily dwellings</td>
<td>Y*</td>
</tr>
<tr>
<td>In nonconcealed spaces</td>
<td>Y*</td>
</tr>
<tr>
<td>Supported by cable trays</td>
<td>Y*</td>
</tr>
<tr>
<td>Plenum</td>
<td>N</td>
</tr>
<tr>
<td>Riser</td>
<td>Y*</td>
</tr>
<tr>
<td>General-Purpose</td>
<td>N</td>
</tr>
</tbody>
</table>

**Note:** An "N" in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A "Y*" indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

### Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

<table>
<thead>
<tr>
<th>Applications</th>
<th>Listed Cable Routing Assembly Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plenum</td>
</tr>
<tr>
<td>In ducts specifically fabricated for environmental air as described in 300.22(B)</td>
<td>In fabricated ducts</td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(B)</td>
<td>N</td>
</tr>
<tr>
<td>In other spaces used for environmental air (plenums) as described in 300.22(C)</td>
<td>In metal raceway that complies with 300.22(C)</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>N</td>
</tr>
<tr>
<td>Supported by open metal cable trays</td>
<td>N</td>
</tr>
<tr>
<td>Supported by solid bottom metal cable trays with solid metal covers</td>
<td>N</td>
</tr>
<tr>
<td>In risers</td>
<td>In vertical runs</td>
</tr>
<tr>
<td>In metal raceways</td>
<td>N</td>
</tr>
<tr>
<td>In fireproof shafts</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>N</td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td>N</td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td>Y*</td>
</tr>
<tr>
<td>General</td>
<td>Y*</td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td>Y*</td>
</tr>
<tr>
<td>In multifamily dwellings</td>
<td>Y*</td>
</tr>
<tr>
<td>In nonconcealed spaces</td>
<td>Y*</td>
</tr>
<tr>
<td>Supported by cable trays</td>
<td>N</td>
</tr>
<tr>
<td>Under carpet or under floor covering, modular tiles, and planks</td>
<td>N</td>
</tr>
<tr>
<td>In distributing frames and cross-connect arrays</td>
<td>Y*</td>
</tr>
<tr>
<td>In any raceway recognized in Chapter 3</td>
<td>N</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>N</td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td>N</td>
</tr>
</tbody>
</table>

**Note:** An "N" in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A "Y*" indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.
Listed Cable Routing Assembly Type

<table>
<thead>
<tr>
<th>Applications</th>
<th>Plenum</th>
<th>Riser</th>
<th>General-Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>raceways</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y*” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

Table 800.154(d) Cable Substitutions

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Permitted Substitutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMR</td>
<td>CMP</td>
</tr>
<tr>
<td>CMG, CM</td>
<td>CMP, CMR</td>
</tr>
<tr>
<td>CMX</td>
<td>CMP, CMR, CMG, CM</td>
</tr>
</tbody>
</table>

Figure 800.154 Cable Substitution Hierarchy.

Statement of Problem and Substantiation for Public Comment

The sentence "The definition of Point of Entrance is in 800.2." of IN No. 1 to Table 800.154(a) is incorrectly deleted. It is only the third sentence that should be deleted as indicated in the Committee Statement to FR 4676 where it is stated: "It is sufficient that IN No. 1 direct the reader to the definition in 800.2 thus avoiding potential confusion." The Committee Statement to FR 4676 also states that Informational Note No. 2 has been revised. The First Draft Report text for Informational Note No. 2 does not reflect any changes as it is identical to the NEC, 2014 Edition.

Related Item
First Revision No. 4676-NFPA 70-2015 [Section No. 800.154]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 09 13:32:21 EDT 2015

Committee Statement

Rejected but see related SR
The sentence "The definition of Point of Entrance is in 800.2." of Informational Note No. 1 to Table 800.154(a) was incorrectly deleted in the First Revision. It is only the third sentence that should be deleted as indicated in the Committee Statement to FR 4676 where it is stated: "It is sufficient that Informational Note No. 1 direct the reader to the definition in 800.2 thus avoiding potential confusion."
800.154 Applications of Listed Communications Wires, Cables and Raceways, and Listed Cable Routing Assemblies.
Permitted and nonpermitted applications of listed communications wires, cables, and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

(1) Listed communications wires and cables as indicated in Table 800.154(a)

(2) Listed communications raceways as indicated in Table 800.154(b)

(3) Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113. The substitutions for communications cables listed in Table 800.154(d) and illustrated in Figure 800.154 shall be permitted. Cables with additional listings that are marked with a suffix shall be permitted to substitute for the basic cable without the suffix. For example, Type CMR-CI is permitted to substitute for Type CMR and Type CMP-LP is permitted to substitute for Type CMP-LP.

Table 800.154(a) Applications of Listed Communications Wires and Cables in Buildings

<table>
<thead>
<tr>
<th>Applications</th>
<th>Wire and Cable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>In ducts specifically fabricated for environmental air as described in 300.22(B)</td>
<td>Wire and Cable Type</td>
</tr>
<tr>
<td>In fabricated ducts</td>
<td></td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(B)</td>
<td></td>
</tr>
<tr>
<td>In other spaces used for environmental air as (plenums) described in 300.22(C)</td>
<td></td>
</tr>
<tr>
<td>In other spaces used for environmental air</td>
<td></td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(C)</td>
<td></td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td></td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td></td>
</tr>
<tr>
<td>Supported by open metal cable trays</td>
<td></td>
</tr>
<tr>
<td>Supported by solid bottom metal cable trays with solid metal covers</td>
<td></td>
</tr>
<tr>
<td>In risers</td>
<td></td>
</tr>
<tr>
<td>In vertical runs</td>
<td></td>
</tr>
<tr>
<td>In metal raceways</td>
<td></td>
</tr>
<tr>
<td>In fireproof shafts</td>
<td></td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td></td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td></td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td></td>
</tr>
<tr>
<td>In riser cable routing assemblies</td>
<td></td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td></td>
</tr>
<tr>
<td>Within buildings in other than air-handling spaces and risers</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td></td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td></td>
</tr>
<tr>
<td>In multifamily dwellings</td>
<td></td>
</tr>
<tr>
<td>In nonconcealed spaces</td>
<td></td>
</tr>
<tr>
<td>Supported by cable trays</td>
<td></td>
</tr>
</tbody>
</table>
### Table 800.154(b) Applications of Listed Communications Raceways in Buildings

<table>
<thead>
<tr>
<th>Applications</th>
<th>Wire and Cable Type</th>
<th>Listed Communications Raceway Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CMP</td>
<td>CMR</td>
</tr>
<tr>
<td>Under carpet or under floor covering, modular tiles, and planks</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In distributing frames and cross-connect arrays</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In any raceway recognized in Chapter 3</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In riser cable routing assemblies</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In general-purpose communications raceways</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In general-purpose cable routing assemblies</td>
<td>Y*</td>
<td>Y*</td>
</tr>
</tbody>
</table>

Note: An “N” in the table indicates that the cable type is not permitted to be installed in the application. A “Y*” indicates that the cable type is permitted to be installed in the application subject to the limitations described in 800.113.

Informational Note No. 1: Part V of Article 800 covers installation methods within buildings. This table covers the applications of listed communications wires, cables, and raceways in buildings.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

Table 800.154(b) Applications of Listed Communications Raceways in Buildings
### Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

<table>
<thead>
<tr>
<th>Applications</th>
<th>Plenum</th>
<th>Riser</th>
<th>General-Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>In ducts specifically fabricated for environmental air as described in 300.22(B)</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In fabricated ducts</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(B)</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In other spaces used for environmental air (plenums) as described in 300.22(C)</td>
<td>Y*</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(C)</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Supported by open metal cable trays</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Supported by solid bottom metal cable trays with solid metal covers</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In vertical runs</td>
<td>Y*</td>
<td>Y*</td>
<td>N</td>
</tr>
<tr>
<td>In metal raceways</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In fireproof shafts</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>General</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In one- and two-family dwellings</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In multifamily dwellings</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In nonconcealed spaces</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>Supported by cable trays</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Under carpet or under floor covering, modular tiles, and planks</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In distributing frames and cross-connect arrays</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>In any raceway recognized in Chapter 3</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>In general-purpose communications raceways</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y*” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.
Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y*” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

Table 800.154(d) Cable Substitutions

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Permitted Substitutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMR</td>
<td>CMG, CM</td>
</tr>
<tr>
<td>CMR, CMP</td>
<td>CMG, CM, CMR</td>
</tr>
<tr>
<td>CMX</td>
<td>CM, CMP, CMR, CMG, CM</td>
</tr>
</tbody>
</table>

Figure 800.154 Cable Substitution Hierarchy.

Statement of Problem and Substantiation for Public Comment

Explicitly permitting cables with a suffix such as Type CMR-CI and Type CMR-LP to substitute for the basic Type CMR adds clarity. While it may be obvious to most members of CMP-16 that these substitutions are permitted, some members of CMP-3 do not necessarily agree. Since CMP-3 permits communications cables to substitute for Class 2 and Class 3 cables in Article 725, adding the recommended clarifying text will help in the correlation of Article 800 with Article 725.

Related Item
Public Input No. 2736-NFPA 70-2014 [Section No. 800.154]

Submitter Information Verification

Submitter Full Name: Terry Peters
Organization: SPI
Affiliation: SPI
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jun 27 10:28:22 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Existing requirements already allow cable substitution. The proposed text does not provide any additional clarification.
Public Comment No. 209-NFPA 70-2015 [Section No. 800.170]

800.170. Equipment.
Communications equipment shall be listed as being suitable for electrical connection to a communications network.


(A) Primary Protectors.
The primary protector shall consist of an arrester connected between each line conductor and ground in an appropriate mounting. Primary protector terminals shall be marked to indicate line and ground as applicable.

Informational Note: One way to determine applicable requirements for a listed primary protector is to refer to ANSI/UL 497-2012, Standard for Protectors for Paired Conductor Communications Circuits.

(B) Secondary Protectors.
The secondary protector shall be listed as suitable to provide means to safely limit currents to less than the current-carrying capacity of listed indoor communications wire and cable, listed telephone set line cords, and listed communications terminal equipment having ports for external wire line communications circuits. Any overvoltage protection, arresters, or grounding connection shall be connected on the equipment terminals side of the secondary protector current-limiting means.

Informational Note: One way to determine applicable requirements for a listed secondary protector is to refer to ANSI/UL 497A-2012, Standard for Secondary Protectors for Communications Circuits.

(C) Plenum Grade Cable Ties.
Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.


Statement of Problem and Substantiation for Public Comment

Referenced current editions.
Removed reference to withdrawn UL 1459.

Related Item
First Revision No. 4677-NFPA 70-2015 [Section No. 800.170]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 11 01:23:12 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4536-NFPA 70-2015
Statement: Referenced UL documents are updated to the current issue and reference to ANSI has been added as applicable.
Communications equipment shall be listed as being suitable for electrical connection to a communications network.


Statement of Problem and Substantiation for Public Comment

Removed withdrawn UL 1459 from the informational note.

Related Item

First Revision No. 4677-NFPA 70-2015 [Section No. 800.170]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Jul 11 00:53:23 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4536-NFPA 70-2015
Statement: Referenced UL documents are updated to the current issue and reference to ANSI has been added as applicable.
(B) Type CMR.

Type CMR communications riser cables shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. Optionally, Type CMR riser cables shall be permitted to be marked as Type CMR ST1 if they are listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor and also listed as exhibiting limited smoke characteristics.

Informational Note 1: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2011, Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.

Informational Note 2: One method of defining optional limited smoke characteristics for riser cables is that the cables exhibit a peak smoke release rate not exceeding 0.40 m²/s and a total smoke released not exceeding 150 m² when tested in accordance with the requirements of CSA, "Vertical Flame Test - Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M-2009, Test Methods for Wires and Cables.

Statement of Problem and Substantiation for Public Comment

Please reconsider the action on this public input and accept the public comment. Smoke obscuration is a key fire safety problem.

The reason that this additional optional listing and informational note are important is that there is no information in any of the test methods for fire propagation of cables how to test for smoke in riser cables. Such information is neither included in UL 1666 nor in CSA FT4 nor in UL 1685. Therefore there can be no standardized way for a manufacturer to demonstrate that a specific type of riser cables has lower smoke than typical riser cables. This is very different from the case of general purpose (or cable tray) cables. Both UL 1685 and CSA FT4 contain information on how to obtain "limited smoke" (meaning reduced smoke) cables that are general purpose cables. Therefore I understand the panel's objections to include optional markings for these cables. However, unless the code provides a systematic and standard way to determine what is a "limited smoke riser cable" the optional markings will not be able to be generated adequately.

A key aspect of wire and cable fire performance is smoke emission since it is well known that lack of visibility and smoke are serious problems in fire. In the NEC there is a designation for "low smoke cables", which are plenum-rated cables. There is also an optional designation of limited smoke cables, which is not required but applies to cable tray cables (tested to UL 1685 or CSA FT4). Riser cables are cables that usually are found in concealed spaces and it would be important to offer an optional marking for limited smoke riser cables, to distinguish them from standard riser cables. This is particularly useful for riser cables because, typically, riser cables are made with insulation and jacket materials that are very similar to CSA FT4 cables and also with materials that do not quite exhibit the smoke characteristics of plenum cables. Therefore, manufacturers of materials who try to achieve a plenum cable rating, and can't quite make it, will often make their material slightly less safe from the point of view of smoke emission, in order to be able to save costs. This new optional marking would permit manufacturers to provide cables with both limited smoke and the flame spread characteristics of riser cable. The choice of criterion for the limited smoke riser cables (and the choice of designation) is based on the ST1 designation associated with the CSA FT4 test, when smoke emission is assessed.

This public comment is being proposed for all instances of riser cables and not public comment is proposed for optional markings of general purpose cables.

Related Item
Public Input No. 1724-NFPA 70-2014 [Section No. 800.179(B)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 15:46:51 EDT 2015

Committee Statement

Committee Action: Rejected
| **Resolution:** | Optional marking is permitted. In reference to the informational note, it is inappropriate to include references to products that do not have a need for specific application rules or products that are permitted but not required by the NEC. |
Cable routing assemblies and communications raceways shall be listed in accordance with 800.182(A) through (C). Cable routing assemblies shall be marked in accordance with Table 800.182(a). Communications raceways shall be marked in accordance with Table 800.182(b).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-5-2015, *Cable Routing Assemblies and Communications Raceways*.

### Table 800.182(a) Cable Routing Assembly Markings

<table>
<thead>
<tr>
<th>Type</th>
<th>Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plenum Cable Routing Assembly</td>
<td>Plenum Cable Routing Assembly</td>
</tr>
<tr>
<td>Riser Cable Routing Assembly</td>
<td>Riser Cable Routing Assembly</td>
</tr>
<tr>
<td>General-Purpose Cable Routing Assembly</td>
<td>General-Purpose Cable Routing Assembly</td>
</tr>
</tbody>
</table>

### Table 800.182(b) Communications Raceway Markings

<table>
<thead>
<tr>
<th>Type</th>
<th>Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plenum Communications Raceway</td>
<td>Plenum Communications Raceway</td>
</tr>
<tr>
<td>Riser Communications Raceway</td>
<td>Riser Communications Raceway</td>
</tr>
<tr>
<td>General-Purpose Communications Raceway</td>
<td>General-Purpose Communications Raceway</td>
</tr>
</tbody>
</table>

## Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4684.

**Related Item**

First Revision No. 4684-NFPA 70-2015 [Section No. 800.182 [Excluding any Sub-Sections]]

## Submitter Information Verification

**Submitter Full Name:** CC on NEC-AAC  
**Organization:** NFPA  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Tue Sep 29 12:40:27 EDT 2015

## Committee Statement

**Committee Action:** Rejected  
**Resolution:** The informational note correctly references the current edition of UL 2024.
Public Comment No. 1876-NFPA 70-2015 [Section No. 800.182(A)]

(A) Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-2014, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723-2013, Standard Test Method for Surface Burning Characteristics of Building Materials.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke producing characteristics is that they exhibit a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2015, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4685

Related Item
First Revision No. 4685-NFPA 70-2015 [Section No. 800.182(A)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 12:41:16 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4537-NFPA 70-2015
Statement: The word “plenum” has been added to the title as the section addresses plenum routing assemblies and plenum communications raceways. Informational Note No. 1 is updated to the current edition, ASTM E84-15a.
Public Comment No. 201-NFPA 70-2015 [Section No. 800.182(A)]

(A) Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-2014, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723-2013, Standard Test Method for Surface Burning Characteristics of Building Materials.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke producing characteristics is that they exhibit a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2015, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

Statement of Problem and Substantiation for Public Comment

The title should be "(A) Plenum Cable Routing Assemblies and Plenum Communications Raceways" for consistency with the first paragraph. The word "plenum" prior to "Cable Routing Assemblies" was omitted.

Related Item

First Revision No. 4685-NFPA 70-2015 [Section No. 800.182(A)]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 09 15:18:25 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4537-NFPA 70-2015
Statement: The word “plenum” has been added to the title as the section addresses plenum routing assemblies and plenum communications raceways. Informational Note No. 1 is updated to the current edition, ASTM E84-15a.
Public Comment No. 298-NFPA 70-2015 [Section No. 800.182(A)]

(A) Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-2014, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723-2013, Standard Test Method for Surface Burning Characteristics of Building Materials.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke producing characteristics is that they exhibit a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2015, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

Statement of Problem and Substantiation for Public Comment

This section deals with Plenum Cable Routing Assemblies and Plenum Communications Raceways. The word “Plenum” was omitted. The recommended text corrects that omission.

Related Item
First Revision No. 4685-NFPA 70-2015 [Section No. 800.182(A)]

Submitter Information Verification

Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 25 19:31:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4537-NFPA 70-2015
Statement: The word “plenum” has been added to the title as the section addresses plenum routing assemblies and plenum communications raceways. Informational Note No. 1 is updated to the current edition, ASTM E84-15a.
Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]

(A) Cable Routing Assemblies and Plenum Communications Raceways.
Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-2015, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723-2013, Standard Test Method for Surface Burning Characteristics of Building Materials.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke producing characteristics is that they exhibit a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2015, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

Statement of Problem and Substantiation for Public Comment
In informational note #1 updated ASTM E84 to 2015.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
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<tr>
<td>Public Comment No. 41-NFPA 70-2015 [Section No. 399.10]</td>
<td>Referred current SDO standard name, and edition.</td>
</tr>
<tr>
<td>Public Comment No. 42-NFPA 70-2015 [Section No. Table]</td>
<td>Referred current SDO standard name, and edition.</td>
</tr>
<tr>
<td>Public Comment No. 43-NFPA 70-2015 [Section B.310.15(B)(2)]</td>
<td>Referred current SDO standard name, and edition.</td>
</tr>
<tr>
<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
<td>Referred current SDO standard name, and edition.</td>
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<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
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<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
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<td>Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]</td>
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<td>Public Comment No. 53-NFPA 70-2015 [Section No. 840.44(B)]</td>
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<td>Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]</td>
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<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
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<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
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<tr>
<td>Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]</td>
<td>Referred current SDO standard name, and edition.</td>
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<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
<td>Referred current SDO standard name, and edition.</td>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
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<td>Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]</td>
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<td>Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]</td>
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<td>Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]</td>
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Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-4537-NFPA 70-2015

Statement: The word "plenum" has been added to the title as the section addresses plenum routing assemblies and plenum communications raceways. Informational Note No. 1 is updated to the current edition, ASTM E84-15a.
Public Comment No. 862-NFPA 70-2015 [Section No. 800.182(A)]

(A) Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-15a, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723-2013, Standard Test Method for Surface Burning Characteristics of Building Materials.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke producing characteristics is that they exhibit a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2015, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

Statement of Problem and Substantiation for Public Comment

Standard date update

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<td>Public Comment No. 878-NFPA 70-2015 [Global Input]</td>
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Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name: Marcelo Hirschler</th>
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<tr>
<td>Organization: GBH International</td>
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<td>Street Address:</td>
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<td>Submittal Date: Mon Sep 21 14:47:55 EDT 2015</td>
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Committee Statement

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<thead>
<tr>
<th>Committee Action:</th>
<th>Resolution: SR-4537-NFPA 70-2015</th>
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</table>
810.6  Antenna Lead-In Protectors.

Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL Subject 497E Outline, Outline of Investigation for Protectors for Antenna Lead-In Conductors.

Statement of Problem and Substantiation for Public Comment

Referenced current title of UL 497E.

Related Item

First Revision No. 7505-NFPA 70-2015 [Detail]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
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Committee Statement

Committee Action: Accepted
Resolution: SR-4538-NFPA 70-2015
Statement: The informational note is revised to reflect the current title of UL 479E as “UL 479 E Outline, Outline of Investigation for Protectors for Antenna Lead-In Conductors”.
**Public Comment No. 322-NFPA 70-2015 [Section No. 810.15]**

810.15  **Grounding.**
Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See NFPA 780-2014, *Standard for the Installation of Lightning Protection Systems*, 4.8.3.1 for the theory, the application, of the term “rolling sphere.”

**Statement of Problem and Substantiation for Public Comment**

The use of the word "theory" is misleading because this word implies that a technical study has been performed where mathematical equations are involved. Instead the correct word to be used is "application" because this method was developed based on field applications.

**Related Item**
First Revision No. 4546-NFPA 70-2015 [Section No. 810.15]

**Submitter Information Verification**

Submitter Full Name: WILLIAM MCCOY  
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Submittal Date: Thu Jul 30 11:04:40 EDT 2015

**Committee Statement**

Committee Action: Accepted  
Resolution: SR-4539-NFPA 70-2015  
Statement: Use of the word “application” clarifies the intended purpose of the informational note.
810.15  Grounding.

Masts and metal structures supporting antennas shall be grounded, bonded, in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See NFPA 780-2014, Standard for the Installation of Lightning Protection Systems, 4.8.3.1 for the theory of the term “rolling sphere.”

Statement of Problem and Substantiation for Public Comment

Delete added text for two reasons: (1) does the Code panel really think that the reader of the Code is going to get NFPA 780, learn about lightning protection and the zone of protection? (2) 'bonding' of the metal antenna per 810.21 (which is what we are doing), so change grounding to bonding.

Committee Statement

Committee Action: Rejected
Resolutions: Masts and metal structures supporting antennas, unless within a “zone of protection”, must be grounded to a grounding electrode or grounding electrode system via a grounding electrode conductor. Hence, “grounding” is the correct term. The supporting mast or metal structure may also be bonded to nearby metallic structures via a bonding conductor to prevent arcing and potential electric shock hazard during lightning events. Section 810.21 addresses both bonding conductors and grounding electrode conductors. If the reader of the Code chooses not to investigate the application of the “zone of protection”, they have the option to ground and bond as they would if they were outside the “zone.”
Article 820 - Community Antenna Television and Radio Distribution Systems - Coaxial Cable

Informational Note: See Informational Note Figure 800(a) and Informational Note Figure 800(b) for an illustrative application of a bonding conductor or grounding electrode conductor.

Part I. General

820.1 Scope.

This article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems.

Informational Note: See 90.2(B)(4) for installations of CATV and radio distribution systems that are not covered.

820.2 Definitions.

See Part I of Article 100. For the purposes of this article, the following additional definitions apply.

Abandoned Coaxial Cable.

Installed coaxial cable that is not terminated at equipment other than a coaxial connector and not identified for future use with a tag.

Exposed (to Accidental Contact).

A circuit in such a position that, in case of failure of supports and or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed.

Point of Entrance.

The point within a building at which the coaxial cable emerges from an external wall, from a concrete floor slab, from rigid metal conduit (RMC), or from intermediate metal conduit (IMC).

Premises.

The land and buildings of a user located on the user side of utility-user network point of demarcation.

820.3 Other Articles.

Circuits and equipment shall comply with 820.3(A) through 820.3(I).

(A) Hazardous (Classified) Locations.

CATV equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.

The requirements of 300.22(A) shall apply.

(C) Equipment in Other Space Used for Environmental Air.

The requirements of 300.22(C)(3) shall apply.

(D) Installation and Use.

The requirements of 110.3(B) shall apply.

(E) Installations of Conductive and Nonconductive Optical Fiber Cables.

The requirements of Article 770 shall apply.

(F) Communications Circuits.

The requirements of Article 800 shall apply.

(G) Network-Powered Broadband Communications Systems.

The requirements of Article 830 shall apply.

(H) Premises-Powered Broadband Communications Systems.

The requirements of Article 840 shall apply.

(I) Alternate Wiring Methods.

The wiring methods of Article 830 shall be permitted to substitute for the wiring methods of Article 820.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.
820.15 Power Limitations.
Coaxial cable shall be permitted to deliver power to equipment that is directly associated with the radio frequency distribution system if the voltage is not over 60 volts and if the current is supplied by a transformer or other device that has power-limiting characteristics.

Power shall be blocked from premises devices on the network that are not intended to be powered via the coaxial cable.

820.21 Access to Electrical Equipment Behind Panels Designed to Allow Access.
Access to electrical equipment shall not be denied by an accumulation of coaxial cables that prevents removal of panels, including suspended ceiling panels.

820.24 Mechanical Execution of Work.
Community television and radio distribution systems shall be installed in a neat and workmanlike manner. Coaxial cables installed exposed on the surface of ceiling and sidewalls shall be supported by the building structure in such a manner that the cables will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4(D) and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 800.170(C).


Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of coaxial cable properties.

820.25 Abandoned Cables.
The accessible portion of abandoned coaxial cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

820.26 Spread of Fire or Products of Combustion.
Installations of coaxial cables and communications raceways in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the possible spread of fire or products of combustion will not be substantially increased. Openings around penetrations of coaxial cables and communications raceways through fire-resistant-rated walls, partitions, floors, or ceilings shall be firestopped using approved methods to maintain the fire resistance rating.

Informational Note: Directories of electrical construction materials published by qualified testing laboratories contain many listing installation restrictions necessary to maintain the fire-resistive rating of assemblies where penetrations or openings are made. Building codes also contain restrictions on membrane penetrations on opposite sides of a fire resistance–rated wall assembly. An example is the 600-mm (24-in.) minimum horizontal separation that usually applies between boxes installed on opposite sides of the wall. Assistance in complying with 820.26 can be found in building codes, fire resistance directories, and product listings.

Part II. Coaxial Cables Outside and Entering Buildings

820.44 Overhead (Aerial) Coaxial Cables.
Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93, shall comply with 820.44(A) through 820.44(E).

(A) On Poles and In-Span.
Where coaxial cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 820.44(A)(1) through 820.44(A)(4) shall be met.

(1) Relative Location.
Where practicable, the coaxial cables shall be located below the electric light or power conductors.

(2) Attachment to Cross-Arms.
Coaxial cables shall not be attached to cross-arm that carries electric light or power conductors.

(3) Climbing Space.
The climbing space through coaxial cables shall comply with the requirements of 225.14(D).
Clearance.

Lead-in or overhead (aerial) - drop coaxial cables from a pole or other support, including the point of initial attachment to a building or structure, shall be kept away from electric light, power, Class 1, or non–power-limited fire alarm circuit conductors so as to avoid the possibility of accidental contact.

*Exception: Where proximity to electric light, power, Class 1, or non–power-limited fire alarm circuit conductors cannot be avoided, the installation shall provide clearances of not less than 300 mm (12 in.) from electric light, power, Class 1, or non–power-limited fire alarm circuit conductors. The clearance requirement shall apply at all points along the drop, and it shall increase to 1.0 m (40 in.) at the pole.*

Above Roofs.

Coaxial cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Vertical clearance requirements shall not apply to auxiliary buildings such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications service drop conductors pass above the roof overhang, and (2) they are terminated at a raceway mast or other approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

On Masts.

Overhead (aerial) coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

Between Buildings.

Coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

On Buildings.

Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(E)(1), 820.44(E)(2), and 820.44(E)(3).

(1) Electric Light or Power.

The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non–power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

(2) Other Communications Systems.

Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.

(3) Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between any coaxial cable and lightning conductors.

*Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2012, National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines.*

*Informational Note No. 2: See Section 4.6 of NFPA 780-2014, Standard for the Installation of Lightning Protection Systems, for the calculation of sideflash distance.*

820.47 Underground Coaxial Cables Entering Buildings.

Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B).

(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.

Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.

(B) Direct-Buried Cables and Raceways.

Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.*
820.48 Unlisted Cables Entering Buildings.
Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

820.49 Metallic Entrance Conduit Grounding.
Metallic conduit containing entrance coaxial cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode in accordance with 820.100(B).

Part III. Protection

820.93 Grounding of the Outer Conductive Shield of Coaxial Cables.
Coaxial cables entering buildings or attached to buildings shall comply with 820.93(A) or (B). Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required. For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding block location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between CATV and other metallic systems.

(A) Entering Buildings.
In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of entrance.

(B) Terminating Outside of the Building.
In installations where the coaxial cable is terminated outside of the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of attachment or termination.

(C) Location.
Where installed, a listed primary protector shall be applied on each community antenna and radio distribution (CATV) cable external to the premises. The listed primary protector shall be located as close as practicable to the entrance point of the cable on either side or integral to the ground block.

(D) Hazardous (Classified) Locations.
Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

Exception: As permitted in 501.150, 502.150, and 503.150.

Part IV. Grounding Methods

820.100 Cable Bonding and Grounding.
The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) through (E).

Exception: For communications systems using coaxial cable completely contained within the building (i.e., they do not exit the building) or the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated bonding jumper and a permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.

Informational Note: See 4.8.3.1 of NFPA 780-2014, Standard for the Installation of Lightning Protection Systems, for the theory of the term “rolling sphere.”

(A) Bonding Conductor or Grounding Electrode Conductor.

(1) Insulation.
The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

(2) Material.
The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

(3) Size.
The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. It shall have a current-carrying capacity not less than the outer sheath of the coaxial cable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.
(4) Length.
The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate grounding electrode as specified in 250.52(A)(6), (A)(6), or (A)(7) shall be used, the grounding electrode conductor shall be connected to the separate grounding electrode in accordance with 250.70, and the separate grounding electrode shall be connected to the power grounding electrode system in accordance with 820.100(D).

(5) Run in Straight Line.
The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

(6) Physical Protection.
Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

(B) Electrode.
The bonding conductor or grounding electrode conductor shall be connected in accordance with 820.100(B)(1), 820.100(B)(2), or 820.100(B)(3).

(1) In Buildings or Structures with an Intersystem Bonding Termination.
If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

(2) In Buildings or Structures with Grounding Means.
If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

   (1) The building or structure grounding electrode system as covered in 250.50
   (2) The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
   (3) The power service accessible means external to enclosures using the options identified in the Exception of 250.94. If an intersystem bonding termination is established, all the rules of 250.94 shall apply.
   (4) The nonflexible metallic power service raceway
   (5) The service equipment enclosure
   (6) The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service, or
   (7) The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to an electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means, as described in 820.93, shall be considered accessible.

(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.
If the building or structure served has no intersystem bonding termination or grounding means, as described in 820.100(B)(2), the grounding electrode conductor shall be connected to the nearest one of the following:

   (1) To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4).
   (2) If the building or structure served has no intersystem bonding termination or grounding means, as described in 820.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8). Steam, hot water pipes, or lightning protection system conductors shall not be employed as grounding electrodes for bonding conductors or grounding electrode conductors.

(C) Electrode Connection.
Connections to grounding electrodes shall comply with 250.70.
Bonding of Electrodes.

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the community antenna television system's grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

Exception: At mobile homes as covered in 820.106.

Informational Note No. 1: See 250.60 for connection to a lightning protection system.

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

Shield Protection Devices.

Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

820.103 Equipment Grounding.

Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

820.106 Grounding and Bonding at Mobile Homes.

(A) Grounding.

Grounding shall comply with 820.106(A)(1) and (A)(2).

(1) Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, the coaxial cable shield ground, or surge arrester grounding terminal, shall be connected to a grounding electrode conductor or grounding electrode in accordance with 820.100(B)(3).

(2) Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, the coaxial cable shield ground, or surge arrester grounding terminal, shall be connected to a grounding electrode in accordance with 820.100(B)(3).

(B) Bonding.

The coaxial cable shield grounding terminal, surge arrester grounding terminal, or grounding electrode shall be connected to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under any of the following conditions:

(1) Where there is no mobile home service equipment or disconnecting means as in 820.106(A)

(2) Where the mobile home is supplied by cord and plug

Part V. Installation Methods Within Buildings

820.110 Raceways and Cable Routing Assemblies for Coaxial Cables.

(A) Types of Raceways.

Coaxial cables shall be permitted to be installed in any raceway that complies with either (A)(1) or (A)(2) and in cable routing assemblies installed in compliance with 820.110(C).

(1) Raceways Recognized in Chapter 3.

Coaxial cables shall be permitted to be installed in any raceway included in Chapter 3. The raceways shall be installed in accordance with the requirements of Chapter 3.

(2) Communications Raceways.

Coaxial cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways, selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

(3) Innerduct for Coaxial Cables.

Listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways selected in accordance with the provisions of Table 800.154(b) shall be permitted to be installed as innerduct in any type of listed raceway permitted in Chapter 3.

(B) Raceway Fill for Coaxial Cables.

The raceway fill requirements of Chapters 3 and 9 shall not apply to coaxial cables.

(C) Cable Routing Assemblies.

Coaxial cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

820.113 Installation of Coaxial Cables.

Installation of coaxial cables shall comply with 820.113(A) through (K). Installation of raceways and cable routing assemblies shall comply with 820.110.
Coaxial cables installed in buildings shall be listed.  
Exception: Coaxial cables that are installed in compliance with 820.48 shall not be required to be listed.

Ducts Specifically Fabricated for Environmental Air.
The following cables shall be permitted in ducts specifically fabricated for environmental air as described in 300.22(B) if they are directly associated with the air distribution system:

1. Up to 1.22 m (4 ft) of Type CATVP
2. Types CATVP, CATVR, CATV, and CATVX installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts see 4.3.4.1 and 4.3.11.3.3 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems.

Other Spaces Used For Environmental Air (Plenums).
The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Type CATVP
2. Type CATVP installed in plenum communications raceways
3. Type CATVP installed in plenum cable routing assemblies
4. Type CATVP supported by open metallic cable trays or cable tray systems
5. Types CATVP, CATVR, CATV, and CATVX installed in raceways that are installed in compliance with 300.22(C)
6. Types CATVP, CATVR, CATV, and CATVX supported by solid-bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)
7. Types CATVP, CATVR, CATV, and CATVX installed in plenum communications raceways, riser communications raceways, or general-purpose communications raceways supported by solid-bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

Informational Note: For information on fire protection of wiring installed in other spaces used for environmental air, see 4.3.11.2, 4.3.11.4, and 4.3.11.5 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems.

Risers — Cables in Vertical Runs.
The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

1. Types CATVP and CATVR
2. Types CATVP and CATVR installed in the following:
   3. Plenum communications raceways
   4. Plenum cable routing assemblies
   5. Riser communications raceways
   6. Riser cable routing assemblies

Informational Note: See 820.26 for firestop requirements for floor penetrations.

Risers — Cables and Innerducts in Metal Raceways.
The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

1. Types CATVP, CATVR, CATV, and CATVX
2. Types CATVP, CATVR, CATV, and CATVX installed in the following:
   3. Plenum communications raceways (innerduct)
   4. Riser communications raceways (innerduct)
   5. General-purpose communications raceways (innerduct)

Informational Note: See 820.26 for firestop requirements for floor penetrations.
(F) Risers — Cables in Fireproof Shafts.

The following cables shall be permitted to be installed in fireproof riser shafts with firestops at each floor:

1. Types CATVP, CATVR, CATV, and CATVX
2. Types CATVP, CATVR, and CATV installed in the following:
   3. Plenum communications raceways
   4. Plenum cable routing assemblies
   5. Riser communications raceways
   6. Riser cable routing assemblies
   7. General-purpose communications raceways
   8. General-purpose cable routing assemblies

Informational Note: See 820.26 for firestop requirements for floor penetrations.

(G) Risers — One- and Two-Family Dwellings.

The following cables shall be permitted in one- and two-family dwellings:

1. Types CATVP, CATVR, and CATV
2. Type CATVX less than 10 mm (\(\frac{3}{8}\) in.) in diameter
3. Types CATVP, CATVR, and CATV installed in the following:
   4. Plenum communications raceways
   5. Plenum cable routing assemblies
   6. Riser communications raceways
   7. Riser cable routing assemblies
   8. General-purpose communications raceways
   9. General-purpose cable routing assemblies

Informational Note: See 820.26 for firestop requirements for floor penetrations.

(H) Cable Trays.

The following cables shall be permitted to be supported by cable trays:

1. Types CATVP, CATVR, and CATV
2. Types CATVP, CATVR, and CATV installed in the following:
   3. Plenum communications raceways
   4. Riser communications raceways
   5. General-purpose communications raceways

(I) Distributing Frames and Cross-Connect Arrays.

The following cables shall be permitted to be installed in distributing frames and cross-connect arrays:

1. Types CATVP, CATVR, and CATV
2. Types CATVP, CATVR, and CATV installed in the following:
   3. Plenum communications raceways
   4. Plenum cable routing assemblies
   5. Riser communications raceways
   6. Riser cable routing assemblies
   7. General-purpose communications raceways
   8. General-purpose cable routing assemblies
Other Building Locations.

The following cables shall be permitted to be installed in building locations other than the locations covered in 820.113(B) through (I):

1. Types CATVP, CATVR, and CATV
2. A maximum of 3 m (10 ft) of exposed Type CATVX in nonconcealed spaces
3. Types CATVP, CATVR, and CATV installed in the following:
   4. Plenum communications raceways
   5. Plenum cable routing assemblies
   6. Riser communications raceways
   7. Riser cable routing assemblies
   8. General-purpose communications raceways
   9. General-purpose cable routing assemblies
10. Types CATVP, CATVR, CATV, and CATVX installed in a raceway of a type recognized in Chapter 3

One- and Two-Family and Multifamily Dwellings.

The following cables shall be permitted to be installed in one- and two-family and multifamily dwellings in locations other than those locations covered in 820.113(B) through (I):

1. Types CATVP, CATVR, and CATV
2. Type CATVX less than 10 mm (⅜ in.) in diameter
3. Types CATVP, CATVR, and CATV installed in the following:
   4. Plenum communications raceways
   5. Plenum cable routing assemblies
   6. Riser communications raceways
   7. Riser cable routing assemblies
   8. General-purpose communications raceways
   9. General-purpose cable routing assemblies
10. Types CATVP, CATVR, CATV, and CATVX installed in a raceway of a type recognized in Chapter 3

820.133 Installation of Coaxial Cables and Equipment.

Beyond the point of grounding, as defined in 820.93, the coaxial cable installation shall comply with 820.133(A) and (B).

(A) Separation from Other Conductors.
In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.

(a) Other Circuits. Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following:

(2) Class 2 and Class 3 remote control, signaling, and power-limited circuits in compliance with Article 645 or Parts I and III of Article 725.

(3) Power-limited fire alarm systems in compliance with Parts I and III of Article 760.

(4) Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770.

(5) Communications circuits in compliance with Parts I and V of Article 800.

(6) Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830.

(g) Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits. Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

Exception No. 1: Coaxial cable shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are separated from all of the coaxial cables by a permanent barrier or listed divider.

Exception No. 2: Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (1/4 in.) separation from coaxial cables.

(2) Other Applications.

Coaxial cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.

Exception No. 2: Separation shall not be required where the coaxial cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.

(B) Support of Coaxial Cables.

Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

Exception: Overhead (aerial) spans of coaxial cables shall be permitted to be attached to the exterior of a raceway-type mast intended for the attachment and support of such cables.
820.154 Applications of Listed CATV Cables.
Permitted and nonpermitted applications of listed coaxial cables shall be as indicated in Table 820.154(a). The permitted applications shall be subject to the installation requirements of 820.110 and 820.113. The substitutions for coaxial cables in Table 820.154(b) and illustrated in Figure 820.154 shall be permitted.

Informational Note: The substitute cables in Table 820.154(b) and Figure 820.154 are only coaxial-type cables.

Table 820.154(a) Applications of Listed Coaxial Cables in Buildings

<table>
<thead>
<tr>
<th>Applications</th>
<th>Listed Coaxial Cable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>In ducts specifically fabricated for environmental air as described in 300.22(B)</td>
<td>CATVP: Y*, CATVR: Y*, CATV: N, CATVX: N</td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(B)</td>
<td>CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y*</td>
</tr>
<tr>
<td>In other spaces used for environmental air (plenums) as described in 300.22(C)</td>
<td>CATVP: Y*, CATVR: N, CATV: N, CATVX: N</td>
</tr>
<tr>
<td>In metal raceway that complies with 300.22(C)</td>
<td>CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y*</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>CATVP: Y*, CATVR: N, CATV: N, CATVX: N</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>CATVP: Y*, CATVR: N, CATV: N, CATVX: N</td>
</tr>
<tr>
<td>Supported by open metal cable trays</td>
<td>CATVP: Y*, CATVR: N, CATV: N, CATVX: N</td>
</tr>
<tr>
<td>Supported by solid-bottom metal cable trays with solid metal covers</td>
<td>CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y*</td>
</tr>
<tr>
<td>In risers</td>
<td>CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y*</td>
</tr>
<tr>
<td>In vertical runs</td>
<td>CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y*</td>
</tr>
<tr>
<td>In metal raceways</td>
<td>CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y*</td>
</tr>
<tr>
<td>In fireproof shafts</td>
<td>CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y*</td>
</tr>
<tr>
<td>In plenum communications raceways</td>
<td>CATVP: Y*, CATVR: Y*, CATV: N, CATVX: N</td>
</tr>
<tr>
<td>In plenum cable routing assemblies</td>
<td>CATVP: Y*, CATVR: Y*, CATV: N, CATVX: N</td>
</tr>
<tr>
<td>In riser communications raceways</td>
<td>CATVP: Y*, CATVR: Y*, CATV: N, CATVX: N</td>
</tr>
<tr>
<td>In riser cable routing assemblies</td>
<td>CATVP: Y*, CATVR: Y*, CATV: N, CATVX: N</td>
</tr>
<tr>
<td>In one- and two- family dwellings</td>
<td>CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y*</td>
</tr>
<tr>
<td>In general-purpose communications raceways</td>
<td>CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y*</td>
</tr>
<tr>
<td>In general-purpose cable routing assemblies</td>
<td>CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y*</td>
</tr>
</tbody>
</table>

Within buildings in other than air-handling spaces and risers

| General                                                                       | CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y* |
| In one- and two-family dwellings                                             | CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y* |
| In multifamily dwellings                                                     | CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y* |
| In nonconcealed spaces                                                       | CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y* |
| Supported by cable trays                                                     | CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: N |
| In distributing frames and cross-connect arrays                              | CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: N |
| In any raceway recognized in Chapter 3                                       | CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: Y* |
| In plenum communications raceways                                             | CATVP: Y*, CATVR: Y*, CATV: N, CATVX: N |
| In plenum cable routing assemblies                                            | CATVP: Y*, CATVR: Y*, CATV: N, CATVX: N |
| In riser communications raceways                                             | CATVP: Y*, CATVR: Y*, CATV: N, CATVX: N |
| In riser cable routing assemblies                                            | CATVP: Y*, CATVR: Y*, CATV: N, CATVX: N |
| In general-purpose communications raceways                                    | CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: N |
| In general-purpose cable routing assemblies                                   | CATVP: Y*, CATVR: Y*, CATV: Y*, CATVX: N |

Note: An “N” in the table indicates that the cable type is not permitted to be installed in the application. A “Y*” indicates that the cable type is permitted to be installed in the application, subject to the limitations described in 820.113.

Informational Note No. 1: Part V of Article 820 covers installation methods within buildings. This table covers the applications of listed coaxial cables in buildings. The definition of Point of Entrance is in 820.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in ducts specifically fabricated for environmental air, see 820.113(B).

Table 820.154(b) Coaxial Cable Uses and Permitted Substitutions

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Permitted Substitutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATVP</td>
<td>CMP, BLP</td>
</tr>
<tr>
<td>CATVR</td>
<td>CATVP, CMP, CMR, BMR, BLP, BLR</td>
</tr>
</tbody>
</table>
Cable Type | Permitted Substitutions
--- | ---
CATV | CATVP, CMP, CATVR, CMR, CMG, CM, BMR, BM, BLP, BLR, BL
CATVX | CATVP, CMP, CATVR, CMR, CATV, CMG, CM, BMR, BM, BLP, BLR, BL, BLX

Figure 820.154 Cable Substitution Hierarchy.

### Part VI. Listing Requirements

#### 820.179 Coaxial Cables.

Cables shall be listed in accordance with 820.179(A) through (D) and marked in accordance with Table 820.179. The cable voltage rating shall not be marked on the cable. Coaxial cables shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of coaxial cables that have a temperature rating exceeding 60°C (140°F).

Informational Note: Voltage markings on cables could be misinterpreted to suggest that the cables may be suitable for Class 1, electric light, and power applications.

**Exception:** Voltage markings shall be permitted where the cable has multiple listings and voltage marking is required for one or more of the listings.

(A) Type CATVP.

Type CATVP community antenna television plenum coaxial cables shall be listed as being suitable for use in ducts, plenums, and other spaces used for environmental air and shall also be listed as having adequate fire-resistant and low smoke-producing characteristics.

Informational Note: One method of defining a cable that is low smoke-producing cable and fire-resistant cable is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2015, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.*

(B) Type CATVR.

Type CATVR community antenna television riser coaxial cables shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*
(C) Type CATV.

Type CATV community antenna television coaxial cables shall be listed as being suitable for general-purpose CATV use, with the exception of risers and plenums, and shall also be listed as being resistant to the spread of fire.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Tray Flame Test" in ANSI/UL 1685-2010, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable.

Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA “Vertical Flame Test — Cables in Cable Trays,” as described in CSA C22.2 No. 0.3-09, Test Methods for Electrical Wires and Cables.

(D) Type CATVX.

Type CATVX limited-use community antenna television coaxial cables shall be listed as being suitable for use in dwellings and for use in raceways and shall also be listed as being resistant to flame spread.

Informational Note: One method of determining that cable is resistant to flame spread is by testing the cable to the VW-1 (vertical-wire) flame test in ANSI/UL 1581-2011, Reference Standard for Electrical Wires, Cables and Flexible Cords.

Table 820.179 Coaxial Cable Markings

<table>
<thead>
<tr>
<th>Cable Marking</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATVP</td>
<td>CATV plenum cable</td>
</tr>
<tr>
<td>CATVR</td>
<td>CATV riser cable</td>
</tr>
<tr>
<td>CATV</td>
<td>CATV cable</td>
</tr>
<tr>
<td>CATVX</td>
<td>CATV cable, limited use</td>
</tr>
</tbody>
</table>

Informational Note: Cable types are listed in descending order of fire resistance rating.

820.180 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, or non–current-carrying metallic members of a cable to a bonding conductor, or grounding electrode conductor, shall be listed or be part of listed equipment.

Statement of Problem and Substantiation for Public Comment

Public input 1293 should have been accepted. When is coaxial cable installed that is not subject to the rules of Article 820? According to the panel, 820 doesn't regulate CCTV installations. Furthermore, the scope of 820 [820.1] clearly states the article covers coaxial cable, with CATV being an example of a location where one could find coaxial cable. "This article covers coaxial cable distribution...typically employed in CATV systems." Reading through 820, the only time you see the letters "CATV" is when those letters are describing coaxial cables. In other rules in the Code, for example 810.3, CATV isn't mentioned, but coaxial cable is.

Related Item
Public Input No. 1293-NFPA 70-2014 [Global Input]

Submitter Information Verification

Submitter Full Name: RYAN JACKSON
Organization: RYAN JACKSON
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:10:54 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel rejects the title change. Article 820 is focused upon the application of coaxial cable with community antenna television and radio distribution systems, typically referred to as “cable TV” or “CATV”. There are other applications of coaxial cable such as communications and broadband systems. Revising the title of Article 820 to state only “Coaxial Cables” would broaden the scope of Article 820 into areas not covered by Article 820, but other Articles within the NEC.
Exposed (to Accidental Contact).
A circuit in such a position that, in case of failure of supports and or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed.

Statement of Problem and Substantiation for Public Comment

The Panel acted on PI 4519 and created FR 4512 that passed ballot. These two items deleted the Informational Note following 820.2, "Exposed (to Accidental Contact)". This is not indicated in the First Draft Report. We do NOT agree with the Panel action to delete the Informational Note. The term “Exposed” has multiple meanings throughout the NEC: uncovered and capable of being touched by persons, susceptible to physical damage, e.g., wiring attached to a surface, susceptible to power influences such as contact or induction, and susceptible to lightning influences, either a direct ‘hit’, induction or ground potential rise. Hence, the Informational Note provides clarity and should be maintained.

Related Item
First Revision No. 4512-NFPA 70-2015 [Definition: Exposed (to Accidental Contact)]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 14 09:54:00 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4556-NFPA 70-2015
Statement: The term “Exposed” has multiple meanings throughout the NEC: uncovered and capable of being touched by persons, susceptible to physical damage, e.g., wiring attached to a surface, susceptible to power influences such as contact or induction, and susceptible to lightning influences, either a direct ‘hit’, induction or ground potential rise. Hence, the informational note provides clarity and should be maintained.
Public Comment No. 458-NFPA 70-2015 [ Definition: Point of Entrance. ]

Point of Entrance.
The point within a building at which the coaxial cable emerges from an external wall or from a concrete floor slab, from rigid metal conduit (RMC), or from intermediate metal conduit (IMC).

Statement of Problem and Substantiation for Public Comment

Panel action on FR 4556 for 820.48 added “The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).”

This action is confusing unless the definition of point of entrance is modified to remove the text about the point of entrance being the point where the cable emerges from the RMC or the IMC.

This PC is offered as an alternative to PC 459. Similar PC are made for Article 770 sections and Article 800 sections.

Related Item
First Revision No. 4556-NFPA 70-2015 [Section No. 820.48]

Submitter Information Verification

Submitter Full Name: ROBERT JENSEN
Organization: DBI-TELECOMMUNICATION INFRASTR
Affiliation: BICSI
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Aug 28 15:10:34 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-4541-NFPA 70-2015
Statement: The definition “Point of Entrance” is simplified and potential confusion is avoided by locating the information regarding the application of rigid metal conduit (RMC) and intermediate metal conduit (IMC) in Section 820.48.
820.24 Mechanical Execution of Work.

Community television and radio distribution systems shall be installed in a neat and workmanlike manner. Coaxial cables installed exposed on the surface of ceiling and sidewalls shall be supported by the building structure in such a manner that the cables will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4(D) and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 800.170(C).


Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of coaxial cable properties.

Statement of Problem and Substantiation for Public Comment

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 195-NFPA 70-2015 [Section No. 830.24]</td>
<td></td>
</tr>
<tr>
<td>Public Comment No. 196-NFPA 70-2015 [Global Input]</td>
<td></td>
</tr>
</tbody>
</table>

Related Item

| First Revision No. 4552-NFPA 70-2015 [Section No. 820.24] |              |
| First Revision No. 4594-NFPA 70-2015 [Section No. 830.24] |              |
| First Revision No. 4651-NFPA 70-2015 [Section No. 800.24] |              |

Submitter Information Verification

submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jul 09 11:33:08 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4503-NFPA 70-2015
Statement: Telecommunications Industry Association (TIA) in its revision process corrected an error in their numbering scheme. Hence the two new parts are ANSI/TIA-568.0-D (generic) and ANSI/TIA-568.1-D (commercial buildings). Current editions of the documents are also provided. Additional TIA standards are added for completeness. The ANSI designation for TIA standards is retained as these standards utilize the ANSI standards development process and should be so designated.
Public Comment No. 202-NFPA 70-2015 [Section No. 820.48]

820.48 Unlisted Cables Entering Buildings.
Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block.

Informational Note: The point of entrance may be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables further into the building by continuing to enclose the entrance cable in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Statement of Problem and Substantiation for Public Comment

The proposed added text "The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC)." is a cumbersome, run-on sentence that is both confusing and redundant. The definition, "point of entrance", currently and adequately defines RMC and IMC as acceptable vehicles establishing the point of entrance. If the Panel feels it is necessary to further clarify the use of RMC and IMC, greater clarity is provided by a simple Informational Note.

Related Item
First Revision No. 4556-NFPA 70-2015 [Section No. 820.48]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 09 15:21:40 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4542-NFPA 70-2015
Statement: The proposed added text clarifies the application of rigid metal conduit (RMC) and intermediate metal conduit (IMC) with unlisted cables entering buildings and eliminates potential confusion by permitting simplification of the definition "Point of Entrance" in 820.2. Inclusion as mandatory text instead of in the informational note permits and facilitates enforcement by the authority having jurisdiction (AHJ).
Public Comment No. 459-NFPA 70-2015 [Section No. 820.48]

820.48 Unlisted Cables Entering Buildings.

Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The information note: Continuously enclosing entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) extends the point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab to the point of emergence from the rigid metal conduit (RMC) or intermediate metal conduit (IMC) by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC).

Statement of Problem and Substantiation for Public Comment

The added text about extending the point of entrance was recommended to be an informational note in PI 1567. If the panel had adopted that recommendation, it would have avoided the confusion of permitting the extension of the point of entrance by using RMC or IMC when the point of entrance is already defined as the point emergence from RMC or IMC.

This PC is offered as an alternative to PC 458. Similar PC are made for Article 770 sections and Article 800 sections.

Related Item

First Revision No. 4556-NFPA 70-2015 [Section No. 820.48]

Submitter Information Verification

Submitter Full Name: ROBERT JENSEN
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Submittal Date: Fri Aug 28 15:13:58 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4542-NFPA 70-2015
Statement: The proposed added text clarifies the application of rigid metal conduit (RMC) and intermediate metal conduit (IMC) with unlisted cables entering buildings and eliminates potential confusion by permitting simplification of the definition "Point of Entrance" in 820.2. Inclusion as mandatory text instead of in the informational note permits and facilitates enforcement by the authority having jurisdiction (AHJ).
Section 820.49 is specific to metallic entrance conduit grounding. The only types of metallic entrance conduit permitted are RMC and IMC. Hence, in this section we are dealing only with RMC and IMC. While it is true that all metallic conduit should be grounded, such a general statement here may mislead the reader to incorrectly conclude that other types of metallic conduit may be used as entrance conduit.

Related Item
First Revision No. 4557-NFPA 70-2015 [Section No. 820.49]

Committee Statement
Committee Action: Rejected
Resolution: Other types of metal conduit besides RMC and IMC are permitted to be used as entrance conduit. All metal conduit is required to be bonded and grounded.
Public Comment No. 1877-NFPA 70-2015 [Section No. 820.100(B)(2)]

(2) In Buildings or Structures with Grounding Means.

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

(1) The building or structure grounding electrode system as covered in 250.50

(2) The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52

(3) The power service accessible means external to enclosures using the options identified in the Exception of 250.94. If an intersystem bonding termination is established, all the rules of 250.94 shall apply.

(4) The nonflexible metallic power service raceway

(5) The service equipment enclosure

(6) The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service, or

(7) The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to an electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means, as described in 820.93, shall be considered accessible.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to review the list items for consistent language. List item 3 is inconsistent with the others.

Related Item
First Revision No. 4651-NFPA 70-2015 [Section No. 800.24]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
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Submittal Date: Tue Sep 29 12:42:13 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4543-NFPA 70-2015
Statement: The Panel has reviewed the list items for consistent language and improved consistency by placing the second sentence of list Item 3 as a requirement outside the list. In list Item 3 the panel recognizes a change in First Revision that separates 250.94 into two subsections A and B.
Coaxial cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways, selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4564.

Related Item
First Revision No. 4564-NFPA 70-2015 [Section No. 820.110(A)(2)]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
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Submittal Date: Tue Sep 29 12:43:13 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The Panel has given further consideration to the comments expressed in voting on FR 4564 and noted that sub-section 820.120(A)(3) is correctly included in the First Draft and SR-4544 puts the text back in the Second Draft.
(3)  Innerduct for Coaxial Cables.

Listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways selected in accordance with the provisions of Table 800.154(b) shall be permitted to be installed as innerduct in any type of listed raceway permitted in Chapter 3.

Statement of Problem and Substantiation for Public Comment

This Public comment is editorial. Superfluous words "the provisions of" have been deleted.

Related Item

First Revision No. 4564-NFPA 70-2015 [Section No. 820.110(A)(2)]
Public Input No. 163-NFPA 70-2014 [Section No. 820.110(A)(2)]
Public Input No. 213-NFPA 70-2014 [New Section after 820.110(A)(2)]

Submitter Information Verification

Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jul 25 19:11:48 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-4544-NFPA 70-2015
Statement: The words "the provisions of" are superfluous and have been deleted.
Public Comment No. 205-NFPA 70-2015 [Section No. 820.113(C)]

(C) Other Spaces Used For Environmental Air (Plenums).
The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Type CATVP
2. Type CATVP installed in plenum communications raceways
3. Type CATVP installed in plenum cable routing assemblies
4. Type CATVP supported by open metallic cable trays or cable tray systems
5. Types CATVP, CATVR, CATV, and CATVX installed in raceways that are installed in compliance with 300.22(C)
6. Types CATVP, CATVR, CATV, and CATVX supported by solid-bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)
7. Types CATVP, CATVR, CATV, and CATVX installed in plenum communications raceways, riser communications raceways, or general-purpose communications raceways supported by solid-bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

Informational Note: For information on fire protection of wiring installed in other spaces used for environmental air, see 4.3.11.2, 4.3.11.4, and 4.3.11.5 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems.

Statement of Problem and Substantiation for Public Comment

The second sentence of the Committee Statement to FR 4569, “The revised text clarifies that the only types of communications raceways and cable routing assemblies permitted must be listed as required in 800.182.” is not supported by the First Draft Report changes.

Related Item
First Revision No. 4569-NFPA 70-2015 [Section No. 820.113(C)]

Submitter Information Verification
Submitter Full Name: JAMES BRUNSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
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Submittal Date: Thu Jul 09 15:49:56 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The Panel has identified a typographical error in the Committee Statement to FR 4569 in that the text “The revised text clarifies that the only types of communications raceways and cable routing assemblies permitted must be listed as required in 800.182.” does not apply to the First Draft revisions to 820.113(C).
820.179  Coaxial Cables.

Cables shall be listed in accordance with 820.179(A) through (D) and marked in accordance with Table 820.179. The cable voltage rating shall not be marked on the cable. Coaxial cables shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of coaxial cables that have a temperature rating exceeding 60°C (140°F).

Informational Note: Voltage markings on cables could be misinterpreted to suggest that the cables may be suitable for Class 1, electric light, and power applications.

Exception: Voltage markings shall be permitted where the cable has multiple listings and voltage marking is required for one or more of the listings.

(A) Type CATVP.

Type CATVP community antenna television plenum coaxial cables shall be listed as being suitable for use in ducts, plenums, and other spaces used for environmental air and shall also be listed as having adequate fire-resistant and low smoke-producing characteristics.

Informational Note: One method of defining a cable that is low smoke-producing cable and fire-resistant cable is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2015, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

(B) Type CATVR.

Type CATVR community antenna television riser coaxial cables shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2011, Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.

(C) Type CATV.

Type CATV community antenna television coaxial cables shall be listed as being suitable for general-purpose CATV use, with the exception of risers and plenums, and shall also be listed as being resistant to the spread of fire.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Tray Flame Test" in ANSI/UL 1685-2010, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables. The smoke measurements in the test method are not applicable.

Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA "Vertical Flame Test — Cables in Cable Trays," as described in CSA C22.2 No. 0.3-09, Test Methods for Electrical Wires and Cables.

(D) Type CATVX.

Type CATVX limited-use community antenna television coaxial cables shall be listed as being suitable for use in dwellings and for use in raceways and shall also be listed as being resistant to flame spread.

Informational Note: One method of determining that cable is resistant to flame spread is by testing the cable to the VW-1 (vertical-wire) flame test in ANSI/UL 1581-2011, Reference Standard for Electrical Wires, Cables and Flexible Cords.

Table 820.179 Coaxial Cable Markings

<table>
<thead>
<tr>
<th>Cable Marking</th>
<th>Type</th>
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<tbody>
<tr>
<td>CATVP</td>
<td>CATV plenum cable</td>
</tr>
<tr>
<td>CATVR</td>
<td>CATV riser cable</td>
</tr>
<tr>
<td>CATV</td>
<td>CATV cable</td>
</tr>
<tr>
<td>CATVX</td>
<td>CATV cable, limited use</td>
</tr>
</tbody>
</table>

Informational Note: Cable types are listed in descending order of fire resistance rating.

Statement of Problem and Substantiation for Public Comment

Referenced current editions.

Related Item

First Revision No. 4581-NFPA 70-2015 [Section No. 820.179]
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4572-NFPA 70-2015 Due to some superfluous underlining of section and sub-section identifying numbers and letters, as well as in Table 820.179 in the PC, the PC could not be accepted as proposed.
Statement: Documents referenced in informational notes to 820.179(B) and (D) have been updated to the current edition.
Type CATVR community antenna television riser coaxial cables shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. Optionally, Type CATVR riser cables shall be permitted to be marked as Type CATVR ST1 if they are listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor and also listed as exhibiting limited smoke characteristics.

Informational Note 1: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2011, Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.

Informational Note 2: One method of defining optional limited smoke characteristics for riser cables is that the cables exhibit a peak smoke release rate not exceeding 0.40 m²/s and a total smoke released not exceeding 150 m² when tested in accordance with the requirements of CSA "Vertical Flame Test - Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M-2009, Test Methods for Wires and Cables.

Statement of Problem and Substantiation for Public Comment

Please reconsider the action on this public input and accept the public comment. Smoke obscuration is a key fire safety problem. The reason that this additional optional listing and informational note are important is that there is no information in any of the test methods for fire propagation of cables how to test for smoke in riser cables. Such information is neither included in UL 1666 nor in CSA FT4 nor in UL 1685. Therefore there can be no standardized way for a manufacturer to demonstrate that a specific type of riser cables has lower smoke than typical riser cables. This is very different from the case of general purpose (or cable tray) cables. Both UL 1685 and CSA FT4 contain information on how to obtain "limited smoke" (meaning reduced smoke) cables that are general purpose cables. Therefore I understand the panel's objections to include optional markings for these cables. However, unless the code provides a systematic and standard way to determine what is a "limited smoke riser cable" the optional markings will not be able to be generated adequately.

A key aspect of wire and cable fire performance is smoke emission since it is well known that lack of visibility and smoke are serious problems in fire. In the NEC there is a designation for "low smoke cables", which are plenum-rated cables. There is also an optional designation of limited smoke cables, which is not required but applies to cable tray cables (tested to UL 1685 or CSA FT4). Riser cables are cables that usually are found in concealed spaces and it would be important to offer an optional marking for limited smoke riser cables, to distinguish them from standard riser cables. This is particularly useful for riser cables because, typically, riser cables are made with insulation and jacket materials that are very similar to CSA FT4 cables and also with materials that do not quite exhibit the flame and smoke characteristics of plenum cables. Therefore, manufacturers of materials who try to achieve a plenum cable rating, and can't quite make it, will often make their material slightly less safe from the point of view of smoke emission, in order to be able to save costs. This new optional marking would permit manufacturers to provide cables with both limited smoke and the flame spread characteristics of riser cable. The choice of criterion for the limited smoke riser cables (and the choice of designation) is based on the ST1 designation associated with the CSA FT4 test, when smoke emission is assessed.

This public comment is being proposed for all instances of riser cables and not public comment is proposed for optional markings of general purpose cables.

Related Item

Public Input No. 1725-NFPA 70-2014 [Section No. 820.179(B)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
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City:
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Submittal Date: Mon Sep 21 15:50:13 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Optional marking is permitted. In reference to the informational note, it is inappropriate to include references to products that do not have a need for specific application rules or products that are permitted but not required by the NEC.
830.1 Scope.
This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data, and interactive services through a network interface unit.

Informational Note 1: A typical basic system configuration includes a cable supplying power and broadband signal to a network interface unit that converts the broadband signal to the component signals. Typical cables are coaxial cable with both broadband signal and power on the center conductor, composite metallic cable with a coaxial member(s) or twisted pair members for the broadband signal and twisted pair members for power, and composite optical fiber cable with a pair of conductors for power. Larger systems may also include network components such as amplifiers that require network power.

Informational Note 2: See 90.2(B)(4) for installations of broadband communications systems that are not covered.

Statement of Problem and Substantiation for Public Comment
Informational Note No. 2 referencing 90.2(B)(4) should not be deleted. It is extremely important, from a communications-provider point of view, that the reader and user of the Code be reminded that there are circumstances under which Article 830 does not apply. The presence of Informational Note No. 2 as contained in this Public Comment will help ensure that AHJs do not erroneously apply the requirements of Article 830 to facilities under the exclusive control of the communications utility.

Related Item
First Revision No. 4588-NFPA 70-2015 [Section No. 830.1]

Submitter Information Verification
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Submittal Date: Mon Jul 20 19:41:33 EDT 2015

Committee Statement
Committee Action: Accepted
Resolution: SR-4546-NFPA 70-2015
Statement: Informational Note No. 2 referencing 90.2(B)(4) should not be deleted. It is extremely important, from a communications-provider point of view, that the reader and user of the Code be reminded that there are circumstances under which Article 830 does not apply.
Exposed (to Accidental Contact):
A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part 1 of Article 100 for two other definitions of Exposed.

Statement of Problem and Substantiation for Public Comment

The term “Exposed” has multiple meanings throughout the NEC: uncovered and capable of being touched by persons, susceptible to physical damage, e.g., wiring attached to a surface, susceptible to power influences such as contact or induction, and susceptible to lightning influences, either a direct ‘hit’, induction or ground potential rise. Hence, the Informational Note provides clarity and should be maintained.

Related Item
First Revision No. 4590-NFPA 70-2015 [Definition: Exposed (to Accidental Contact).]

Submitter Information Verification
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Submittal Date: Mon Jul 13 16:07:46 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-4547-NFPA 70-2015
Statement: The term “exposed” has multiple meanings throughout the NEC: uncovered and capable of being touched by persons, susceptible to physical damage, e.g., wiring attached to a surface, susceptible to power influences such as contact or induction, and susceptible to lightning influences, either a direct ‘hit’, induction or ground potential rise. Hence, the informational note provides clarity and has been maintained.
Public Comment No. 195-NFPA 70-2015 [Section No. 830.24]

830.24 Mechanical Execution of Work.

Network-powered broadband communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4(A), (D), (E), (F), and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 800.170(C).


Informational Note No. 2: See 4.3.11.2.6.5 and 4.3.11.5.5.6 of NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of network-powered broadband cable properties.

Statement of Problem and Substantiation for Public Comment

Referenced current editions of standards in informational note 1.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
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</table>

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
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Submittal Date: Thu Jul 09 11:36:58 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4503-NFPA 70-2015
Statement: Telecommunications Industry Association (TIA) in its revision process corrected an error in their numbering scheme. Hence the two new parts are ANSI/TIA-568.0-D (generic) and ANSI/TIA-568.1-D (commercial buildings). Current editions of the documents are also provided. Additional TIA standards are added for completeness. The ANSI designation for TIA standards is retained as these standards utilize the ANSI standards development process and should be so designated.
Public Comment No. 52-NFPA 70-2015 [ Section No. 830.44(C) ]

(C) Clearance from Ground.

Overhead (aerial) spans of network-powered broadband communications cables shall conform to not less than the following:

1. 2.9 m (9 1/2 ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only

2. 3.5 m (11 1/2 ft) — over residential property and driveways, and those commercial areas not subject to truck traffic

3. 4.7 m (15 1/2 ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-2012, National Electrical Safety Code, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 800 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant.

Statement of Problem and Substantiation for Public Comment

Referenced correct SDO in the informational note after (3).

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tr>
<td>Public Comment No. 42-NFPA 70-2015 [Section No. Table]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 43-NFPA 70-2015 [Section No. B.310.15(B)(2)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 53-NFPA 70-2015 [Section No. 840.44(B)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
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<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 107-NFPA 70-2015 [Section No. Table]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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Public Comment No. 111-NFPA 70-2015 [Section No. 505.2]
Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]
Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]

Related Item
First Revision No. 4596-NFPA 70-2015 [Section No. 830.44(C)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jun 25 02:16:54 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4548-NFPA 70-2015
Statement: C2-2012 was approved by ANSI on June 3, 2011 and is referenced to IEEE.

C2-2012 was approved by ANSI on June 3, 2011 and is referenced to IEEE.
(B) Direct-Buried Cables and Raceways.

Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in.) from conductors of any light, power, non-power-limited fire alarm circuit conductors or Class 1 circuit.

Exception No. 1: Direct-buried network-powered broadband communications cables shall not be required to be separated by at least 300 mm (12 in.) from conductors of any light, power, non-power-limited fire alarm circuit conductors or Class 1 circuit. Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.

Exception No. 2: Direct-buried network-powered broadband communications cables. Separation shall not be required to be separated by at least 300 mm (12 in.) from conductors of any light, power, non-power-limited fire alarm circuit conductors or Class 1 circuit where electric light or power branch-circuit or feeder conductors, non-power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.

Statement of Problem and Substantiation for Public Comment

The text for both Exceptions 1 and 2 may be greatly simplified by stating: "Separation shall not be required where .....".

Related Item

First Revision No. 4600-NFPA 70-2015 [Section No. 830.47(B)]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
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City:
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Zip:
Submittal Date: Mon Jul 13 16:15:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4549-NFPA 70-2015
Statement: The text for both Exceptions 1 and 2 is simplified by stating: "Separation shall not be required where .....".
830.49 Metallic Entrance Conduit Grounding.

Metallic conduit, Rigid metal conduit (RMC) or intermediate metal conduit (IMC), containing network-powered broadband communications entrance cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode in accordance with 830.100(B).

Statement of Problem and Substantiation for Public Comment

Section 830.49 is specific to metallic entrance conduit grounding. The only types of metallic entrance conduit permitted are RMC and IMC. Hence, in this section we are dealing only with RMC and IMC. While it is true that all metallic conduit should be grounded, such a general statement here may mislead the reader to incorrectly conclude that other types of metallic conduit may be used as entrance conduit.

Related Item
First Revision No. 4601-NFPA 70-2015 [Section No. 830.49]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
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Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jul 13 16:21:53 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Other types of metal conduit besides RMC and IMC are permitted to be used as entrance conduit. All metal conduit is required to be bonded and grounded.
In Buildings or Structures with Grounding Means.

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to enclosures using the options identified in the Exception of 250.94. If an intersystem bonding termination is established, all the rules of 250.94 shall apply.
4. The nonflexible metallic power service raceway
5. The service equipment enclosure
6. The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service
7. The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to an electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means, as described in 830.93, shall be considered accessible.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to review the list items for consistent language. List item 3 is inconsistent with the others. The Correlating Committee also directs the panel to review the language in 830.100(B)(2)(3) and revise “Exception of” to “Exception to.”

Related Item
First Revision No. 4605-NFPA 70-2015 [Section No. 830.100(B)(2)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:44:26 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4550-NFPA 70-2015
Statement: The Panel has reviewed the list items for consistent language and improved consistency by placing the second sentence of list Item 3 as a requirement outside the list. In list Item 3 the panel recognizes a change in First Revision that separates 250.94 into two subsections A and B.
Public Comment No. 383-NFPA 70-2015 [Section No. 830.110(A)(2)]

(2) Communications Raceways.
Low-power network-powered broadband communications cables shall be permitted to be installed in plenum communications raceways, riser communications raceways and general-purpose communications raceways, selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing apply.

Statement of Problem and Substantiation for Public Comment
This is an editorial Public Comment. The recommended text deletes a superfluous comma after “riser communications raceways”.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 384-NFPA 70-2015 [Section No. 830.110(C)]</td>
<td></td>
</tr>
<tr>
<td>Public Comment No. 379-NFPA 70-2015 [Section No. 800.110(A)(2)]</td>
<td></td>
</tr>
<tr>
<td>Public Comment No. 380-NFPA 70-2015 [Section No. 800.110(C) [Excluding any Sub-Sections]]</td>
<td></td>
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<tr>
<td>Public Comment No. 381-NFPA 70-2015 [Section No. 800.113(C)]</td>
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<tr>
<td>Public Comment No. 382-NFPA 70-2015 [Section No. 800.113(D)]</td>
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</tr>
</tbody>
</table>

Related Item
First Revision No. 4608-NFPA 70-2015 [Section No. 830.110(A)(2)]

Submitter Information Verification
Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Aug 05 09:08:06 EDT 2015

Committee Statement
Committee Action: Rejected
Resolution: The serial commas are editorially correct.
(C) Cable Routing Assemblies.

Low-power network-powered broadband communications cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

Statement of Problem and Substantiation for Public Comment

This is an editorial Public Comment. The recommended text deletes a superfluous comma after “riser cable routing assemblies”.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 379-NFPA 70-2015 [Section No. 800.110(A)(2)]</td>
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</tr>
<tr>
<td>Public Comment No. 380-NFPA 70-2015 [Section No. 800.110(C) [Excluding any Sub-Sections]]</td>
<td></td>
</tr>
<tr>
<td>Public Comment No. 381-NFPA 70-2015 [Section No. 800.113(C)]</td>
<td></td>
</tr>
<tr>
<td>Public Comment No. 382-NFPA 70-2015 [Section No. 800.113(D)]</td>
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<tr>
<td>Public Comment No. 383-NFPA 70-2015 [Section No. 830.110(A)(2)]</td>
<td></td>
</tr>
</tbody>
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Related Item

First Revision No. 4610-NFPA 70-2015 [Section No. 830.110(C)]

Submitter Information Verification

Submitter Full Name: DAVID KIDDOO
Organization: CCCA
Affiliation: CCCA
Street Address:
City:
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Submittal Date: Wed Aug 05 09:11:54 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The serial commas are editorially correct.
Public Comment No. 230-NFPA 70-2015 [Section No. 830.113(I)]

(I) Other Building Locations.

The following cables shall be permitted to be installed in building locations other than those covered in 830.113(B) through (G):

1. Types BLP, BMR, BLR, BM, and BL
2. Types BLP, BMR, BLR, BM, BL, and BLX installed in raceways recognized in Chapter 3.
3. Types BLP, BLR, and BL installed in the following:
   4. Plenum communications raceways
   5. Plenum cable routing assemblies
   6. Riser communications raceways
   7. Riser cable routing assemblies
   8. General-purpose communications raceways
   9. General-purpose cable routing assemblies
10. Type BLX less than 10 mm (3/8 in.) in diameter in one- and two-family dwellings
11. Types BMU and BLU entering the building from outside and run in rigid metal conduit (RMC) or intermediate metal conduit (IMC) where the conduit is connected by a bonding conductor or grounding electrode conductor in accordance with 830.100(B)

Informational Note: This provision limits the length of Type BLX cable to 15 m (50 ft), while 830.90(B) requires that the primary protector, or NIU with integral protection, be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, or NIU with integral protection, Type BLX cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the entrance point.

12. A maximum length of 15 m (50 ft), within the building, of Type BLX cable entering the building from outside and terminating at an NIU or a primary protection location

Statement of Problem and Substantiation for Public Comment

Item (I)(2) needs to clarify what type of raceways are permitted. The term “raceway” is too general and may include all types of raceway, e.g., communications raceway. Medium-power cables are not permitted in Communications raceway.

Related Item
First Revision No. 4619-NFPA 70-2015 [Section No. 830.113(H)]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
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Submittal Date: Tue Jul 14 13:33:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4553-NFPA 70-2015
Statement: The revised text clarifies what type of raceways are permitted. The term “raceway” is too general and may include all types of raceway, e.g., communications raceway. The reference to 830.113(B) through (G) is corrected to 830.113(B) through (H) because a new section 830.113(H) was inserted in the first draft stage.
(2) Other Applications.

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

Exception No. 1: Network-powered broadband communications cable Separation shall not be required to be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits where—
either (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.

Exception No. 2: Network-powered broadband communications cable Separation shall not be required to be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.

Statement of Problem and Substantiation for Public Comment

The text of Exception Nos. 1 and 2 may be greatly simplified by stating “Separation shall not be required where…” rather than repeating the full text of the introductory paragraph.

Related Item
First Revision No. 4645-NFPA 70-2015 [Section No. 830.133]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
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City: 
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Submittal Date: Tue Jul 14 13:40:52 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-4570-NFPA 70-2015
Statement: The text of Exception Nos. 1 and 2 is simplified by stating “Separation shall not be required where…” rather than repeating the full text of the introductory paragraph.
830.154. Applications of Network-Powered Broadband Communications System Cables.
Permitted and nonpermitted applications of listed network-powered broadband communications system cables shall be as indicated in Table 830.154(a). The permitted applications shall be subject to the installation requirements of 830.40, 830.110, and 830.113. The substitutions for network-powered broadband system cables listed in Table 830.154(b) shall be permitted.

<table>
<thead>
<tr>
<th>Applications</th>
<th>List of Permitted Network-Powered Broadband Cables in Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inducts specifically fabricated for environmental air as described in 300.22(B)</td>
<td>In fabricated ducts as described in 300.22(B)</td>
</tr>
<tr>
<td></td>
<td>In metal raceway that complies with 300.22(B)</td>
</tr>
<tr>
<td>In other spaces used for environmental air (plenums) as described in 300.22(C)</td>
<td>In other spaces used for environmental air as described in 300.22(C)</td>
</tr>
<tr>
<td></td>
<td>In metal raceway that complies with 300.22(C)</td>
</tr>
<tr>
<td></td>
<td>In plenum communications raceways</td>
</tr>
<tr>
<td></td>
<td>In plenum cable routing assemblies</td>
</tr>
<tr>
<td></td>
<td>Supported by open metal cable trays</td>
</tr>
<tr>
<td></td>
<td>Supported by solid-bottom metal cable trays with solid metal covers</td>
</tr>
<tr>
<td>In risers</td>
<td>In vertical runs</td>
</tr>
<tr>
<td></td>
<td>In metal raceways</td>
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<tr>
<td></td>
<td>In fireproof shafts</td>
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<tr>
<td></td>
<td>In plenum communications raceways</td>
</tr>
<tr>
<td></td>
<td>In plenum cable routing assemblies</td>
</tr>
<tr>
<td></td>
<td>In riser communications raceways</td>
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<tr>
<td></td>
<td>In riser cable routing assemblies</td>
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<tr>
<td></td>
<td>In one- and two-family dwellings</td>
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<tr>
<td>Within buildings in other than air-handling spaces and risers</td>
<td>General</td>
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<tr>
<td></td>
<td>Supported by cable trays</td>
</tr>
<tr>
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<td>In rigid metal conduit (RMC) and intermediate metal conduit (IMC)</td>
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<td></td>
<td>In any raceway recognized in Chapter 3</td>
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<td></td>
<td>In plenum communications raceways</td>
</tr>
<tr>
<td></td>
<td>In plenum cable routing assemblies</td>
</tr>
<tr>
<td></td>
<td>In general-purpose communications raceways</td>
</tr>
<tr>
<td></td>
<td>In general-purpose cable routing assemblies</td>
</tr>
</tbody>
</table>

**Table 830.154(b) Cable Substitutions**

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Permitted Cable Substitutions</th>
</tr>
</thead>
</table>

Note: An “N” in the table indicates that the cable type shall not be permitted to be installed in the application. A “Y” indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 830.113.

Informational Note No. 1: Part V of Article 830 covers installation methods within buildings. This table covers the applications of listed network-powered broadband communications cables in buildings. The definition of Point of Entrance is in 830.2.

Informational Note No. 2: For information on the restrictions to the installation of network-powered broadband communications cables in ducts specifically fabricated for environmental air, see 830.113(B).
### Cable Type

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Permitted Cable Substitutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM</td>
<td>BMR</td>
</tr>
<tr>
<td>BLP</td>
<td>CMP, CL3P</td>
</tr>
<tr>
<td>BLR</td>
<td>CMP, CL3P, CMR, CL3R, BLP, BMR</td>
</tr>
<tr>
<td>BL</td>
<td>CMP, CMR, CM, CMG, CL3P, CL3R, CL3, BMR, BM, BLP, BLR</td>
</tr>
<tr>
<td>BLX</td>
<td>CMP, CMR, CM, CMG, CMX, CL3P, CL3R, CL3, CL3X, BMR, BM, BLP, BRP, BL</td>
</tr>
</tbody>
</table>

### Statement of Problem and Substantiation for Public Comment

The sentence "The definition of Point of Entrance is in 830.2." of Informational Note No. 1 to Table 830.154(a) is incorrectly struck out. It is only the third sentence that should be struck as indicated in the Committee Statement where it is stated: “It is sufficient that IN No. 1 direct the reader to the definition in 830.2 thus avoiding potential confusion.”

### Related Item
First Revision No. 4620-NFPA 70-2015 [Section No. 830.154]

### Submitter Information Verification

- **Submitter Full Name:** JAMES BRUNSSEN
- **Organization:** TELCORDIA TECHNOLOGIES ERICSSON
- **Affiliation:** ATIS
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Tue Jul 14 13:49:57 EDT 2015

### Committee Statement

- **Committee Action:** Accepted
- **Resolution:** SR-4555-NFPA 70-2015
- **Statement:** The sentence "The definition of Point of Entrance is in 830.2." of Informational Note No. 1 to Table 830.154(a) is inadvertently struck out in the First Draft. It is only the third sentence that should be struck as indicated in the First Revision Committee Statement where it is stated: “It is sufficient that IN No. 1 direct the reader to the definition in 830.2 thus avoiding potential confusion.”
Type BMR cables shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. Optionally, Type BMR riser cables shall be permitted to be marked as Type BMR ST1 if they are listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor and also listed as exhibiting limited smoke characteristics.

Informational Note 1: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2011, Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.

Informational Note 2: One method of defining optional limited smoke characteristics for riser cables is that the cables exhibit a peak smoke release rate not exceeding 0.40 m²/s and a total smoke released not exceeding 150 m² when tested in accordance with the requirements of CSA, "Vertical Flame Test - Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M-2009, Test Methods for Wires and Cables.

Statement of Problem and Substantiation for Public Comment

Please reconsider the action on this public input and accept the public comment. Smoke obscuration is a key fire safety problem.

The reason that this additional optional listing and informational note are important is that there is no information in any of the test methods for fire propagation of cables how to test for smoke in riser cables. Such information is neither included in UL 1666 nor in CSA FT4 nor in UL 1685. Therefore there can be no standardized way for a manufacturer to demonstrate that a specific type of riser cables has lower smoke than typical riser cables. This is very different from the case of general purpose (or cable tray) cables. Both UL 1685 and CSA FT4 contain information on how to obtain "limited smoke" (meaning reduced smoke) cables that are general purpose cables. Therefore I understand the panel's objections to include optional markings for these cables. However, unless the code provides a systematic and standard way to determine what is a "limited smoke riser cable" the optional markings will not be able to be generated adequately.

A key aspect of wire and cable fire performance is smoke emission since it is well known that lack of visibility and smoke are serious problems in fire. In the NEC there is a designation for "low smoke cables", which are plenum-rated cables. There is also an optional designation of limited smoke cables, which is not required but applies to cable tray cables (tested to UL 1685 or CSA FT4). Riser cables are cables that usually are found in concealed spaces and it would be important to offer an optional marking for limited smoke riser cables, to distinguish them from standard riser cables. This is particularly useful for riser cables because, typically, riser cables are made with insulation and jacket materials that are very similar to CSA FT4 cables and also with materials that do not quite exhibit the flame and smoke characteristics of plenum cables. Therefore, manufacturers of materials who try to achieve a plenum cable rating, and can't quite make it, will often make their material slightly less safe from the point of view of smoke emission, in order to be able to save costs. This new optional marking would permit manufacturers to provide cables with both limited smoke and the flame spread characteristics of riser cable. The choice of criterion for the limited smoke riser cables (and the choice of designation) is based on the ST1 designation associated with the CSA FT4 test, when smoke emission is assessed.

This public comment is being proposed for all instances of riser cables and not public comment is proposed for optional markings of general purpose cables.

Related Item

Public Input No. 1726-NFPA 70-2014 [Section No. 830.179(A)(1)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 15:52:47 EDT 2015

Committee Statement

Committee Action: Rejected
| Resolution: | Optional marking is permitted. It is inappropriate to include references to products that do not have a need for specific application rules or products that are permitted but not required by the NEC. |
(2) Type BLR.

Type BLR cables shall be listed as being suitable for use in a vertical run in a shaft, or from floor to floor, and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. Optionally, Type BLR riser cables shall be permitted to be marked as Type BLR ST1 if they are listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor and also listed as exhibiting limited smoke characteristics.

Informational Note 1: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2011, Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.

Informational Note 2: One method of defining optional limited smoke characteristics for riser cables is that the cables exhibit a peak smoke release rate not exceeding 0.40 m²/s and a total smoke released not exceeding 150 m² when tested in accordance with the requirements of CSA, "Vertical Flame Test - Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M-2009, Test Methods for Wires and Cables.

Statement of Problem and Substantiation for Public Comment

Please reconsider the action on this public input and accept the public comment. Smoke obscuration is a key fire safety problem.

The reason that this additional optional listing and informational note are important is that there is no information in any of the test methods for fire propagation of cables how to test for smoke in riser cables. Such information is neither included in UL 1666 nor in CSA FT4 nor in UL 1685. Therefore there can be no standardized way for a manufacturer to demonstrate that a specific type of riser cables has lower smoke than typical riser cables. This is very different from the case of general purpose (or cable tray) cables. Both UL 1685 and CSA FT4 contain information on how to obtain "limited smoke" (meaning reduced smoke) cables that are general purpose cables. Therefore I understand the panel's objections to include optional markings for these cables. However, unless the code provides a systematic and standard way to determine what is a "limited smoke riser cable" the optional markings will not be able to be generated adequately.

A key aspect of wire and cable fire performance is smoke emission since it is well known that lack of visibility and smoke are serious problems in fire. In the NEC there is a designation for "low smoke cables", which are plenum-rated cables. There is also an optional designation of limited smoke cables, which is not required but applies to cable tray cables (tested to UL 1685 or CSA FT4). Riser cables are cables that usually are found in concealed spaces and it would be important to offer an optional marking for limited smoke riser cables, to distinguish them from standard riser cables. This is particularly useful for riser cables because, typically, riser cables are made with insulation and jacket materials that are very similar to CSA FT4 cables and also with materials that do not quite exhibit the flame and smoke characteristics of plenum cables. Therefore, manufacturers of materials who try to achieve a plenum cable rating, and can't quite make it, will often make their material slightly less safe from the point of view of smoke emission, in order to be able to save costs. This new optional marking would permit manufacturers to provide cables with both limited smoke and the flame spread characteristics of riser cable. The choice of criterion for the limited smoke riser cables (and the choice of designation) is based on the ST1 designation associated with the CSA FT4 test, when smoke emission is assessed.

This public comment is being proposed for all instances of riser cables and not public comment is proposed for optional markings of general purpose cables.

Related Item

Public Input No. 1727-NFPA 70-2014 [Section No. 830.179(B)(2)]

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 21 15:54:58 EDT 2015

Committee Statement

Committee Action: Rejected
| Resolution: | Optional marking is permitted. It is inappropriate to include references to products that do not have a need for specific application rules or products that are permitted but not required by the NEC. |
Public Comment No. 233-NFPA 70-2015 [Section No. 840.3(E)]

(E) Output Circuits.
As appropriate for the services provided, the output circuits derived from the network terminal shall comply with the requirements of the following:

1. Installations of communications circuits — Part V of Article 800
2. Installations of premises (within buildings) community antenna television and radio distribution circuits — Part V of Article 820
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725

Informational Note: See 725.121 for information on the classification of information technology equipment circuits.

5. Installations of power-limited fire alarm circuits — Part III of Article 760

Statement of Problem and Substantiation for Public Comment

The word “premises” includes areas outside the building. If the Panel intends that the requirement of 840.3(E)(2) apply within buildings as stated in the Committee Statement, then it should specifically state “within buildings”. See Panel Action on FR 4559, 820.100, Exception.

Related Item
First Revision No. 4625-NFPA 70-2015 [Section No. 840.3(E)]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 14 14:01:17 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-4571-NFPA 70-2015
Statement: The word “premises” also includes areas outside the building. The requirement of 840.3(E)(2) applies only within buildings and this second revision specifically clarifies this.
(B) Above Roofs.
Outside plant optical fiber cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

Exception No. 1: Vertical clearance requirements shall not apply to auxiliary buildings, such as garages and the like.

Exception No. 2: A reduction in clearance above only the overhanging portion of the roof, to not less than 450 mm (18 in.), shall be permitted if (a) not more than 1.2 m (4 ft) of premises-powered broadband communications service-drop cable passes above the roof overhang, and (b) the cable is terminated at a through- or above-the-roof raceway or approved support.

Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.

Informational Note: For additional information regarding overhead wires and cables, see IEEE C2-2012, National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines.

Statement of Problem and Substantiation for Public Comment
Corrected reference from ANSI to IEEE in information note for exception #3.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 42-NFPA 70-2015 [Section No. Table]</td>
<td>Referenced current SDO standard name, and edition.</td>
</tr>
<tr>
<td>Public Comment No. 43-NFPA 70-2015 [Section No. B.310.15(B)(2)]</td>
<td>Referenced current SDO standard name, and edition.</td>
</tr>
<tr>
<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 52-NFPA 70-2015 [Section No. 830.44(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 66-NFPA 70-2015 [Section No. 620.23(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]
Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]

Related Item
First Revision No. 4630-NFPA 70-2015 [Section No. 840.44(B)]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Jun 25 02:30:36 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4558-NFPA 70-2015
Statement: C2-2012 was approved by ANSI on June 3, 2011 and is referenced to IEEE.
Underground wires and cables entering buildings shall comply with 840.47(A) through (C).

(A) Optical Fiber Cables.

(1) Class 1 or Non–Power-Limited Fire Alarm Circuits.
Underground conductive optical fiber cables with a non–current-carrying metallic member entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

(2) Direct-Buried Cables.
Direct-buried conductive optical fiber cables with a non–current-carrying metallic member shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

Exception No. 1: Direct-buried premises-powered broadband communications cables shall not be required to be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit where the electric service conductors are installed in raceways or have metal cable armor.

Exception No. 2: Direct-buried premises-powered broadband communications cables shall not be required to be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.

(3) Mechanical Protection.
Direct-buried cable, conduit, or other raceway shall be installed to have a minimum cover of 150 mm (6 in.).

(B) Communications Wires and Cables.
Installations of communications wires and multipair communications cables shall comply with 800.47.

(C) Coaxial Cables.
Installations of coaxial cables shall comply with 820.47.

Statement of Problem and Substantiation for Public Comment

The primary purpose of this Public comment is to correct errors. The opening sentence should require compliance with 840.47(A) through (C), not 840.47(A)(1) through (C).

Section 840.47(A)(2) deals with fiber optic cables, not premises powered broadband communications cables. The recommended text corrects that error. It also simplifies the text of the exceptions.

“Optical fiber cables with a non-current-carrying metallic member” are conductive optical fiber cables. The recommended text uses “conductive optical fiber cables” instead of “optical fiber cables with a non-current-carrying metallic member”. The definition of a conductive optical fiber cable is:

Conductive Optical Fiber Cable. A factory assembly of one or more optical fibers having an overall covering and containing non–current-carrying conductive member(s) such as metallic strength member(s), metallic vapor barrier(s), metallic armor or metallic sheath.

Related Item
First Revision No. 4632-NFPA 70-2015 [Section No. 840.47]

Submitter Information Verification
Submitter Full Name: Terry Peters
Organization: SPI
Affiliation: SPI
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Jun 23 00:07:24 EDT 2015
<table>
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<tr>
<td><strong>Committee Action:</strong></td>
</tr>
<tr>
<td><strong>Resolution:</strong></td>
</tr>
<tr>
<td><strong>Statement:</strong></td>
</tr>
</tbody>
</table>

Section 840.47(A)(2) deals with optical fiber cables, not premises powered broadband communications cables. The revised text corrects that error and also simplifies the text of the exceptions. “Optical fiber cables with a non-current-carrying metallic member” are conductive optical fiber cables. The revised text uses “conductive optical fiber cables” instead of “optical fiber cables with a non-current-carrying metallic member.”
Public Comment No. 234-NFPA 70-2015 [ Section No. 840.47(A)(2) ]

(2) Direct-Buried Cables.

Direct-buried optical fiber cables with a non–current-carrying metallic member shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

Exception No. 1: Direct-buried premises-powered broadband communications cables. Separation shall not be required to be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit where electric service conductors are installed in raceways or have metal cable armor.

Exception No. 2: Direct-buried premises-powered broadband communications cables. Separation shall not be required to be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.

Statement of Problem and Substantiation for Public Comment

Exception Nos. 1 and 2 refer to “direct-buried premises-powered broadband communications cables” which is much too broad. This section deals only with optical fiber cables as identified in 800.47(A) and described in the introductory text to 840.47(A)(2) that states “Direct-buried optical fiber cables with non-current carrying metallic member ....”. Further, Exception Nos. 1 and 2 may be greatly simplified by stating “Separation shall not be required where....” rather than repeating the majority of the text of the introductory paragraph.

Related Item
First Revision No. 4632-NFPA 70-2015 [Section No. 840.47]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Jul 14 14:13:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4559-NFPA 70-2015
Statement: The opening sentence should require compliance with 840.47(A) through (C), not 840.47(A)(1) through (C).

Section 840.47(A)(2) deals with optical fiber cables, not premises powered broadband communications cables. The revised text corrects that error and also simplifies the text of the exceptions. “Optical fiber cables with a non-current-carrying metallic member” are conductive optical fiber cables. The revised text uses “conductive optical fiber cables” instead of “optical fiber cables with a non-current-carrying metallic member”.
Public Comment No. 24-NFPA 70-2015 [Section No. 840.48]

### 840.48 Unlisted Wires and Cables Entering Buildings.
Installations of unlisted wires and cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

(A) Optical Fiber Cables.
Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

(B) Communications Wires and Cables.
Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 800.48.

(C) Coaxial Cables.
Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

### Statement of Problem and Substantiation for Public Comment
This is an editorial Public Comment. The title of 840.48 includes “wires”. The opening sentence should also include “wires”.

### Related Item
First Revision No. 4633-NFPA 70-2015 [Section No. 840.48]

### Submitter Information Verification
Submitter Full Name: Terry Peters
Organization: SPI
Affiliation: SPI
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Jun 23 00:17:15 EDT 2015

### Committee Statement
Committee Action: Rejected
Resolution: Section 800.173 has listing requirements for communications drop wire. Section 800.48 only permits unlisted cables, not unlisted wires, to enter a building.
Installations of unlisted wires and cables entering buildings shall comply with 840.48(A), through (B D), or (C), as applicable.

Statement of Problem and Substantiation for Public Comment

The introductory text is revised to reflect the section title. The subsection list is expanded to accommodate the addition of a new subsection for communications wires. This is a companion comment to Public Comments 237 and 239.

Related Item
First Revision No. 4633-NFPA 70-2015 [Section No. 840.48]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 14 14:55:59 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Section 800.173 has listing requirements for communications drop wire. Section 800.48 only permits unlisted cables, not unlisted wires, to enter a building.
(B) Communications Wires and Cables.
Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 800.48.

(C) Communications wires.
Installations of communications wires entering buildings shall comply with 800.48 as pertains to communications cables.

Statement of Problem and Substantiation for Public Comment

Section 800.48 does not address communications wires. Hence, stating in 840.48(B) that "Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 800.48" is misleading. A new subsection (C) is added to address communications wires. The word "multipair" is deleted as it is redundant. The term "cable" is defined in 800.2 as "A factory assembly of two or more conductors having an overall covering.", i.e., multicord. This is a companion comment to Public Comments 236 and 239.

Related Item
First Revision No. 4633-NFPA 70-2015 [Section No. 840.48]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 14 14:59:05 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Section 800.173 has listing requirements for communications drop wire. Section 800.48 only permits unlisted cables, not unlisted wires, to enter a building.
Coaxial Cables.
Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

Statement of Problem and Substantiation for Public Comment

Subsection (C) is redesignated as subsection (D) to accommodate new subsection addressing communications wires. This is a companion comment to Public Comments 236 and 237.

Related Item
First Revision No. 4633-NFPA 70-2015 [Section No. 840.48]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 14 15:17:28 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: Section 800.173 has listing requirements for communications drop wire. Section 800.48 only permits unlisted cables, not unlisted wires, to enter a building.
Network and Cable Grounding.

Grounding required for protection of the network terminal, conductive optical fiber cables, multipair communications cables, antenna lead-in conductors, and coaxial cables shall comply with 770.100, 800.100, 810.21, or 820.100, as applicable.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4636.

Related Item
First Revision No. 4636-NFPA 70-2015 [Section No. 840.100]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:45:51 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4560-NFPA 70-2015
Statement: The title of 840.100 should state “840.100 Network Terminal and Cable Grounding.” It is the network terminal, not the network, that is to be grounded as indicated in the text of 840.100. The word “terminal” was omitted in the First Draft.

This revision complies with the Correlating Committee directive to reconsider the comments expressed in the ballot.
840.100 Network Terminal and Cable Grounding.

Grounding required for protection of the network terminal, conductive optical fiber cables, multipair communications cables, antenna lead-in conductors, and coaxial cables shall comply with 770.100, 800.100, 810.21, or 820.100, as applicable.

Statement of Problem and Substantiation for Public Comment

The word “terminal” was omitted from the panel action; it was included in PI 1853.

Related Item

First Revision No. 4636-NFPA 70-2015 [Section No. 840.100]

Submitter Information Verification

Submitter Full Name: Terry Peters
Organization: SPI
Affiliation: SPI
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 22 23:45:48 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4560-NFPA 70-2015
Statement: The title of 840.100 should state “840.100 Network Terminal and Cable Grounding.” It is the network terminal, not the network, that is to be grounded as indicated in the text of 840.100. The word “terminal” was omitted in the First Draft.

This revision complies with the Correlating Committee directive to reconsider the comments expressed in the ballot.
**Statement of Problem and Substantiation for Public Comment**

The title of 840.100 should state "840.100 Network Terminal and Cable Grounding." It is the network terminal, not the network, that is to be grounded as indicated in the text of 840.100.

**Related Item**
First Revision No. 4636-NFPA 70-2015 [Section No. 840.100]

**Submitter Information Verification**

Submitter Full Name: JAMES BRUNSSEN  
Organization: TELCORDIA TECHNOLOGIES ERICSSON  
Affiliation: ATIS  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Tue Jul 14 15:25:44 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR  
Resolution: SR-4560-NFPA 70-2015  
Statement: The title of 840.100 should state "840.100 Network Terminal and Cable Grounding." It is the network terminal, not the network, that is to be grounded as indicated in the text of 840.100. The word "terminal" was omitted in the First Draft.  

This revision complies with the Correlating Committee directive to reconsider the comments expressed in the ballot.
Public Comment No. 1881-NFPA 70-2015 [Section No. 840.113]

840.113 Installation Past the Network Terminal.
Installation of premises communications circuits and premises coaxial circuits shall comply with 840.113(A) or (B) as applicable.

(A) Premises Communications Circuits.
Premises communications wires and multipair cables installed in a building from the network terminal shall be listed in accordance with 800.179, and the installation shall comply with 800.113 and 800.133.

(B) Premises Community Antenna Television (CATV) Circuits.
Premises CATV coaxial cables installed in a building from the network terminal shall be listed in accordance with 820.179, and the installation shall comply with 820.113 and 820.133.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4640.

Related Item
First Revision No. 4640-NFPA 70-2015 [Section No. 840.113]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:46:53 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4561-NFPA 70-2015
Statement: The title is revised to identify that it is the customer premises side of the network terminal that is being addressed.

This revision complies with the Correlating Committee directive to reconsider the comments expressed in the First Draft ballot.
Public Comment No. 241-NFPA 70-2015 [Section No. 840.113]

840.113   Installation Past the Network Terminal.
Installation of premises communications circuits and premises coaxial circuits shall comply with 840.113(A) or (B) as applicable.

(A) Premises Communications Circuits.
Premises communications wires and multipair cables installed in a building from the network terminal shall be listed in accordance with 800.179, and the installation shall comply with 800.113 and 800.133.

(B) Premises Community Antenna Television (CATV) Circuits.
Premises CATV coaxial cables installed in a building from the network terminal shall be listed in accordance with 820.179, and the installation shall comply with 820.113 and 820.133.

Statement of Problem and Substantiation for Public Comment

The title of the section “Installation Past the Network Terminal” is unclear. Use of the word “Past” begs the question “Is it the network side or the customer side?” The title should identify that it is the customer premises side of the network terminal that is being addressed.

Related Item
First Revision No. 4640-NFPA 70-2015 [Section No. 840.113]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 14 15:29:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4561-NFPA 70-2015
Statement: The title is revised to identify that it is the customer premises side of the network terminal that is being addressed.

This revision complies with the Correlating Committee directive to reconsider the comments expressed in the First Draft ballot.
**Public Comment No. 1032-NFPA 70-2015 [Section No. 840.160]**

**840.160 - Powering Circuits.**

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

(A) - Power Limitations.

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950.1, Information Technology Equipment Safety Part 21: Remote Power Feeding.

**Table 840.160(A) Communications Conductor Ampacity Based on Copper Conductors at Ambient Temperature of 30°C (86°F), Conductor Temperature 60°C (140°F)**

<table>
<thead>
<tr>
<th>Conductor Size (AWG)</th>
<th>Ampacity of Each Conductor in a Single 4-Pair Multipair Communications Cable Installed Separated from All Other Cables</th>
<th>Ampacity of Each Conductor in a Multipair Communications Cable when More Than One Cable Is Installed Together or the Multipair Cable Is Larger Than 4 Pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>0.8</td>
<td>0.4</td>
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<tr>
<td>24</td>
<td>1.3</td>
<td>0.6</td>
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<tr>
<td>23</td>
<td>2.2</td>
<td>1.1</td>
</tr>
<tr>
<td>22</td>
<td>3.1</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Informational Note: The conductor size of existing communications cable, including "category X" type cables, can be as small as 26 AWG.

(B) - Ampacity.

The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) - Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

(D) - Using Cables Without the "LP" Marking for Supplying Premises Power and Communications.

New and existing cables without the "LP" marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other that 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

**Statement of Problem and Substantiation for Public Comment**

- Combinations of cable types, AWGs, installation conditions, and usage conditions makes this a very complex task requiring further detailed investigations
- Working in isolation can lead to an incomplete, simplistic, and premature solutions that could negatively impact the industry and the market
- The industry has managed power delivery over communications cables for 10 years now with no documented record of loss
- This management and safeguards by the industry, individual manufacturers, and owners/operators will continue to evolve and improve in the future and should be taken into account
- Introduction of new LP class of cables is premature without the necessary review and refinement by the industry

As project leader of ISO/IEC/SC 25/WG 3 TR 29125 remote powering task group, we would like to work together with regulatory organizations like NEC and IEC TC 64 to develop appropriate requirements that will continue to keep remote powering a safe and popular application.

**Related Item**

Public Input No. 4643-NFPA 70-2014 [New Section after 394.104]

**Submitter Information Verification**
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Public Comment No. 1181-NFPA 70-2015 [ Section No. 840.160 ]

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

(A) . Power Limitations.
The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-21, Information Technology Equipment Safety Part 21: Remote Power Feeding.

Table 840.160(A) Communications Conductor Ampacity Based on Copper Conductors at Ambient Temperature of 30°C (86°F), Conductor Temperature 60°C (140°F)

<table>
<thead>
<tr>
<th>Conductor Size (AWG)</th>
<th>Single 4-Pair Multipair Communications Cable Installed Separated from All Other Cables</th>
<th>Multipair Communications Cable when More Than One Cable Installed Together or the Multipair Cable Is Larger Than 4 Pairs</th>
</tr>
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<tbody>
<tr>
<td>26</td>
<td>0.8</td>
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<td>1.3</td>
<td>0.6</td>
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<tr>
<td>23</td>
<td>2</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Informational Note: The conductor size of existing communications cables, including “category X” type cables, can be as small as 26 AWG.

(B) . Ampacity.
The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) . Installations of New Cables.
New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

(D) . Using Cables Without the “LP” Marking for Supplying Premises Power and Communications.
New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other than 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

Statement of Problem and Substantiation for Public Comment

This section should be resolved due to inadequate technical substantiation. Chapter 3 of the NEC deals with power conductors. This section is more suitable as part of Article 725 which covers remote control, signaling, and power limited circuits that are not an integral part of a device or appliance. Equipment or devices connected to such cables also may be subject to voltages exceeding their original intended maximum values.

Related Item
First Revision No. 4643-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: Michael Johnston
Organization: National Electrical Contractor
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 10:30:10 EDT 2015

Committee Statement
<table>
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<td>Resolution:</td>
<td>SR-4564-NFPA 70-2015</td>
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<tr>
<td>Statement:</td>
<td>The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.</td>
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840.160 Powering Circuits.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits greater than 0.5A per conductor or greater than 100 watts per cable in accordance with the voltage and power limitations of Table 11(B) in chapter 9 for sources up to 60V dc shall comply with 840.160(A), (B), and (C), as applicable.

(A) Power Limitations.

The power circuits greater than 0.5A per conductor or greater than 100 watts shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-21, Information Technology Equipment Safety Part 21: Remote Power Feeding.

Table 840.160(A) Communications Conductor Ampacity Based on Copper Conductors at Ambient Temperature of 30°C (86°F), Conductor Temperature 60°C (140°F)

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<th>Conductor Size (AWG)</th>
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Informational Note: The conductor size of existing communications cable, including “category X” type cables, can be as small as 26 AWG.

(B) Ampacity.

The maximum current carried by each communications conductor greater than 0.5A shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall greater than 0.5A per conductor or greater than 100 watts per cable shall be Type CMP-LP, CRM-LP, or CM-LP, as applicable.

(D) Using Cables Without the “LP” Marking for Supplying Premises Power and Communications.

New and existing cables without carrying both communications and power less than or equal to 0.5A per conductor or less than or equal to 100 watts per cable without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other than 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(a).

(E) Cables and Equipment Marking Supplying Premises Power and Communications.

Data cables connected to a powering circuit sourcing greater than 0.5A per conductor or greater than 100 watts per cable must be identified with a red tape circling at minimum 3 times around the cable on each end within 6 inches from the connector. Powering circuits supplying more than 0.5A per conductor or greater than 100 watts per cable must be clearly labeled on the equipment face plate in maximum watts per port.

Statement of Problem and Substantiation for Public Comment

1) The table 840.160(A) has not been verified for accuracy or test methodology in accordance with TIA cabling guidance.
2) The new LP cable classification has not been demonstrated as applicable in any data cabling implementation. TIA and IEEE802.3 have done little to no work verifying the cable can carry data.
3) There are currently no power over data ports in telecommunications that support more than 100 watts per cable. It may be true that there exist power sources delivering only power at the higher wattage, but it is not true that telecom gear exists in such capacity.
4) Technology in the data port for ports carrying power over data greater than 100 watts does not exist and will not be developed by the telecommunications industry.
5) The RJ-45 connection system simply cannot carry adequately more than 1.0A per conductor on a good day.

**Related Item**
First Revision No. 4644-NFPA 70-2015 [Sections Part VI., 840.170, 840.180]
First Revision No. 4643-NFPA 70-2015 [Global Input]

**Submitter Information Verification**

Submitter Full Name: JOEL GOERGEN
Organization: Cisco Systems, Inc.
Affiliation: Cisco Systems, Inc.
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 17:08:02 EDT 2015

**Committee Statement**

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Public Comment No. 1278-NFPA 70-2015 [Section No. 840.160]

840.160 Powering Circuits.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

(A) Power Limitations.

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 6095021, Information Technology Equipment Safety Part 21: Remote Power Feeding.

Table 840 REPLACE THE EXISTING TABLE 840.160(A) Communications Conductor Ampacity Based on Copper Conductors at Ambient Temperature of 30°C (86°F), Conductor Temperature 60°C (140°F)

<table>
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Informational Note: The conductor size of existing communications cable, including "category X" type cables, can be as small as 26 AWG.

(B) Ampacity.

The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

(D) Using Cables Without the "LP" Marking for Supplying Premises Power and Communications.

New and existing cables without the "LP" marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other that 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

Extensive testing done at UL LLC has shown that cable bundling greatly influences heat dissipation. Consequently, the table needs to be revised to account for bundle sizes as well as the temperature rating of the cables.

See the UL Fact Finding Report on Power over Local Area Network Type Cables (4-Pair Data / Communications Cables) for supporting data.

Related Item

First Revision No. 4643-NFPA 70-2015 [Global Input]
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

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Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337 2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-2, Information Technology Equipment Safety Part 21: Remote Power Feeding.

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New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other than 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

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Statement of Problem and Substantiation for Public Comment

The addition of new section VI on premises powering of communications equipment over communications cables is premature and not based on a demonstrated record of loss. This results in several technical errors which are both unjustified and confusing to the reader. I respectfully request that the matter be held over to the 2020 code cycle to determine what, if any, restrictions are necessary, and provide adequate opportunity for peer review by industry-expert bodies.

I am an actively participating member of both the IEEE 802.3 working group (including the IEEE 802.3bt Power over MDI Task Force) and the TIA TR42.7 Copper Cabling Subcommittee. I have spent considerable time reviewing data relevant to the most widespread use of power over data cabling today – that based on IEEE Std. 802.3 Clause 33 Data Terminal Equipment Power via Media Dependent Interface (MDI). Systems designed to IEEE Std. 802.3 Clause 33 limits make up the overwhelming majority of “Power over Ethernet” systems, but, as discussed below, the term is abused. I am also familiar with specifications for power over HDBASE-T, as they currently exist. In years of investigation, in industry committees with collective experience of tens of millions of ports, I am not aware of any documented instances of fire hazard caused by overheating of wiring. Additionally, when questioned in these groups, advocates for the proposed changes have repeatedly failed to cite any such instances.

Perhaps as a consequence of both the lack of technical justification and adequate public review of data, there are several fatal flaws in the currently proposed section VI, which would benefit from postponing any inclusions until the 2020 code cycle. By that time, extensive
reviews in process in several industry standards bodies with cross-industry experts will be complete. Some of the flaws in the existing proposed section are listed below:

- The ‘informational note’ that begins the section offers NO SPECIFIC GUIDANCE as to what might be considered included in the clause. It only references ‘Including Power over Ethernet’, which is itself an imprecise and often abused term, but, if one wishes to equate it to only those systems in the IEEE Standard for Ethernet (802.3-2012), would result in amperage levels that are specifically below those mentioned in the section (hence this cannot be the meaning). The informational note only adds confusion, listing no specific applications included, excluding others, as well as suggesting some as included which are specifically below the power levels addressed.

- Proposed Section 840.160 (A) provides for voltage sources up to 60 V dc, and references Chapter 9, Table 11(B). This is not a requirement on the communications cabling, but rather on power sources. Application to this section is inappropriate for several technical reasons, including that Table 11(B) of Chapter 9 speaks to current limits which vary inversely with voltage, and hence, is inappropriate to relate to heating of cabling due to current.

- Proposed Table 840.160 (A) provides for current levels in single cable instances that are incompatible with the interfaces used in conjunction with the data ports on communications equipment today. Continuous currents of greater than 1A per conductor, suggested by the table, are outside the technology used today on communications ports providing power and are not provided today, to the best of my knowledge.

- Proposed Table 840.160 (A), mandated by 840.160(B) and (D) for existing cabling types, is inappropriately applied to the types of cabling used in premises broadband data communications equipment. The record of contributions and experience brought by members of the TIA TR42.7 Copper Cabling committee in the preparation of TIA TSB-184 and TIA-TSB-184-A (in progress) has clearly shown the wide variation of cable heating with relation to current in communications cabling. It particularly shows variation based on not only conductor diameter (which the proposed table captures), but also several uncaptured parameters, including cable construction, the number of cables bundled, the percentage of cables carrying current, and the environment (e.g., conduit or free air) that the cabling is in. Additionally, data gathered by UL, which has yet to be peer-reviewed and is in conflict with other well-reviewed data, has shown this same variability. The proposed table captures none of these effects, and erroneously suggests that even 2 cables provides a substantially worse heating environment than a single one, equivalent to bundles of hundreds. At this stage, efforts to substitute tables or add substantial additional content at this stage would suffer from lack of time for detailed public input. Experience shows that even with expert bodies, this is a subject that requires careful comparisons of measurements, methodology and results. Without an urgent technical justification, any material addition or substitution in the proposed code would suffer from inadequate review.

- Proposed Section 840.160 (C) mandates a currently unknown and uncharacterized class of cabling, ‘-LP’ cabling. It is unknown whether such cabling is available, whether it is appropriate for communications applications, and what the amperage of the proposed –LP cabling would be. To the best of my knowledge, there is currently no –LP listed cabling in use. The inclusion of this section requires trust in a specification that would be promulgated with minimal peer-review, without any practical experience, and still without any demonstrated record of loss that it is supposedly addressing.

Industry standards bodies have carefully addressed the conditions for supplying power along with data over premises cabling, and have consistently applied limitations that keep them under both SELV, and Class 2 LPS limits on a per-cable (generally 8 conductors) basis. They have considered and continue to consider the limits of cable heating. Open industry-standard forums provide a forum to evaluate concerns and give guidance to continue to avoid a record of loss. For these reasons, in view of the above, and lack of technical justification, deletion of these flawed sections now, and consideration for the 2020 code is the prudent course of action.

Related Item
First Revision No. 4643-NFPA 70-2015 [Global Input]
First Revision No. 4644-NFPA 70-2015 [Sections Part VI., 840.170, 840.180]

Submitter Information Verification

Submitter Full Name: George Zimmerman
Organization: CME Consulting, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 10:46:41 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
840.160 - Powering Circuits.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

(A) - Power Limitations.

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337 2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 6095021, Information Technology Equipment Safety Part 21: Remote Power Feeding.

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Informational Note: The conductor size of existing communications cable, including “category X” type cables, can be as small as 26 AWG.

(B) - Ampacity.

The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) - Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

(D) - Using Cables Without the “LP” Marking for Supplying Premises Power and Communications.

New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other that 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

SEE THE ATTACHED FILE FOR RECOMMENDED TEXT AND THE SUBSTANTIATION

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

SEE THE ATTACHED FILE FOR RECOMMENDED TEXT AND SUBSTANTIATION

SEE THE ATTACHED UL FACT FINDING REPORT

Related Item
First Revision No. 4643-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: Terry Peters
Organization: SPI
Affiliation: SPI
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Public Comment No. 1528-NFPA 70-2015 [Section No. 840.160]

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

(A). Power Limitations.
The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 6095021, Information Technology Equipment Safety Part 21: Remote Power Feeding.

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Conductor Size (AWG) | Ampacity |
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28                   | 0.2     |
26                   | 0.3     |
24                   | 0.4     |
22                   | 0.6     |
20                   | 0.8     |
18                   | 1.0     |
16                   | 1.3     |
14                   | 1.5     |
12                   | 2.0     |
10                   | 2.5     |
8                    | 3.0     |
6                    | 4.0     |
4                    | 5.5     |
2                    | 8.0     |

Informational Note: The conductor size of existing communications cable, including “category X” type cables, can be as small as 26 AWG.

(B). Ampacity.
The maximum current carried by each communications conductor shall conform to Table 840.160(A).

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(C). Installations of New Cables.
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New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other than 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

Deletion of the entire contents of FR4643, hold for further action in 2020 NEC revision cycle.

Statement of Problem and Substantiation for Public Comment

Individual members of the Ethernet Alliance have reviewed the proposed First Revision No. 4643-NFPA 70-2015 submitted by CMP 16 proposing the addition of a new Part VI to article 840 addressing remote powering over data communication cables. This comment is endorsed by the Ethernet Alliance. The Ethernet Alliance is a global consortium of system and component vendors, industry experts, and university and government professionals who are committed to the success and expansion of IEEE 802 Ethernet technologies. “Power over Ethernet” has become a generic term used in the marketplace for remote powering schemes. Some of these schemes abuse this term and may not even be compatible with IEEE Std 802.3 Clause 33 Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI) remote powering or data communication standards.

The Ethernet Alliance recognizes the general issue in the industry using the term “Power over Ethernet”, and its association with IEEE Std 802.3 Clause 33 DTE Power via MDI. For the past year, the Ethernet Alliance PoE Subcommittee members have been working to create a PoE Logo Certification program intended for the industry to identify actual remote powering systems designed in accordance with IEEE Std 802.3 Clause 33 DTE Power via MDI.

It is important to recognize that systems designed per IEEE Std 802.3 Clause 33 DTE Power via MDI specifications do not exceed the limitations of Safety Extra Low Voltage (SELV) and Limited Power Source (LPS) use a maximum of 100 VA per eight-conductor cable as a limiting condition for remote powering applications. Additionally, there has always been an IEEE Std 802.3 consideration as the cable’s data communication degrades as a function of increased temperature.

Notwithstanding the above, for the following reasons, the individual members of the Ethernet Alliance believe this change to the code is premature and should be deferred to the 2020 code revision cycle in order to allow all interested and affected parties sufficient time to review and comment:

• No Demonstrated Record of Loss

Based on market data from the Dell’Oro Group which provides market information about the telecommunications, networking, and data center IT industries, hundreds of millions of PoE Ethernet Switch Ports, Internet Protocol Desk Phones and Enterprise Wireless LAN...
Access Points utilizing IEEE Std 802.3 Clause 33 DTE Power via MDI compliant remote powering have shipped. To our best knowledge, there is no demonstrated record of loss attributed to the implementation of this standard. Furthermore, we are not aware of any safety related issues cited in general industry or US Consumer Product Safety Commission notices that would justify the proposed change.

- Insufficient Technical Justification
  We are not aware of any available data to support the proposed changes in FR4643 prior to the written submission deadline. Any data provided after this deadline would not permit sufficient time for industry review and comment.

- Lack of LP Cable Specification
  Prior to the written submission deadline, we are not aware of any available LP cable specifications, certification procedures or vendors manufacturing LP cables. Any information provided after this deadline would not permit sufficient time for industry review and comment.

Related Item
First Revision No. 4643-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: David Tremblay
Organization: Ethernet Alliance

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
640.160 - Powering Circuits

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

(A) - Power Limitations.

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-2, Information Technology Equipment Safety Part 21: Remote Power Feeding.

Table 840.160(A) Communications Conductor Ampacity Based on Copper Conductors at Ambient Temperature of 30°C (86°F), Conductor Temperature 60°C (140°F)

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<th>Conductor Size (AWG)</th>
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Informational Note: The conductor size of existing communications cable, including "category X" type cables, can be as small as 26 AWG.

(B) - Ampacity.

The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) - Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

(D) - Using Cables Without the "LP" Marking for Supplying Premises Power and Communications.

New and existing cables without the "LP" marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other than 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

Additional Proposed Changes

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<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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<tr>
<td>DAmbrosia_Dell_Comment.docx</td>
<td>Text submitted by John D'Ambrosia on behalf of Dell</td>
<td></td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

Statement of Problem and Substantiation

I am submitting this comment on behalf of Dell Inc., which is a supplier of solutions that support IEEE Std 802.3 Clause 33 DTE Power via MDI, which is. This comment is to address the proposed First Revision No. 4643-NFPA70-2015 submitted by CMP 16 proposing the addition of a new Part VI to article 840 addressing remote powering over data communication cables.

Dell is concerned about the lack of any available data prior to the written submission deadline that supports the proposed changes in FR4643. We are also unaware of any available LP cable specifications, certification procedures or vendors manufacturing LP cables. Both types of data are necessary with adequate time to allow the industry to sufficiently review and comment.

Furthermore, as a supplier of equipment that supports IEEE Std 802.3 Clause 33 DTE Power via MDI compliant remote powering, to the best of our knowledge, we are unaware of any demonstrated records of loss. We are, also, not aware of any safety related issues cited in general industry or US Consumer Product Safety Commission notices that would justify the proposed change.

Given the stated concerns above, we believe this change to the code is premature and should be deferred to the 2020 code revision cycle in order to allow all interested and affected parties sufficient time to review and comment.

Related Item

First Revision No. 4643-NFPA 70-2015 [Global Input]
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
840.160 Powering Circuits.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall greater than 0.5A per conductor or greater than 100 watts per cable in accordance with the voltage and power limitations of Table 11(B) in chapter 9 for sources up to 60V dc shall comply with 840.160(A), (B), and (C), (D) and (E), as applicable.

(A) Power Limitations.
The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-1, Information Technology Equipment Safety Part 21: Remote Power Feeding.

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Informational Note: The conductor size of existing communications cable, including "category X" type cables, can be as small as 26 AWG.

(B) Ampacity.
The maximum current carried by each communications conductor, greater than 0.5A, shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) Installations of New Cables.
New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall greater than 0.5A per conductor or greater than 100 watts per cable shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

(D) Using Cables Without the “LP” Marking for Supplying Premises Power and Communications.
New and existing cables without carrying both communications and power less than or equal to 0.5A per conductor or less than or equal to 100 watts per cable without the "LP" marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table to 60 V dc.

(E) Cables and Equipment Marking Supplying Premises Power and Communications.
Data cables connected to a powering circuit sourcing greater than 0.5A per conductor or greater than 100 watts per cable shall be identified with a red band comprising tape circling at minimum 3 times around the cable or equivalent permanent marking on each end within 6 inches from the connector. Powering circuits supplying more than 0.5A per conductor or greater than 100 watts per cable shall be clearly labeled on the equipment face plate in maximum watts per port.

Justification
1) The table 840.160(A)
   For ambient temperatures other than 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a), has not been verified for accuracy or test methodology in accordance with TIA cabling guidance.
2) The new LP cable classification has not been demonstrated as applicable in any data cabling implementation. TIA and IEEE802.3 have not verified that this cable can carry data.
3) There are currently no power over data ports in telecommunications that support more than 100 watts per cable. Power sources capable of delivering only power at higher wattage do exist, but it is not true that telecom gear exists in such capacity.

4) Technology in the data port for ports carrying power over data greater than 100 watts does not currently exist and is not planned to be developed by the telecommunications industry.

5) The RJ-45 connection system in use for data communications cannot safely carry more than 1.0A per conductor, regardless of the associated cable wire gauge.

Statement of Problem and Substantiation for Public Comment

Clarification of the current and power limitations related to communications circuit wiring is needed. Provision is needed to address the lack of qualification of "LP" cables for data communications, hence provision must be made to address the use of non "LP" cables in existing and new installations. Data circuits (equipment and cables) sourcing or carrying high (> 0.5 A per conductor or >100 W per cable) should carry identification marking to distinguish from data only or low power cables. Lastly, the current carrying capacity of the RJ-45 connectors typically used for data communications circuits should be recognized.

Related Item

Public Input No. 4643-NFPA 70-2014 [New Section after 394.104]

Submitter Information Verification

Submitter Full Name: TONY OBRIEN
Organization: Cisco Systems, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 15:36:48 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
840.160, Powering Circuits.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C) and (D), as applicable.

(A) Power Limitations.

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 6095021, Information Technology Equipment Safety Part 21: Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems.

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Informational Note: The conductor size of existing communications cable, including “category X” type cables, can be as small as 26 AWG.

(B) Ampacity.

The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum listed Communication Cables, including listed Limited Power Communication Cables (CMP-LP, CMR-LP and CM-LP), installed shall be permitted to connect to equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other that 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

(D) Using Existing Cables Without the “LP” Marking for Supplying Premises Power and Communications.

New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other that 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

Statement of Problem and Substantiation for Public Comment

Communication Cables are connected to equipment other than Communication equipment for power delivery (e.g. Cameras, Monitor, Lights) and text modified to show this. Ampacity limits need to apply to both new and existing communication cables, regardless of optional markings, and text modified to show this. Text regarding optional marking “LP” cables changed as it has not been adequately defined or adequately shown that it can safely operate at higher current (Ampacity) than Communication Cables. It is unclear how LP listed cables will have different Ampacity than non LP listed communication cables with same wire gauge and temperature rating for...
worst-case ambient thermal conditions and worst-case heating produced by the maximum permissible current being carried by the cables. As it is an optional marking, they are not precluded as long as they meet all requirements of communication cable.

**Related Item**
First Revision No. 4643-NFPA 70-2015 [Global Input]

### Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name</th>
<th>Eric Lawrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Berk-Tek LLC</td>
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<tr>
<td>Street Address</td>
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### Committee Statement

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<td>Resolution</td>
<td>SR-4564-NFPA 70-2015</td>
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Public Comment No. 696-NFPA 70-2015 [ Section No. 840.160 ]

840.160 - Powering Circuits.
Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

(A) - Power Limitations.
The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-21, Information Technology Equipment Safety Part 21: Remote Power Feeding.

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Informational Note: The conductor size of existing communications cable, including “category X” type cables, can be as small as 26 AWG.

(B) - Ampacity.
The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) - Installations of New Cables.
New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

(D) - Using Cables Without the “LP” Marking for Supplying Premises Power and Communications.
New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A).
For ambient temperatures other than 30°C (86°F), ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

Statement of Problem and Substantiation for Public Comment

Electrical safety is extremely important and as such any action to reduce real risks is worthwhile to pursue. As such, we see that IEEE Power over DTE is a valuable technology due to the large number of safeguards that it mandates:
- Unless plugged in to a valid device, there is no voltage on the cable greater than a few volts, limited to very small power.
- During operation, both unplugging of the load, over-current and short-circuit are constantly monitored and action taken in case of an abnormal situation.
- PoE loads (PDs) are required to shut down in case the loop resistance of the cable exceeds the maximum supported.

We also note that there is a very large number of PoE ports operating in the field today. Across all these ports, we are not aware of a single instance of an unsafe situation arising due to the use of Power over Ethernet within the limits of IEEE 802.3.

The proposed addition to the NEC 4643-NFPA 70-2015 has been produced without consultation of the relevant group of PoE experts in the IEEE 802.3bt task group.

The comment also introduces a new form of cabling, for which no specification currently exists. This seems to preclude proper review of the proposed addition.

For this reason, and considering that there is no demonstrated incident of loss pressing safety problem to address, this addition to the NEC should be postponed to the next revision of the Code. In this way, both BICSI and the cabling experts can contribute to a quality solution to be proposed for the 2020 version of NEC.

Consequently IEEE 802.3 BICSI as well as many individual companies affected by these proposed changes, including Philips, will file a comment on the proposed draft. A comment by BICSI to the effect of postponing action to the 2020 Code cycle revision would seem appropriate.

BICSI is very interested in arranging collaboration between the NEC Panel 16, ISO/IEC/JTC 1/ SC 25/WG 3, TIA TR42 IEC TC 64, IEEE 802.3, HDBase-T, CCCA and BICSI Standards in this effort.
**Submitter Information Verification**

- **Submitter Full Name:** Robert Jensen  
- **Organization:** dbi-Telecommunication Infrastr  
- **Affiliation:** BICSI  
- **Street Address:**  
- **City:**  
- **State:**  
- **Zip:**  
- **Submittal Date:** Thu Sep 17 14:14:29 EDT 2015

**Committee Statement**

- **Committee Action:** Rejected but see related SR  
- **Resolution:** SR-4564-NFPA 70-2015  
- **Statement:** The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Public Comment No. 722-NFPA 70-2015 [ Section No. 840.160 ]

840.160  Powering Circuits.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for
powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A),
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The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same
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New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors
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New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies
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per Table 310.15(B)(2)(a).

Statement of Problem and Substantiation for Public Comment

The work in this section was not performed with and/or coordinated with the international standards group responsible for Power-
Over-Ethernet specifications; specifically the IEEE 802.3 Ethernet Working Group. Until such a time as such coordination exists, do not
put forth any code language for power over twisted pair cabling.

Related Item

First Revision No. 4643-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: Mark Laubach
Organization: Representing Self, as a voting member of IEEE 802.3 Ethernet Working Group
Affiliation: Representing Self.
State: 
Zip: 
Submittal Date: Thu Sep 17 20:54:37 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.


Public Comment No. 724-NFPA 70-2015 [ Section No. 840.160 ]

840.160 Powering Circuits.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

(A) Power Limitations.

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337-2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-1, Information Technology Equipment Safety Part 21: Remote Power Feeding.

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Informational Note: The conductor size of existing communications cable, including "category X" type cables, can be as small as 26 AWG.

(B) Ampacity.

The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

(D) Using Cables Without the "LP" Marking for Supplying Premises Power and Communications.

New and existing cables without the "LP" marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other that 30°C (86°F), ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

Statement of Problem and Substantiation for Public Comment

For the following reasons, we (Panduit) believe that this particular code change requires more investigative time to sufficiently evaluate the real nature of the issue and allow the technical community (especially the 802.3 working group of the IEEE and the TIA TR42.7 group whose membership represent industry experts from a broad spectrum of equipment providers and users of the equipment) to assist in the characterization of power on communication cable. We recommend that at a minimum that this code change be deferred to the 2020 or later code revision so that ample time for a thorough technical analysis can be completed.

Concerns with the present version of the proposed code change

1. The proposed code change as it is, will create confusion to the industry
   With the lack of clear and holistic specifications on the proposed LP cable, it will be very difficult for communication cable manufacturers as well as installers to understand how best to proceed.

2. Wire AWG, Cable construction and Material Selection control temperature rise above ambient
   An ampacity table as proposed where the controlling variable is only wire AWG is necessary but not sufficient in specifying maximum ampacity for a given rise above ambient. Although 28 AWG cable is widely used in the industry it is not included in the ampacity tables. The IEEE 802.3at task group and the TIA TR42.7 group can help to develop a better ampacity table.

Concerns with the overall direction and need for a code change

1. Collaboration with Standard Bodies
   The NFPA and the PoE standard bodies (IEEE and the TIA) should collaboratively work together on the recommendation going forward. As the PoE standard IEEE 802.3bt is not yet complete, there would be time for pro-active collaborative technical discussions.

2. Concern as to why the NFPA feels that there is a safety issue
   It is not clear nor has there been any information provided as to what constitutes a safety concern and how it is related to the power levels contained on communication cable that the IEEE, TIA and ISO standard bodies provide specifications for. More specifically, what
is the nature of the safety aspect and how does it manifest itself in the presence of cable.

**Related Item**
First Revision No. 4643-NFPA 70-2015 [Global Input]

**Submitter Information Verification**

<table>
<thead>
<tr>
<th>Submitter Full Name:</th>
<th>Ronald Nordin</th>
</tr>
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<td>Panduit</td>
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**Committee Statement**

| Committee Action: | Rejected but see related SR |
| Resolution:       | SR-4564-NFPA 70-2015       |
| Statement:        | The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables. |
840.160 - Powering Circuits

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

(A) - Power Limitations.

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-1, Information Technology Equipment Safety Part 21: Remote Power Feeding.

Table 840.160(A) Communications Conductor Ampacity Based on Copper Conductors at Ambient Temperature of 30°C (86°F), Conductor Temperature 60°C (140°F)

<table>
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<tr>
<th>Conductor Size (AWG)</th>
<th>Ampacity of Each Conductor in a Single 4-Pair Multipair Communications Cable Installed Separated from All Other Cables</th>
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</tr>
</tbody>
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Informational Note: The conductor size of existing communications cable, including “category X” type cables, can be as small as 26 AWG.

(B) - Ampacity.

The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) - Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

(D) - Using Cables Without the “LP” Marking for Supplying Premises Power and Communications.

New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other than 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

Statement of Problem and Substantiation for Public Comment

New Section 840.160 appears to have no technical justification. I work for an employer that has shipped millions of Powered Ethernet devices, and in more than 12 years we have not a single record of loss due to these devices.

Related Item

First Revision No. 4643-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: David Dwelley
Organization: Linear Technology
Affiliation: Linear Technology
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 17 21:17:41 EDT 2015

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840.160 Powering Circuits.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment.

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(A) - Power Limitations.

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-1, Information Technology Equipment Safety Part 21: Remote Power Feeding.

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Informational Note: The conductor size of existing communications cable, including “category X” type cables, can be as small as 26 AWG.

(B) - Amperage.

The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) - Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

(D) - Using Cables Without the "LP" Marking for Supplying Premises Power and Communications.

New and existing cables without the "LP" marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other than 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

Statement of Problem and Substantiation for Public Comment

The current proposed table 840.160A has been acknowledged as a placeholder and is not correct nor adequate for determination of current limitations on new or existing communications cabling. As of this date, assessment of temperature rise vs current in cabling installations is still under vigorous study, and industry agreement on these investigations and their results has not been achieved. New proposals to replace Table 840.160A with a more comprehensive table need to be adequately assessed by the cabling industry. This is not possible within the comment period. Preliminary results from the proprietary UL-Plastics industry study are not in agreement with data from other sources, nor my own careful measurements and calculations. The temperature rise of cables is highly dependent on installation conditions and must be addressed by installation guidelines and not through ampacity tables. The addition of a new LP class of cabling is premature, being submitted, A: before adequate assessment of the problem and optimal solutions have been studied, B: Without consideration of industry impact of such a requirement, and C: With no specification of the requirements for compliance to this new specification. I foresee at least two profound negative economic effects of this new cable classification: 1. Compliance to this requirement creates cables with larger conductors which increases cost. 2. Compliance to this requirement results in no change to existing cable constructions but adds cost through compliance testing. There are many unforeseen consequences of bringing communications cabling under the purview of electrical safety inspections that are too broad to be discussed in this comment. As has been mentioned in previous negative comments related to this section, a safety hazard has not been well established nor sufficiently studied by cabling standards bodies and lacks justification. Therefore this rulemaking is not only premature, but misguided. The proper venue to address the limitations of temperature rise power carrying communications cables is in the industry groups that create the cabling standards and installation methods for these products.
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

(A) . Power Limitations.

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950.21, Information Technology Equipment Safety Part 21: Remote Power Feeding.

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Informational Note: The conductor size of existing communications cable, including “category X” type cables, can be as small as 26 AWG.

(B) . Ampacity.

The maximum current carried by each communications conductor shall conform to Table 840.160(A).

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(C) . Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

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Statement of Problem and Substantiation for Public Comment

Statement of Problem and Substantiation:

For the following reasons, the IEEE 802.3 Working Group believes that this change to the code is premature and should be deferred to the 2020 code revision cycle. This delay should permit sufficient time for all interested and affected parties to review and comment.

1. Lack of LP Cable specification

At the date of the written comment submission deadline, 21 August 2015, the specifications and availability of the referenced LP cabling was not, to the best of our knowledge, publicly available. This fact alone makes it impossible to provide adequate technical review of this new type of cabling, thus effectively precluding public input.

2. Insufficient Technical Justification

At the date of the written comment submission deadline, 21 August 2015, no publicly-available technical data had been provided detailing the testing methodologies used as the basis for the proposed changes. There is insufficient technical justification provided for the change to require the use of LP cabling.

In addition, no technical data has been provided showing that when operating a communications circuit over a communications type cable under the established guidelines that a safety condition is created or exists.

This comment is being submitted on behalf of the IEEE 802.3 Ethernet Working Group.

Related Item

First Revision No. 4643-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: Steven Carlson
<table>
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<th>Organization:</th>
<th>HIGH SPEED DESIGN</th>
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<tr>
<td>Affiliation:</td>
<td>IEEE 802.3 Ethernet Working Group</td>
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**Committee Statement**

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Statement of Problem and Substantiation for Public Comment

See 638-NFPA 70-2015

Related Item

Public Input No. 1861-NFPA 70-2014 [New Section after 840.154]

Submitter Information Verification

Submitter Full Name: DON MILETICH
Organization: CREE INC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 14:37:16 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Public Comment No. 638-NFPA 70-2015 [Section No. 840.160(A)]

(A) Power Limitations.

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-1, Information Technology Equipment Safety Part 21: Remote Power Feeding.

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Informational Note: The conductor size of existing communications cable, including "category X" type cables, can be as small as 26 AWG.

Statement of Problem and Substantiation for Public Comment

Aside from defining basic level of power requirements this section has no basis for specifying ampacities of the individual conductors. Table 840.160(A) and related references should be removed from the proposed code verbiage for the following reasons:

1) The Scope of Chapter 8 is Communication Circuits and Equipment and as such is primarily concerned with communication aspects of the equipment, equipment installation and caballing. The requirements for communication cables carrying power in conjunction with data are unique and is often limited to power levels far below those that would approach levels based on conductor gauge/ construction.

2) Given that the voltages and currents involved are SELV (Class 2/Limited-Power) there are no safety issues (risk of electric shock or risk of fire) associated with the use and installation of communication cables.

3) Transmitting power in conjunction with data over these cable assemblies has been going on for decades. To my knowledge there have not been any field reports regarding safety that would warrant introducing this ampacity table.

4) Ampacity table such as this belongs in Chapter 7 under 725 -Remote Control Signaling and Power-Limited Circuits, where standards for power being transmitted over these cables may in fact push the limit of the conductors themselves. However before any tables are added in the code careful review and study needs to be performed to account not only for cable construction but also for:
   a. Ambient temperatures around the cables
   b. Cable construction and number of active power carrying conductors
   c. Number of cables in a bundle of cables

Related Item

Public Input No. 1861-NFPA 70-2014 [New Section after 840.154]

Submitter Information Verification

Submitter Full Name: DON MILETICH
Organization: CREE INC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 14:39:03 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Public Comment No. 639-NFPA 70-2015 [Section No. 840.160(B)]

Statement of Problem and Substantiation for Public Comment

See 638-NFPA 70-2015

Related Item

Public Input No. 1861-NFPA 70-2014 [New Section after 840.154]

Submitter Information Verification

Submitter Full Name: DON MILETICH
Organization: CREE INC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 14:51:34 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Public Comment No. 743-NFPA 70-2015 [Section No. 840.160(B)]

(B) Ampacity.

The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

Please replace the values in table 840.160(A) with values that can be derived from the draft of TIA TSB-184-A.

<table>
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<tr>
<th>AWG</th>
<th>Ampacity by bundle size</th>
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TIA TR-42 is willing to supply its expertise to determine these values if that would be of help.

Additional Proposed Changes

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Statement of Problem and Substantiation for Public Comment

There are certain issues with table 840.160(A):
1. The third column implies that the ampacity capacity is the same for any number of cables in a bundle, from 2 to the largest bundle that can be made. Experimental evidence has shown there is a larger temperature rise in a larger bundle.
2. There is a need for a bundle size limitation for new installations.
3. A 30 degree ambient temperature may not be high enough for modern data centers.

Related Public Comments for This Document

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<td>Public Comment No. 744-NFPA 70-2015 [Sections 840.160(C), 840.160(D)]</td>
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Submitter Information Verification

Submitter Full Name: Ray Emplit
Organization: Harger Lightning and Grounding
Affiliation: TIA Engineering Committee TR-42
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 18 16:18:01 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
**Statement:** The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Public Comment No. 171-NFPA 70-2015 [Section No. 840.160(C)]

(C) Includes Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CMG-LP or CM-LP, as applicable.

Statement of Problem and Substantiation for Public Comment

CMG is also an accepted type of Communications Cable currently in the 2014 NEC and should also be included in the new "limited power" [-LP] type cables.

Related Public Comments for This Document

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<td>First Revision No. 4643-NFPA 70-2015 [Global Input]</td>
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Submitter Information Verification

Submitter Full Name: GERALD DORNA
Organization: BELDEN
Street Address: 
City: 
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Zip: 
Submittal Date: Wed Jul 08 10:53:30 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Public Comment No. 640-NFPA 70-2015 [Section No. 840.160(C)]

(C) Installations of New Cables
New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

Statement of Problem and Substantiation for Public Comment

At the present time evaluation and listing program does not exist for LP cable and should not be in the code until it is developed and properly vetted.

Related Item
Public Input No. 1861-NFPA 70-2014 [New Section after 840.154]

Submitter Information Verification
Submitter Full Name: DON MILETICH
Organization: CREE INC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 14:53:09 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Public Comment No. 742-NFPA 70-2015 [Section No. 840.160(C)]

(C) Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

Cabling systems that serve power delivery systems that conform to the requirements of Table 11(B) in chapter 9 installed in accordance with TIA TSB-184-A, including those conforming to IEEE 802.3, are not subject to this clause.

Additional Proposed Changes

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<tr>
<th>File Name</th>
<th>Description</th>
<th>Approved</th>
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</thead>
</table>

Statement of Problem and Substantiation for Public Comment

The present wording of 840.160 (C) makes it appear as if all cables that can deliver both power and information are subject to this requirement. This needs to be clarified.

Related Public Comments for This Document

<table>
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<th>Related Comment</th>
<th>Relationship</th>
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<tr>
<td>Public Comment No. 743-NFPA 70-2015 [Section No. 840.160(B)]</td>
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<td>Public Comment No. 744-NFPA 70-2015 [Sections 840.160(C), 840.160(D)]</td>
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Related Item

First Revision No. 4643-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: Ray Emplit
Organization: Harger Lightning & Grounding
Affiliation: TIA Engineering Committee TR42
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 18 16:08:21 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Sections 840.160(C), 840.160(D)

(D) — Using Cables Without the “LP” Marking for Supplying Premises Power and Communications.

New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A).

(C) — Installations of New Cables.

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP as applicable.

Adjustment for ambient temperature.

For ambient temperatures other that 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

Statement of Problem and Substantiation for Public Comment

If we understand the draft, a cable rated as xxx-LP would not be subject to table 840.160(A), but only to the power limitations in chapter 9. This will not provide a current limit for the cables, except as implied by the power limit and the voltage the power supply system uses, which can vary. Consequently, even though the ‘LP cables will have higher temperature rating, there is no assurance provided by this document that those cables will not be overheated.

The existing requirement (D) is largely redundant with (A) and (B) except for the temperature adjustment information. It seems to be intended to provide an exception to (C) but none is needed if (A) and (B) are met.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Comment No. 742-NFPA 70-2015 [Section No. 840.160(C)]</td>
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Related Item

First Revision No. 4643-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: Ray Emplit
Organization: Harger Lightning and Grounding
Affiliation: TIA Engineering Committee TR42
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 18 16:25:08 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
(D) Using Cables Without the “LP” Marking for Supplying Premises Power and Communications

New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other than 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

Statement of Problem and Substantiation for Public Comment

See 640-NFPA 70-2015

Related Item

Public Input No. 1861-NFPA 70-2014 [New Section after 840.154]

Submitter Information Verification

Submitter Full Name: DON MILETICH
Organization: CREE INC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 14:56:55 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
840.170 Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (I).

(A) Network Terminal.
The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.


Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

(B) Optical Fiber Cables.
Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

(C) Communications Equipment.
Communications equipment shall be listed in accordance with 800.170. Premises communications wires and cables connecting to the network terminal shall be listed in accordance with 800.179.

(D) Cable Routing Assemblies and Communications Raceways
Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

(E) Premises Communications Wires and Cables.
Communications wires and cable shall be listed and marked in accordance with 800.179.

(F) Communications Limited-Power Cables
Communications limited-power cables shall be listed as suitable for carrying communications circuits and limited power circuits as specified in 840.160(C). Communications limited-power cable shall be marked CMP-LP, CMR-LP or CM-LP, as applicable.

(G) Premises Community Antenna Television (CATV) Circuits.
Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

(H) Power Source.
The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in 840.170(H)(1) or 840.170(H)(2):

(1) A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.

(2) A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950, Safety of Information Technology Equipment; ANSI/UL 60950-1-2007, Standard for Safety of Information Technology Equipment-Safety-Part 1; or ANSI/UL 62368-1, Audio/Video, Information and Communication Technology Equipment-Part 1: Safety Requirements. Typically such circuits are used to interconnect equipment for the purpose of exchanging information (data).

(I) Accessory Equipment.
Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to UL 1863, Communications-Circuit Accessories.

Statement of Problem and Substantiation for Public Comment

This is an editorial Public Comment.

In 840.170(C), the recommended text corrects “ONT” to “network terminal”.
The recommended text deletes the redundant “Informational Note” in the informational note to 840.170(H).
The reference in 840.170(F) to the power limitations in 840.160(C) is incorrect. In FR 4643 the power limitations are in 840.160(A). The
recommended text corrects that error. The recommended text updates the issue of UL 60950 to 2014 in two places.

**Related Item**
First Revision No. 4644-NFPA 70-2015 [Sections Part VI., 840.170, 840.180]

**Submitter Information Verification**

**Submitter Full Name:** Terry Peters
**Organization:** SPI
**Affiliation:** SPI

**Committee Statement**

**Committee Action:** Rejected but see related SR
**Resolution:** SR-4565-NFPA 70-2015
**Statement:**
This revision corrects “ONT” to “network terminal” in (C).

The section for “Communications Limited-Power Cables” has been removed because the application was deleted in SR 4564.

This revision deletes the redundant “Informational Note” in the informational note to 840.170(G). The informational note references to UL standards have been updated to the current edition and ANSI added as applicable.
840.170. Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (I).

(A) Network Terminal.

The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.


Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

(B) Optical Fiber Cables.

Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

(C) Communications Equipment.

Communications equipment shall be listed in accordance with 800.170. Premises communications wires and cables connecting to the network terminal shall be listed in accordance with 800.179.

(D) Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

(E) Premises Communications Wires and Cables.

Communications wires and cable shall be listed and marked in accordance with 800.179.

(F) Communications Limited-Power Cables.

Communications limited-power cables shall be listed as suitable for carrying communications circuits and limited power circuits as specified in 840.160(C). Communications limited-power cable shall be marked with the suffix "-LP(xxA)" where the xx is the current limit in amperes per conductor. For example, 1 ampere communications limited-power cable shall be marked CMP-LP (1A), CMR-LP (1A), CMG-LP(1A), or CM-LP (1A), as applicable.

Informational Note: LP cables are listed with current limits of 0.5, 0.6, 0.7, 0.8, 0.9, or 1.0 amperes per conductor. See UL444, the Standard for Communications Cables.

(G) Premises Community Antenna Television (CATV) Circuits.

Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

(H) Power Source.

The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in 840.170(H)(1) or 840.170(H)(2):

1. A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.

2. A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950, Safety of Information Technology Equipment; ANSI/UL 60950-1-2007, Standard for Safety of Information Technology Equipment-Safety-Part 1; or ANSI/UL 60950-1-2007, Standard for Safety of Information Technology Equipment-Safety-Part 1: Safety Requirements. Typically, such circuits are used to interconnect equipment for the purpose of exchanging information (data).

(I) Accessory Equipment.

Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to UL 1863, Communications-Circuit Accessories.
Additional Proposed Changes

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<td>UL FACT FINDING REPORT</td>
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Statement of Problem and Substantiation for Public Comment

Part of this Public Comment is editorial.

In 840.170(C), the recommended text corrects “ONT” to “network terminal”.

The recommended text deletes the redundant “Informational Note” in the informational note to 840.170(H).

The recommended text updates the issue of UL 60950 to 2014 in two places.

Part of this Public comment is technical.

The recommended text adds a Type CMG limited power cable. It was an oversight to omit Type CMG from the first draft.

The first draft provided for the listing of a limited power communications cable which would be suitable to install in worst-case installation conditions. Aside from having plenum, riser and general-purpose types, it was envisioned that there would be one LP cable for use in any bundle size. Although not explicitly stated in the Panel statement, a practical LP cable cannot have conductors larger than 22 AWG because 22 AWG is the largest conductor that will fit into a RJ 45 connector. Extensive testing at UL LLC has shown that, in many cases, large bundles of 4-pair cables with 22 AWG or smaller conductors exceed their temperature rating with all conductors carrying 1 amperes, which is well below the 1.67 ampere maximum current permitted in a 60 volt, 100 VA circuit. Accordingly, this Public Comment recommends that LP cables have a specified upper current limit. That will facilitate the use of small gauge conductors, 23 or 24 AWG for example, in low power systems used for communicating with, and powering of, communications equipment. It should be noted that wire gauge is not the only determinant of the thermal behavior of a cable; other aspects of the cable design are also important. Specifying the performance level of a cable, i.e.; capable of carrying 1 amperes in large enclosed cable bundle without exceeding its temperature rating, rather than specifying wire gauge and temperature rating will promote innovation in cable design.

See the attached UL Fact Finding Report on Power over Local Area Network Type Cables (4-Pair Data / Communications Cables) for supporting data.

UL has issued a Certification Requirement Decision to begin listing of LP cables.

Related Item

First Revision No. 4644-NFPA 70-2015 [Sections Part VI, 840.170, 840.180]

Submitter Information Verification

Submitter Full Name: Terry Peters
Organization: SPI
Affiliation: SPI
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 22 11:33:50 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4565-NFPA 70-2015
Statement: This revision corrects “ONT” to “network terminal” in (C).

The section for “Communications Limited-Power Cables” has been removed because the application was deleted in SR 4564.

This revision deletes the redundant “Informational Note” in the informational note to 840.170(G). The informational note references to UL standards have been updated to the current edition and ANSI added as applicable.
840.170 Equipment and Cables.
Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (I).

(A) Network Terminal.
The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.


Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

(B) Optical Fiber Cables.
Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

(C) Communications Equipment.
Communications equipment shall be listed in accordance with 800.170. Premises communications wires and cables connecting to the ONT shall be listed in accordance with 800.179.

(D) Cable Routing Assemblies and Communications Raceways
Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

(E) Premises Communications Wires and Cables.
Communications wires and cable shall be listed and marked in accordance with 800.179.

(F) Communications Limited-Power Cables
Communications limited-power cables shall be listed as suitable for carrying communications circuits and limited power circuits as specified in 840.160(C). Communications limited-power cable shall be marked CMP-LP, CMR-LP or CM-LP, as applicable.

Premises Community Antenna Television (CATV) Circuits.
Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

(H) Power Source.
The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in 840.170(H)(1) or 840.170(H)(2):

1. A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.

2. A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950, Safety of Information Technology Equipment; ANSI/UL 60950-1-2007, Standard for Safety of Information Technology Equipment-Safety-Part 1; or ANSI/UL 62368-1, Audio/Video, information and Communication Technology Equipment-Part 1: Safety Requirements. Typically such circuits are used to interconnect equipment for the purpose of exchanging information (data).

(I) Accessory Equipment.
Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to UL 1863, Communications-Circuit Accessories.

Statement of Problem and Substantiation for Public Comment
CMP-LP, CMR-LP and CMX-LP cables are not defined, specified, tested and vetted for use in communications cables. This adds an unnecessary layer of confusion to the market and the industry which now has to determine when and where to use these cable types.
Until an known documented instance of a problem with existing cable types has been identified, there is no need for these cables.

**Related Item**
First Revision No. 4644-NFPA 70-2015 [Sections Part VI., 840.170, 840.180]

**Submitter Information Verification**

**Submitter Full Name:** Masood Shariff  
**Organization:** CommScope  
**Affiliation:** CommScope  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Fri Aug 14 11:47:24 EDT 2015

**Committee Statement**

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-4565-NFPA 70-2015  
**Statement:** This revision corrects “ONT” to “network terminal” in (C).

The section for “Communications Limited-Power Cables” has been removed because the application was deleted in SR 4564.

This revision deletes the redundant “Informational Note” in the informational note to 840.170(G). The informational note references to UL standards have been updated to the current edition and ANSI added as applicable.
840.170 Equipment and Cables.
Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (I).

(A) Network Terminal.
The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.


Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

(B) Optical Fiber Cables.
Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

(C) Communications Equipment.
Communications equipment shall be listed in accordance with 800.170. Premises communications wires and cables connecting to the network terminal shall be listed in accordance with 800.179.

(D) Cable Routing Assemblies and Communications Raceways.
Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

(E) Premises Communications Wires and Cables.
Communications wires and cable shall be listed and marked in accordance with 800.179.

(F) Communications Limited-Power Cables.
Communications limited-power cables shall be listed as suitable for carrying communications circuits and limited power circuits as specified in 840.160(C). Communications limited-power cable shall be marked CMP-LP, CMR-LP or CM-LP, as applicable.

(G) Premises Community Antenna Television (CATV) Circuits.
Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

(H) Power Source.
The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in 840.170(H)(1) or 840.170(H)(2):

1) A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.

2) A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950, Safety of Information Technology Equipment; ANSI/UL 60950-1-2007, Standard for Safety of Information Technology Equipment-Safety-Part 1; or ANSI/UL 62368-1, Audio/Video, information and Communication Technology Equipment-Part 1: Safety Requirements. Typically such circuits are used to interconnect equipment for the purpose of exchanging information (data).

(I) Accessory Equipment.
Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to UL 1863, Communications-Circuit Accessories.
F - Electrical safety is extremely important and as such any action to reduce real risks is worthwhile to pursue. As such, we see that IEEE Power over DTE is a valuable technology due to the large number of safeguards that it mandates:

- Unless plugged in to a valid device, there is no voltage on the cable greater than a few volts, limited to very small power.
- During operation, both unplugging of the load, over-current and short-circuit are constantly monitored and action taken in case of an abnormal situation.
- PoE loads (PDs) are required to shut down in case the loop resistance of the cable exceeds the maximum supported.

We also note that there is a very large number of PoE ports operating in the field today. Across all these ports, we are not aware of a single instance of an unsafe situation arising due to the use of Power over Ethernet within the limits of IEEE 802.3.

The proposed addition to the NEC 4643-NFPA 70-2015 has been produced without consultation of the relevant group of PoE experts in the IEEE 802.3bt task group.

The comment also introduces a new form of cabling, for which no specification currently exists. This seems to preclude proper review of the proposed addition.

For this reason, and considering that there is no demonstrated incident of loss pressuring safety problem to address, this addition to the NEC should be postponed to the next revision of the Code. In this way, both BICSI and the cabling experts can contribute to a quality solution to be proposed for the 2020 version of NEC.

Consequently IEEE 802.3 Bicsi as well as many individual companies affected by these proposed changes, including Philips, will file a comment on the proposed draft. A comment by BICSI to the effect of postponing action to the 2020 Code cycle revision would seem appropriate.

BICSI is very interested in arranging collaboration between the NEC Panel 16, ISO/IEC/JTC 1/ SC 25/WG 3, TIA TR42 IEC TC 64, IEEE 802.3, HDBase-T, CCCA and BICSI Standards in this effort.

Related Item
First Revision No. 4644-NFPA 70-2015 [Sections Part VI., 840.170, 840.180]

Submitter Information Verification
Submitter Full Name: Robert Jensen
Organization: dbi-Telecommunication Infrastr
Affiliation: BICSI
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 17 15:20:54 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-4565-NFPA 70-2015
Statement: This revision corrects “ONT” to “network terminal” in (C).

The section for “Communications Limited-Power Cables” has been removed because the application was deleted in SR 4564.

This revision deletes the redundant “Informational Note” in the informational note to 840.170(G). The informational note references to UL standards have been updated to the current edition and ANSI added as applicable.
Public Comment No. 185-NFPA 70-2015 [Section No. 840.170(A)]

(A) Network Terminal.
The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.


Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

Statement of Problem and Substantiation for Public Comment

Referenced updated editions.

Related Item
First Revision No. 4644-NFPA 70-2015 [Sections Part VI., 840.170, 840.180]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Jul 08 22:34:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4565-NFPA 70-2015
Statement: This revision corrects “ONT” to “network terminal” in (C).

The section for “Communications Limited-Power Cables” has been removed because the application was deleted in SR 4564.

This revision deletes the redundant “Informational Note” in the informational note to 840.170(G). The informational note references to UL standards have been updated to the current edition and ANSI added as applicable.
Public Comment No. 242-NFPA 70-2015 [ Section No. 840.170(C) ]

(C) Communications Equipment.
Communications equipment shall be listed in accordance with 800.170. Premises communications wires and cables connecting to the ONT shall be listed in accordance with 800.179.

Statement of Problem and Substantiation for Public Comment

The deleted information is already covered in 840.170(E). Should the Panel decide to retain the deleted sentence then the term "ONT" should be changed to "Network Terminal".

Related Item
First Revision No. 4644-NFPA 70-2015 [Sections Part VI., 840.170, 840.180]

Submitter Information Verification

Submitter Full Name: JAMES BRUNSEN
Organization: TELCORDIA TECHNOLOGIES ERICSSON
Affiliation: ATIS
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 14 15:42:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4565-NFPA 70-2015
Statement: This revision corrects "ONT" to "network terminal" in (C).

The section for "Communications Limited-Power Cables" has been removed because the application was deleted in SR 4564.

This revision deletes the redundant "Informational Note" in the informational note to 840.170(G). The informational note references to UL standards have been updated to the current edition and ANSI added as applicable.
(F) Communications Limited-Power Cables

Communications limited-power cables shall be listed as suitable for carrying communications circuits and limited power circuits as specified in 840.160(C). Communications limited-power cable shall be marked CMP-LP, CMR-LP, CMG-LP or CM-LP, as applicable.

Statement of Problem and Substantiation for Public Comment

CMG is also an accepted type of Communications Cable currently in the 2014 NEC and should also be included in the new "limited power" [-LP] type cables. I have also submitted PC# 171 to add "CMG-LP" to 840.160(C)

Related Public Comments for This Document

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</table>

Submitter Information Verification

Submitter Full Name: GERALD DORNA
Organization: BELDEN WIRE CABLE CO

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4565-NFPA 70-2015
Statement: This revision corrects "ONT" to "network terminal" in (C).

The section for "Communications Limited-Power Cables" has been removed because the application was deleted in SR 4564.

This revision deletes the redundant "Informational Note" in the informational note to 840.170(G). The informational note references to UL standards have been updated to the current edition and ANSI added as applicable.
Article 90  Introduction

Sections 90.1, 90.2, 90.3, 90.4, 90.5, 90.6, 90.7, 90.8, 90.9

90.1 Purpose.

(A) Practical Safeguarding.

The purpose of this Code is the practical safeguarding of persons and property from hazards arising from the use of electricity. This Code is not intended as a design specification or an instruction manual for untrained persons.

(B) Adequacy.

This Code contains provisions that are considered necessary for safety. Compliance therewith and proper maintenance result in an installation that is essentially free from hazard but not necessarily efficient, convenient, or adequate for good service or future expansion of electrical use.

Informational Note: Hazards often occur because of overloading of wiring systems by methods or usage not in conformity with this Code. This occurs because initial wiring did not provide for increases in the use of electricity. An initial adequate installation and reasonable provisions for system changes provide for future increases in the use of electricity.

(C) Relation to Other International Standards.

The requirements in this Code address the fundamental principles of protection for safety contained in Section 131 of International Electrotechnical Commission Standard 60364-1, Electrical Installations of Buildings.

Informational Note: IEC 60364-1, Section 131, contains fundamental principles of protection for safety that encompass protection against electric shock, protection against thermal effects, protection against overcurrent, protection against fault currents, and protection against overvoltage. All of these potential hazards are addressed by the requirements in this Code.

90.2 Scope.

(A) Covered.

This Code covers the installation and removal of electrical conductors, equipment, and raceways; signaling and communications conductors, equipment, and raceways; and optical fiber cables and raceways for the following:

(1) Public and private premises, including buildings, structures, mobile homes, recreational vehicles, and floating buildings

(2) Yards, lots, parking lots, carnivals, and industrial substations

(3) Installations of conductors and equipment that connect to the supply of electricity

(4) Installations used by the electric utility, such as office buildings, warehouses, garages, machine shops, and recreational buildings, that are not an integral part of a generating plant, substation, or control center
(B) Not Covered.

This Code does not cover the following:

1. Installations in ships, watercraft other than floating buildings, railway rolling stock, aircraft, or automotive vehicles other than mobile homes and recreational vehicles
   Informational Note: Although the scope of this Code indicates that the Code does not cover installations in ships, portions of this Code are incorporated by reference into Title 46, Code of Federal Regulations, Parts 110–113.

2. Installations underground in mines and self-propelled mobile surface mining machinery and its attendant electrical trailing cable

3. Installations of railways for generation, transformation, transmission, energy storage, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communications purposes

4. Installations of communications equipment under the exclusive control of communications utilities located outdoors or in building spaces used exclusively for such installations

5. Installations under the exclusive control of an electric utility where such installations
   a. Consist of service drops or service laterals, and associated metering, or
   b. Are on property owned or leased by the electric utility for the purpose of communications, metering, generation, control, transformation, transmission, energy storage, or distribution of electric energy, or
   c. Are located in legally established easements or rights-of-way, or
   d. Are located by other written agreements either designated by or recognized by public service commissions, utility commissions, or other regulatory agencies having jurisdiction for such installations. These written agreements shall be limited to installations for the purpose of communications, metering, generation, control, transformation, transmission, energy storage, or distribution of electric energy where legally established easements or rights-of-way cannot be obtained. These installations shall be limited to federal lands, Native American reservations through the U.S. Department of the Interior Bureau of Indian Affairs, military bases, lands controlled by port authorities and state agencies and departments, and lands owned by railroads.

   Informational Note to (4) and (5): Examples of utilities may include those entities that are typically designated or recognized by governmental law or regulation by public service/utility commissions and that install, operate, and maintain electric supply (such as generation, transmission, or distribution systems) or communications systems (such as telephone, CATV, Internet, satellite, or data services). Utilities may be subject to compliance with codes and standards covering their regulated activities as adopted under governmental law or regulation. Additional information can be found through consultation with the appropriate governmental bodies, such as state regulatory commissions, the Federal Energy Regulatory Commission, and the Federal Communications Commission.

(C) Special Permission.

The authority having jurisdiction for enforcing this Code may grant exception for the installation of conductors and equipment that are not under the exclusive control of the electric utilities and are used to connect the electric utility supply system to the service conductors of the premises served, provided such installations are outside a building or structure, or terminate inside at a readily accessible location nearest the point of entrance of the service conductors.
90.3 Code Arrangement.

This Code is divided into the introduction and nine chapters, as shown in Figure 90.3. Chapters 1, 2, 3, and 4 apply generally. Chapters 5, 6, and 7 apply to special occupancies, special equipment, or other special conditions, and may supplement or modify the requirements in Chapters 1 through 7.

Chapter 8 covers communications systems and is not subject to the requirements of Chapters 1 through 7 except where the requirements are specifically referenced in Chapter 8.

Chapter 9 consists of tables that are applicable as referenced.

Informative annexes are not part of the requirements of this Code but are included for informational purposes only.

Figure 90.3 Code Arrangement.

90.4 Enforcement.

This Code is intended to be suitable for mandatory application by governmental bodies that exercise legal jurisdiction over electrical installations, including signaling and communications systems, and for use by insurance inspectors. The authority having jurisdiction for enforcement of the Code has the responsibility for making interpretations of the rules, for deciding on the approval of equipment and materials, and for granting the special permission contemplated in a number of the rules.

By special permission, the authority having jurisdiction may waive specific requirements in this Code or permit alternative methods, where it is assured that equivalent objectives can be achieved by establishing and maintaining effective safety.

This Code may require new products, constructions, or materials that may not yet be available at the time the Code is adopted. In such event, the authority having jurisdiction may permit the use of the products, constructions, or materials that comply with the most recent previous edition of this Code adopted by the jurisdiction.

90.5 Mandatory Rules, Permissive Rules, and Explanatory Material.

(A) Mandatory Rules.

Mandatory rules of this Code are those that identify actions that are specifically required or prohibited and are characterized by the use of the terms shall or shall not.

(B) Permissive Rules.

Permissive rules of this Code are those that identify actions that are allowed but not required, are normally used to describe options or alternative methods, and are characterized by the use of the terms shall be permitted or shall not be required.

(C) Explanatory Material.

Explanatory material, such as references to other standards, references to related sections of this Code, or information related to a Code rule, is included in this Code in the form of informational notes. Such notes are informational only and are not enforceable as requirements of this Code.

Brackets containing section references to another NFPA document are for informational purposes only and are provided as a guide to indicate the source of the extracted text. These bracketed references immediately follow the extracted text.

Informational Note: The format and language used in this Code follows guidelines established by NFPA and published in the NEC Style Manual. Copies of this manual can be obtained from NFPA.

(D) Informative Annexes.

Nonmandatory information relative to the use of the NEC is provided in informative annexes. Informative annexes are not part of the enforceable requirements of the NEC but are included for information purposes only.
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.

90.7  Examination of Equipment for Safety.
For specific items of equipment and materials referred to in this Code, examinations for safety made under standard conditions provide a basis for approval where the record is made generally available through promulgation by organizations properly equipped and qualified for experimental testing, inspections of the run of goods at factories, and service-value determination through field inspections. This avoids the necessity for repetition of examinations by different examiners, frequently with inadequate facilities for such work, and the confusion that would result from conflicting reports on the suitability of devices and materials examined for a given purpose.

It is the intent of this Code that factory-installed internal wiring or the construction of equipment need not be inspected at the time of installation of the equipment, except to detect alterations or damage, if the equipment has been listed by a qualified electrical testing laboratory that is recognized as having the facilities described in the preceding paragraph and that requires suitability for installation in accordance with this Code.

Informational Note No. 1: See requirements in 110.3.
Informational Note No. 2: Listed is defined in Article 100.
Informational Note No. 3: Informative Annex A contains an informative list of product safety standards for electrical equipment.

90.8  Wiring Planning.
(A) Future Expansion and Convenience.
Plans and specifications that provide ample space in raceways, spare raceways, and additional spaces allow for future increases in electric power and communications circuits. Distribution centers located in readily accessible locations provide convenience and safety of operation.

(B) Number of Circuits in Enclosures.
It is elsewhere provided in this Code that the number of circuits confined in a single enclosure be varyingly restricted. Limiting the number of circuits in a single enclosure minimizes the effects from a short circuit or ground fault.

90.9  Units of Measurement.
(A) Measurement System of Preference.
For the purpose of this Code, metric units of measurement are in accordance with the modernized metric system known as the International System of Units (SI).

(B) Dual System of Units.
SI units shall appear first, and inch-pound units shall immediately follow in parentheses. Conversion from inch-pound units to SI units shall be based on hard conversion except as provided in 90.9(C).

(C) Permitted Uses of Soft Conversion.
The cases given in 90.9(C)(1) through (C)(4) shall not be required to use hard conversion and shall be permitted to use soft conversion.

(1) Trade Sizes.
Where the actual measured size of a product is not the same as the nominal size, trade size designators shall be used rather than dimensions. Trade practices shall be followed in all cases.

(2) Extracted Material.
Where material is extracted from another standard, the context of the original material shall not be compromised or violated. Any editing of the extracted text shall be confined to making the style consistent with that of the NEC.

(3) Industry Practice.
Where industry practice is to express units in inch-pound units, the inclusion of SI units shall not be required.

(4) Safety.
Where a negative impact on safety would result, soft conversion shall be used.

(D) Compliance.
Conversion from inch-pound units to SI units shall be permitted to be an approximate conversion. Compliance with the numbers shown in either the SI system or the inch-pound system shall constitute compliance with this Code.

Informational Note No. 1: Hard conversion is considered a change in dimensions or properties of an item into new sizes that might or might not be interchangeable with the sizes used in the original measurement. Soft conversion is considered a direct mathematical conversion and involves a change in the description of an existing measurement but not in the actual dimension.

Statement of Problem and Substantiation for Public Comment

Public Input 1953 should have been accepted. There was no substantiation because it is a usability issue. What I proposed is a basic mathematical principal, it isn't mine to substantiate.

Related Item
Public Input No. 1953-NFPA 70-2014 [New Article after 90]

Submitter Information Verification

Submitter Full Name: RYAN JACKSON
Organization: RYAN JACKSON
Street Address: 
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State: 
Zip: 
Submittal Date: Fri Sep 25 16:29:40 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The proposed text does not add clarity to the application of this requirement. There is not adequate substantiation to support the need to add the proposed text to Article 90. Duplication of section 220.5(B) is unnecessary.
Public Comment No. 123-NFPA 70-2015 [Section No. 90.2(B)]

(B) Not Covered.
This Code does not cover the following:

(1) Installations in ships, watercraft other than floating buildings, railway rolling stock, aircraft, or automotive vehicles other than mobile homes and recreational vehicles

   Informational Note: Although the scope of this Code indicates that the Code does not cover installations in ships, portions of this Code are incorporated by reference into Title 46, Code of Federal Regulations, Parts 110–113.

(2) Installations underground in mines and self-propelled mobile surface mining machinery and its attendant electrical trailing cable

(3) Installations of railways for generation, transformation, transmission, energy storage, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communications purposes

(4) Installations of communications equipment under the exclusive control of communications utilities located outdoors or in building spaces used exclusively for such installations

(5) Installations under the exclusive control of an electric utility where such the electric utility installs, maintains, and repairs such installations

   (6) Consist of service drops or service laterals, and associated metering and meter-mounted transfer switches, or

   (7) Are on property owned or leased by the electric utility for the purpose of communications, metering, generation, control, transformation, transmission, energy storage, or distribution of electric energy, or

   (8) Are located in legally established easements or rights-of-way, or

   (9) Are located by other written agreements either designated by or recognized by public service commissions, utility commissions, or other regulatory agencies having jurisdiction for such installations. These written agreements shall be limited to installations for the purpose of communications, metering, generation, control, transformation, transmission, energy storage, or distribution of electric energy where legally established easements or rights-of-way cannot be obtained. These installations shall be limited to federal lands, Native American reservations through the U.S. Department of the Interior Bureau of Indian Affairs, military bases, lands controlled by port authorities and state agencies and departments, and lands owned by railroads.

Informational Note to (4) and (5): Examples of utilities may include those entities that are typically designated or recognized by governmental law or regulation by public service/utility commissions and that install, operate, and maintain electric supply (such as generation, transmission, or distribution systems) or communications systems (such as telephone, CATV, Internet, satellite, or data services). Utilities may be subject to compliance with codes and standards covering their regulated activities as adopted under governmental law or regulation. Additional information can be found through consultation with the appropriate governmental bodies, such as state regulatory commissions, the Federal Energy Regulatory Commission, and the Federal Communications Commission.

Statement of Problem and Substantiation for Public Comment

The UL 1008M standard for meter-mounted transfer switches was recently amended to allow for the connection of a permanently installed generator. The scope of this UL standard, in Section 1.3 clearly states that these types of devices be under the exclusive control of the serving utility, and are not under the purview of the NEC. The term "exclusive control" needs to be defined by the code as the party who is responsible for the installation, maintaining, servicing, and repairing of the equipment in question. Utility installation are not under the purview of the NEC, however if the device was installed by an electrical contractor, the installation would be under the purview of the NEC and the UL listing of the device would be violated. The proposed language would bring clarity that these types of devices are UL listed as utility equipment to be installed by the utility, and under the utilities exclusive control, and not as listed electrical equipment that can be installed by an electrical contractor.

UL 1008M TRANSFER SWITCH EQUIPMENT, METER MOUNTED

1 Scope

1.1 These requirements cover automatic and non-automatic (manual) transfer switch equipment, operating at 600 V ac less, and intended for installation in a utility meter base, in ordinary locations only.

1.2 These devices are intended for use in optional standby systems only, and are intended for cord connection of a portable generator to power a premise wiring system, where the neutral (grounded circuit conductor) of the generator is not bonded to ground or the generator frame. Bonding of the neutral (grounded circuit conductor) to ground will occur within the meter base. These devices are not...
intended for use in Emergency or Legally Required Standby Systems.

1.3 The installation of these devices is intended to be under the exclusive control of the serving utility, and these are not considered under the purview of the National Electrical Code, NFPA 70.

1.4 An automatic transfer switch as covered by these requirements is a device that automatically transfers a common load from a normal supply to an alternate supply in the event of failure of the normal supply, and automatically returns the load to the normal supply when the normal supply is restored. An automatic transfer switch may be provided with a logic control circuit that inhibits automatic operation of the device from either a normal to an alternate supply, or from an alternate to a normal supply when the switch reverts to automatic operation upon loss of power to the load.

1.5 A non-automatic transfer switch as covered by these requirements is a device, operated manually by a physical action, or electrically by a remote control, for transferring a common load between a normal and alternate supply.

1.6 A transfer switch may incorporate overcurrent protection for the main power circuits.

1.7 These requirements only cover transfer switches which are completely enclosed when installed in a meter base in conjunction with the electrical utility meter.

1.8 Transfer switches are rated in amperes and are considered to be acceptable for total system transfer, which includes control of motors, electric-heating loads, and transformer loads.

Related Public Comments for This Document

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<td>First Revision No. 2-NFPA 70-2015 [Section No. 90.2(B)]</td>
<td>Related Item</td>
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Submitter Information Verification

Submitter Full Name: BRIAN BAUGHMAN  
Organization: GENERAC POWER SYSTEMS  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Mon Jul 06 11:59:03 EDT 2015

Committee Statement

Committee Action: Rejected  
Resolution: The proposed language does not enhance clarity or usability of what is not covered. It is not necessary to further clarify what “exclusive control” means.
Public Comment No. 1505-NFPA 70-2015 [Section No. 90.2(A)]

(A) Covered.

This Code covers the installation and removal of electrical conductors, equipment, and raceways; signaling and communications conductors, equipment, and raceways; and optical fiber cables and raceways for the following:

(1) Public and private premises, including buildings, structures, mobile homes, recreational vehicles, and floating buildings
(2) Yards, lots, parking lots, carnivals, and industrial substations
(3) Installations of conductors and equipment that connect to the supply of electricity
(4) Installations used by the electric utility, such as office buildings, warehouses, garages, machine shops, and recreational buildings, that are not an integral part of a generating plant, substation, or control center

Statement of Problem and Substantiation for Public Comment

FR-1 should not have been accepted. While the Code covers the removal of wiring, these requirements are limited to only a few sections. The addition of "removal" to 90.2(A) may have unintended consequences and be misinterpreted to include more widespread removal of conductors, equipment and raceway than the sections specifically addressed. "Installation" is used in a broad sense and a laundry list of what aspects of installations the Code covers is not necessary.

Related Item

First Revision No. 1-NFPA 70-2015 [Section No. 90.2(A)]

Submitter Information Verification

Submitter Full Name: Louis Barrios
Organization: Shell Global Solutions
Affiliation: American Chemistry Council
Street Address: City:
State:
Zip:
Submittal Date: Fri Sep 25 13:18:28 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The committee reaffirms that "removal" is within the scope of the NEC. There are numerous requirements requiring removal of electrical conductors and equipment.
Public Comment No. 1882-NFPA 70-2015 [Section No. 90.2(B)]

(B) Not Covered.
This Code does not cover the following:

1. Installations in ships, watercraft other than floating buildings, railway rolling stock, aircraft, or automotive vehicles other than mobile homes and recreational vehicles
   Informational Note: Although the scope of this Code indicates that the Code does not cover installations in ships, portions of this Code are incorporated by reference into Title 46, Code of Federal Regulations, Parts 110–113.

2. Installations underground in mines and self-propelled mobile surface mining machinery and its attendant electrical trailing cable

3. Installations of railways for generation, transformation, transmission, energy storage, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communications purposes

4. Installations of communications equipment under the exclusive control of communications utilities located outdoors or in building spaces used exclusively for such installations

5. Installations under the exclusive control of an electric utility where such installations
   a. Consist of service drops or service laterals, and associated metering, or
   b. Are on property owned or leased by the electric utility for the purpose of communications, metering, generation, control, transformation, transmission, energy storage, or distribution of electric energy, or
   c. Are located in legally established easements or rights-of-way, or
   d. Are located by other written agreements either designated by or recognized by public service commissions, utility commissions, or other regulatory agencies having jurisdiction for such installations. These written agreements shall be limited to installations for the purpose of communications, metering, generation, control, transformation, transmission, energy storage, or distribution of electric energy where legally established easements or rights-of-way cannot be obtained. These installations shall be limited to federal lands, Native American reservations through the U.S. Department of the Interior Bureau of Indian Affairs, military bases, lands controlled by port authorities and state agencies and departments, and lands owned by railroads.

   Informational Note to (4) and (5): Examples of utilities may include those entities that are typically designated or recognized by governmental law or regulation by public service/utility commissions and that install, operate, and maintain electric supply (such as generation, transformation, or distribution systems) or communications systems (such as telephone, CATV, Internet, satellite, or data services). Utilities may be subject to compliance with codes and standards covering their regulated activities as adopted under governmental law or regulation. Additional information can be found through consultation with the appropriate governmental bodies, such as state regulatory commissions, the Federal Energy Regulatory Commission, and the Federal Communications Commission.

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 2. For information, definitions related to "energy storage" are contained in FR 3662.

Related Item
First Revision No. 2-NFPA 70-2015 [Section No. 90.2(B)]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 12:47:44 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: CMP1 reviewed comments under FR-2 and "energy storage" is the correct term.
90.7 Examination of Equipment for Safety.

For specific items of equipment and materials referred to in this Code, examinations for safety made under standard conditions provide a basis for approval where the record is made generally available through promulgation by organizations properly equipped and qualified for experimental testing, inspections of the run of goods at factories, and service-value determination through field inspections. This avoids the necessity for repetition of examinations by different examiners, frequently with inadequate facilities for such work, and the confusion that would result from conflicting reports on the suitability of devices and materials examined for a given purpose.

It is the intent of this Code that factory-installed internal wiring or the construction of equipment need not be inspected at the time of installation of the equipment, except to detect alterations or damage, if the equipment has been listed by a qualified electrical testing laboratory that is recognized as having the facilities described in the preceding paragraph and that requires suitability for installation in accordance with this Code. Suitability shall be determined by application of requirements which are compatible with this Code.

Informational Note No. 1: See requirements in 110.3.
Informational Note No. 2: Listed is defined in Article 100.
Informational Note No. 3: Informative Annex A contains an informative list of product safety standards for electrical equipment which are compatible with this Code.

Statement of Problem and Substantiation for Public Comment

Equipment standards are developed in coordination with installation Codes to ensure safety and compatibility. Product standards which do not specifically anticipate compliance or coordination with the NEC present installation problems (such as specifying metric conductor sizes), non-compliance issues (with Code specific construction requirements) and safety concerns (such as overcurrent protection schemes which are incompatible with the NEC). Product standards which are developed to align with the NEC identify this intention in the scope of each Standard, and unless additional evaluation is performed, only these products can be assured to meet NEC requirements.

Related Item

Public Input No. 4655-NFPA 70-2014 [Section No. 90.7]
Public Input No. 654-NFPA 70-2014 [Section No. 110.3(B)]
Public Input No. 2839-NFPA 70-2014 [Section No. 110.3]

Submitter Information Verification

Submitter Full Name: Robert Osborne
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City:
State:
Zip:
Submittal Date: Tue Sep 08 13:09:52 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-1-NFPA 70-2015
Statement: CMP 1 reconsidered this text at the public comment stage and agrees with the substantiation provided in PC 573.
Informative Annex A, Product Safety Standards

Informative Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only.

This informative annex provides a list of product safety standards used for product listing where that listing is required by this Code. It is recognized that this list is current at the time of publication but that new standards or modifications to existing standards can occur at any time while this edition of the Code is in effect.

This informative annex does not form a mandatory part of the requirements of this Code but is intended only to provide Code users with informational guidance about the product characteristics about which Code requirements have been based.

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Cable and Cable Fittings for Use in Hazardous (Classified) Locations (UL 2225)

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Cables for Power-Limited Fire-Alarm Circuits (UL 1424)

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Cellular Metal Floor Raceways and Fittings (UL 209)

Circuit Breakers for Use in Communication Equipment (UL 489A)

Circuit Integrity (CI) Cable — Fire Tests for Electrical Circuit Protective Systems

Subject 1724 Outline

Circuit Integrity (CI) Cable — Tests for Fire Resistive Cables (UL 2196)

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Communications-Circuit Accessories (UL 1863)

Communications Cables (UL 444)

Community-Antenna Television Cables (UL 1655)

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UL 6703A Outline
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ANSI

ISA-12.12.01
Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
Nonmetallic Surface Raceways and Fittings
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- **Requirements for Process Sealing Between Electrical Systems and Potentially Flammable and Flammable or Combustible Process Fluids**
- **ANSI/ISA-12.27.01**
  - Residential Pipe Heating Cable

## Subject 2049

**UL 2049 Outline**

- **Roof and Gutter De-Icing Cable Units**

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- **Room Air Conditioners**
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## Subject 3703
### UL 3703 Outline

| Solid State Overcurrent Protectors | UL 2367 |
| Specialty Transformers | UL 506 |
| Splicing Wire Connectors | UL 486C |
| Stage and Studio Luminaires and Connector Strips | UL 1573 |
| Standby Batteries | UL 1989 |
| Stationary Engine Generator Assemblies | UL 2200 |
| Strut-Type Channel Raceways and Fittings | UL 5B |
| Supplemental Requirements for Extra-Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings | UL 2515A |
| Surface Metal Raceways and Fittings | UL 5 |
| Surface Raceways and Fittings for Use with Data, Signal and Control Circuits | UL 5C |
| Surge Arresters — Gapped Silicon-Carbide Surge Arresters for AC Power Circuits | IEEE C62.1 |
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| Surge Protective Devices | UL 1449 |
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| Wind Turbine Generating Systems — Large | UL 6141 |
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| Wireways, Auxiliary Gutters, and Associated Fittings | UL 870 |

### Statement of Problem and Substantiation for Public Comment

Referenced correct UL Outlines and standard names.

**Related Item**

First Revision No. 11-NFPA 70-2015 [Annex A]

### Submitter Information Verification

**Submitter Full Name:** Aaron Adamczyk  
**Organization:** [ Not Specified ]  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Wed Jun 24 21:34:42 EDT 2015

### Committee Statement

**Committee Action:** Rejected but see related SR  
**Resolution:** SR-4-NFPA 70-2015  
**Statement:** The word "potentially" was removed from a document title to match current title of ANSI/ISA 12.27.01.
Typical Applications Covered by Tables.

Typical ampacities for conductors rated 0 through 2000 volts are shown in Table B.310.15(B)(2)(1) through Table B.310.15(B)(2)(10). Table B.310.15(B)(2)(11) provides the adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity. Underground electrical duct bank configurations, as detailed in Figure B.310.15(B)(2)(3), Figure B.310.15(B)(2)(4), and Figure B.310.15(B)(2)(5), are utilized for conductors rated 0 through 5000 volts. In Figure B.310.15(B)(2)(2) through Figure B.310.15(B)(2)(5), where adjacent duct banks are used, a separation of 1.5 m (5 ft) between the centerlines of the closest ducts in each bank or 1.2 m (4 ft) between the extremities of the concrete envelopes is sufficient to prevent derating of the conductors due to mutual heating. These ampacities were calculated as detailed in the basic ampacity paper, AIEE Paper 57-660, *The Calculation of the Temperature Rise and Load Capability of Cable Systems*, by J. H. Neher and M. H. McGrath. For additional information concerning the application of these ampacities, see IEEE/CEA Standard S-135/P-46426, *Power Cable Ampacities*, and IEEE Standard IEEE STD 835-1994, *Standard Power Cable Ampacity Tables*.

Typical values of thermal resistivity (Rho) are as follows:

- Average soil (90 percent of USA) = 90
- Concrete = 55
- Damp soil (coastal areas, high water table) = 60
- Paper insulation = 550
- Polyethylene (PE) = 450
- Polyvinyl chloride (PVC) = 650
- Rubber and rubber-like = 500
- Very dry soil (rocky or sandy) = 120

*Thermal resistivity*, as used in this informative annex, refers to the heat transfer capability through a substance by conduction. It is the reciprocal of thermal conductivity and is normally expressed in the units°C-cm/watt. For additional information on determining soil thermal resistivity (Rho), see ANSI/IEEE Standard IEEE STD 442-1996, *Guide for Soil Thermal Resistivity Measurements*.

Statement of Problem and Substantiation for Public Comment

Removed superseded national standards.

Related Public Comments for This Document

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<td>Referenced current SDO standard name, and edition.</td>
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<td>Referenced current SDO standard name, and edition.</td>
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<td>Referenced current SDO standard name, and edition.</td>
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Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]
Public Comment No. 93-NFPA 70-2015 [Section No. 210.12(A)]
Public Comment No. 95-NFPA 70-2015 [Section No. 620.1]
Public Comment No. 96-NFPA 70-2015 [Definition: Equipment Rack.]
Public Comment No. 101-NFPA 70-2015 [Section No. 690.7]
Public Comment No. 107-NFPA 70-2015 [Section No. 500.5(A)]
Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]
Public Comment No. 111-NFPA 70-2015 [Section No. 505.2]
Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]
Public Comment No. 114-NFPA 70-2015 [Section No. 505.6 [Excluding any Sub-Sections]]

Related Item
Public Input No. 1902-NFPA 70-2014 [Global Input]

Submitter Information Verification

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Zip:
Submittal Date: Thu Jun 25 00:22:52 EDT 2015

Committee Statement

Committee Action: Accepted
Resolution: SR-1501-NFPA 70-2015
Statement: Removed superseded national standards.
Public Comment No. 309-NFPA 70-2015 [Definition: Feeder Short-Circuit and Ground-Fault Protection]

Feeder Short-Circuit and Ground-Fault Protection

The rating of the feeder protective device is based on the sum of the largest branch-circuit protective device for the specific device protecting the feeder (example is 110 A) plus the sum of the full-load currents of the other motors, or 110 A \(+\) 40 A \(=\) 190 A. The nearest standard non time delay fuse that does not exceed this value is 175 A [see 240.6 and 430.62(A)].

Feeder Short-Circuit and Ground-Fault Protection Using Inverse Time Circuit Breaker.

The rating of the feeder protective device is based on the sum of the largest branch-circuit protective device for the specific device protecting the feeder, plus the sum of the full load currents of the other motors. 250\% \times 34 \text{ Amps} = 85 \text{ A}. The next larger standard size is 90 A, plus the sum of the full load currents of the other motors or 90 A plus 40 A plus 40 A = 170 A. The nearest standard breaker that does not exceed this value is 150 A [see 240.6, 430.62(A)].

Statement of Problem and Substantiation for Public Comment

This PI was misplaced and sent to the wrong panel, then to the wrong section in 430.62. CMP 11 rightfully rejected it as it is informative in nature an belongs in the Annex. The original PI was submitted as modifying the annex example D8 due to the considerable confusion that exists as to how to calculate the protection of the feeder. This additional example makes the intent clear and prevents feeders from being unprotected by oversizing the short circuit ground fault protection of the feeder. The existing example uses the same kind of branch circuit protection as the feeder, the submitted text provides an additional example to make certain that the "(based on the maximum permitted value for the specific type of overcurrent protective device...)" in 430.62 is in regard to the device protecting the feeder and not one of the branch circuits. This phrase was added to the 1993 code due to the confusion and used a breaker example for substantiation and was unanimously affirmative by the panel in the ROC stage (See11-30-(430.62 (a)) Log 2416, page 451). By including an actual breaker example, this eliminates confusion.

Please note the terra-view software did not allow a plus sign to be added in the formula for the breaker, and the word "plus" was used instead to reduce any misunderstanding.

Related Item

Public Input No. 440-NFPA 70-2014 [Definition: Feeder Short-Circuit and Ground-Fault Protection]

Submitter Information Verification

Submitter Full Name: JOHN MCCAMISH
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Street Address:
City:
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Zip:
Submittal Date: Tue Jul 28 13:30:59 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3007-NFPA 70-2015
Statement: The changes to the example clarify the application method.
Feeder Short-Circuit and Ground-Fault Protection

(a) Example using Nontime delay fuse. The rating of the feeder protective device is based on the sum of the largest branch-circuit protective device \((\text{example is } 110 \text{ A})\) plus for the specific type of device protecting the feeder, \(300\% \times 34 \text{ A} = 110 \text{ A}\). Plus, the sum of the full-load currents of the other motors, or \(110 \text{ A } + 40 \text{ A } + 40 \text{ A} = 190 \text{ A}\). The nearest standard fuse that does not exceed this value is 175 A [see 240.6 and 430.62(A)].

(b) Example using Inverse Time Circuit Breaker. The largest branch-circuit protective device for the specific type of device protecting the feeder, \(250\% \times 34 \text{ A} = 85\). The next larger standard size is 90 A. Plus the sum of the full-load currents of the other motors, or 90 A (plus sign) 40 A (plus sign) 40 A = 170 A. The nearest standard breaker that does not exceed this value is 150 A. (see 240.6 and 430.62(A)).

Statement of Problem and Substantiation for Public Comment

The original Public Input 440 was incorrectly identified as a definition and was not directed to CMP-11 for a proposed change to Annex D: Examples, Example D8 as intended by the author. The working in 430.62 is clear but Annex example D8 relating to motor feeder short-circuit and ground-fault protection calculations did not accurately reflect the requirements of 430.62. The key being the inclusion of "for the specific device protecting the feeder" to correspond with 430.62. The additional example further clarifies the requirement where a different type of protective device is used.

Related Item

Public Input No. 440-NFPA 70-2014 [Definition: Feeder Short-Circuit and Ground-Fault Protection]

Submitter Information Verification

Submitter Full Name: Rodney Jones
Organization: Clackamas County, Oregon
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 19:38:49 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3007-NFPA 70-2015
Statement: The changes to the example clarify the application method.
Public Comment No. 1049-NFPA 70-2015 [ Definition: Energy Storage System (ESS). [Excluding any Sub... ]

A device or more than one device assembled together capable of storing energy for use at a future time. ESS(s) includes can include, but is not limited to electrochemical storage devices (e.g., batteries), flow batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). These systems can have ac or dc output for utilization and can include inverters and converters to change stored energy into electrical energy.

Statement of Problem and Substantiation for Public Comment

As written, the 2nd sentence of the definition implies that an ESS always has the items that are listed (i.e., electrochemical storage devices, flow batteries, capacitors, and kinetic energy devices), which contradicts the previous sentence. This PC changes "includes" to "can include" to harmonize the two sentences.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUSER
Organization: STEVE MCCLUSER LLC
Affiliation: none
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed Sep 23 12:02:13 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3638-NFPA 70-2015
Statement: The definition is editorially revised for clarity and correlation within Article 706 and compliance with the NEC Style Manual.
Public Comment No. 1708-NFPA 70-2015 [ New Part after I. ]

694 - Wind Turbines Systems - Working Clearances
Working space shall be provided for electrical cabinets and other electrical equipment in accordance with 110.26(A).

For large wind turbines permitting entry of service personnel, where space constraints exist and there is a necessity for performing diagnostic work on energized equipment (for example in the Nacelle), working clearances shall comply with following table up to 1,000:

<table>
<thead>
<tr>
<th>Nominal voltage to ground</th>
<th>Condition 1</th>
<th>Condition 2</th>
<th>Condition 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-150</td>
<td>900 mm (3 ft)</td>
<td>900 mm (3 ft)</td>
<td>900 mm (3 ft)</td>
</tr>
<tr>
<td>151-1,000</td>
<td>900 (3 ft)</td>
<td>1.0 m (3 ft 6 in)</td>
<td>1.2 m (4 ft)</td>
</tr>
</tbody>
</table>

Note: Conditions are defined in accordance with section 110.26, extending the values from 600V to 1,000V

Conditions of maintenance and supervision shall ensure that only qualified persons examine, adjust, service, and maintain the equipment.

Statement of Problem and Substantiation for Public Comment
Working spaces in large wind turbines in the nacelle and hub where space is limited, and considering UL 6141 with consideration to extended voltage range to 1000V

Related Item
Public Input No. 1-NFPA 70-2013 [Section No. 310.15(B)(3)]

Submitter Information Verification
Submitter Full Name: Amir Zohar
Organization: Suzlon Wind Energy Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 17:01:34 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-921-NFPA 70-2015
Statement:
The 2017 first draft changed Table 110.26(A)(1) to reflect the change throughout the Code from 600 to 1000 V. A third line was added to the table:

601–1000 V: 900 mm (3 ft) 1.2 m (4 ft) 1.5 m (5 ft)

Many wind turbines operate at 690 Vac and in the past took spacings requirements from the 2014 Table 110.26(A)(1) line 2. The new requirements for greater than 600 V use the 2014 values from Table 110.34(A) line 1 (601-2500V).

Requirements for 2500 V are a major change for systems that may operate at 690 V, and 30 cm of additional space is very difficult to implement in existing designs, and especially for wind turbine nacelles.

Access using reduced spacings is limited to qualified personnel.
Public Comment No. 1676-NFPA 70-2015 [Part I.]

<table>
<thead>
<tr>
<th>Article 280 Surge Arresters, Over 2000 Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part I. General</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Comment

Due to transcription errors the title was not changed to 2000 Volts as passed by the panel. See ballot comments from Charles Mello

Related Item
First Revision No. 1244-NFPA 70-2015 [Section No. 280.1]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:14:25 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There is inadequate technical substantiation to increase this to 2000 volts at this time.
Public Comment No. 1687-NFPA 70-2015 [Part I.]

Article 285 Surge Protective Devices (SPDs), 2000 Volts or Less

Part I. General

Statement of Problem and Substantiation for Public Comment

Due to transcription errors the voltage in the Article title did not get changes. See ballot comment from Charles Mello

Related Item

First Revision No. 1245-NFPA 70-2015 [Sections 285.1, 285.3]

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 16:27:33 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: There is inadequate technical substantiation to increase this to 2000 volts at this time.
Part I. General
See Correlating Committee Note below

Statement of Problem and Substantiation for Public Comment
The Correlating Committee directs that all references within Article 400 including but not limited to 400.3 and 400.4 be revised to align with the new article title.

Related Item
First Revision No. 1510-NFPA 70-2015 [Global Input]

Submitter Information Verification
Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 28 14:16:43 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1502-NFPA 70-2015
Statement: This change is based on the recommendation from the correlating committee per the statement in PC#1740.
Public Comment No. 1811-NFPA 70-2015 [Part I.]

Part I. General

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs the panel to reconsider the text of Article 516 and revise to comply with the NEC Style Manual including the use of section titles, mandatory references to other standards, and the extract policy.

Related Item
First Revision No. 3956-NFPA 70-2015 [Article 516]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Sep 29 09:37:47 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3914-NFPA 70-2015
Statement: Revisions were made to reference current editions of NFPA documents 77, 91 and 701. Editorial revisions were made to extracted text to comply with the NEC Style Manual.
Part III. Electrochemical Energy Storage Systems

Part III of this article applies to ESSs that are comprised of sealed and non-sealed cells or batteries or system modules that are comprised of multiple sealed cells or batteries that are not components within a listed product.

Informational Note: Energy storage devices, such as batteries, that are integrated into a larger piece of listed equipment, such as an uninterruptible power supply (UPS), are not covered by this section.

Statement of Problem and Substantiation for Public Comment

Article 706 does not put any boundaries on the size of an ESS. It is not the intent that Article 706 should cover items such as a single-phase UPS system or an emergency lighting chassis. This PC clarifies that a listed product, such as a UPS system or a piece of medical equipment, that happens to contain a battery or a string of batteries, would not be considered as an Energy Storage System that is covered by this section.

This Public Comment also adds an informational note to clarify the intent of the added text.

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUER
Organization: STEVE MCCLUER LLC
Affiliation: None
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 24 11:17:05 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3631-NFPA 70-2015
Statement: This revision provides necessary clarity for the application of Part III in Article 706.
Public Comment No. 1195-NFPA 70-2015 [Part III.]

Part III IV. Flow Battery Energy Storage Systems

The provisions Part IV apply to ESSs composed of or containing flow batteries.

Statement of Problem and Substantiation for Public Comment

Editorial comment to correct the title from "Part III" to "Part IV"

Related Item
First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]

Submitter Information Verification

Submitter Full Name: STEPHEN MCCLUER
Organization: STEVE MCCLUER LLC
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 11:55:53 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3632-NFPA 70-2015
Statement: Editorial comment to correct the title from "Part III" to "Part IV".

In addition to the correction of the Part number, the extraneous text "provisions" has been removed.
Part III of this article applies to ESSs that are comprised of sealed and non-sealed cells or batteries or system modules that are comprised of multiple sealed cells or batteries.

**Statement of Problem and Substantiation for Public Comment**

Seems simpler to just call it a battery.

**Related Public Comments for This Document**

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Comment No. 1478-NFPA 70-2015 [Definition: Electrochemical Battery.]</td>
<td></td>
</tr>
<tr>
<td>First Revision No. 3662-NFPA 70-2015 [New Section after 705.143]</td>
<td></td>
</tr>
</tbody>
</table>

**Submitter Information Verification**

Submitter Full Name: MARVIN HAMON  
Organization: HAMON ENGINEERING INC  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Fri Sep 25 13:05:00 EDT 2015

**Committee Statement**

Committee Action: Rejected  
Resolution: The proposed revision limits the types of ESS and there was no substantiation provided to support this. All electrochemical systems are not batteries.
Statement of Problem and Substantiation for Public Comment

Fixed a typo.

Related Item
First Revision No. 3362-NFPA 70-2015 [Definition: Power-Supply Cord.]

Submitter Information Verification

Submitter Full Name: MARVIN HAMON
Organization: HAMON ENGINEERING INC
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri Sep 25 13:18:25 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-3632-NFPA 70-2015
Statement: Editorial comment to correct the title from "Part III" to "Part IV".

In addition to the correction of the Part number, the extraneous text "provisions" has been removed.
Part IV. Microgrid (Intentionally Islanded and Stand-Alone) Systems

Statement of Problem and Substantiation for Public Comment

This heading should be modified as:
1/ part of this section should move to Art 710 [proposed] Standalone Systems, as recommended by TCC, and thus "Standalone" is removed from heading/
Standalone systems DOES NOT belong in Interconnected Systems! They are fundamental opposites.
Creation of Article 710 standalone systems [new] should be referred to a task group prior to the SD meeting.

2/ The common and now widely used term for intentional island systems is now "microgrids". The former term (used in IEEE1547.4 is now superseded. See for example IEEE P2030.7 and 2030.8.

3/ intentional island systems should be changed to microgrid (intentional island) systems throughout this section (i.e. all sub-paragraphs below this heading.
A task group should be assigned to this part of Article 705.

Related Item
First Revision No. 1045-NFPA 70-2015 [New Part after III.]

Submitter Information Verification
Submitter Full Name: Robert Wills
Organization: Intergrid, LLC
Affiliation: NEC DC Taskgroup / Microgrid WG.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 25 13:33:34 EDT 2015

Committee Statement
Committee Action: Rejected but see related SR
Resolution: SR-1005-NFPA 70-2015
Statement: This revised title removes reference to Stand-Alone Systems, which are covered in 710.
The term "Intentionally Islanded Systems" is changed to "Microgrid Systems," which is the modern industry term for the systems addressed by this Part.
Part IV. Portable Switchboards on Stage

Statement of Problem and Substantiation for Public Comment

The Correlating Committee directs that further consideration be given to the comments expressed in voting on FR 4223 for changes to the title of Part VI in Article 520.

Related Item
First Revision No. 4223-NFPA 70-2015 [Sections 520.71, 520.72, 520.73]

Submitter Information Verification

Submitter Full Name: CC on NEC-AAC
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 29 09:58:45 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4226-NFPA 70-2015
Statement: Change to the Title of Part VI. is required to better cover First Draft changes made to sections 520.71, 520.72, 520.73, and 520.74.
Part IV. Listing Requirements

725.170 Listing and Marking of Equipment. The listed power source for circuits intended to provide power and data over Class 2 cables to remote equipment shall be as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection. Powered devices connected to a circuit supplying data and power shall be listed. Nameplate ratings shall include rated voltage and current available at the output of the listed power source equipment.

Statement of Problem and Substantiation for Public Comment

This Public Comment is one of a series on cable heating due to the transmission of power and data using cables that are typically bundled, and in support of the Public Comment to resolved Public Input 1837.

Presently there is no requirement for equipment listed to UL 60950 to have nameplate ratings. Without a nameplate rating, as required for Class 2 and Class 3 power sources, it is difficult to know or find the rated output voltage and current of a power source.

The Committee Statement is correct for Class 2 and Class 3 power sources. That is, the output wiring is not permitted to be paralleled, unless listed for the application, and the text preceding Tables 11(A) and (B) in Chapter 9 requires the “power source shall be durably marked where plainly visible to indicate the class of supply and its electrical rating.”

However, the above paragraph applies to Class 2 and Class 3 power sources. It does not apply to power sources listed in compliance with UL 60950. It is important for installation, inspection and evaluation of the system for change to have the nameplate ratings marked on the equipment.

While listed equipment may contain listed or “Recognized” power sources, the text of the requirement addresses the outputs of the listed equipment.

Related Public Comments for This Document

<table>
<thead>
<tr>
<th>Related Comment</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Public Comment No. 688-NFPA 70-2015 [Section No. 725.179]</td>
<td>Related Item</td>
</tr>
<tr>
<td>Public Comment No. 689-NFPA 70-2015 [Section No. 725.133]</td>
<td>Related Item</td>
</tr>
<tr>
<td>Public Comment No. 692-NFPA 70-2015 [Section No. 725.143]</td>
<td>Related Item</td>
</tr>
<tr>
<td>Public Input No. 1838-NFPA 70-2014 [New Part after IV.]</td>
<td>Related Item</td>
</tr>
<tr>
<td>Public Input No. 1837-NFPA 70-2014 [New Section after 725.154(C)]</td>
<td>Related Item</td>
</tr>
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Submitter Information Verification

Submitter Full Name: Terry Peters
Organization: SPI
Affiliation: SPI
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Sep 17 11:30:56 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-614-NFPA 70-2015
Statement: This new section provides appropriate references to other Sections within Article 725 that apply to Power and Data Transmission equipment. Marking of the output connections was referred back to 725.121(C) where the marking requirement originates.
Public Comment No. 235-NFPA 70-2015 [ New Part after IX. ]

Review and accept PI 1303.
I respectfully request the CMP to review PI 1303 again and consider the substantiation I am providing during the Public Comments.

Statement of Problem and Substantiation for Public Comment

Currently, there are no provisions for secondary conductors for installations over 1000V similar to the tap rules in 240.21. Adding these requirements would allow secondary conductors over 1000V to be used as they are today. It clearly states in Article 240, I. General, that only part IX applies to over 1000V.

It is very common for secondary conductors to be installed without overcurrent protection at the transformer secondary on medium voltage installations such as 4160v and 13.8kV systems. The secondary conductors are typically cable, cable bus, or bus duct. The low voltage tap rules have erroneously been used for years for medium voltage installations. There isn't any issue with the words that I've proposed as far as safety goes to the best of my knowledge. This is being done all over the world and the NEC hasn't caught up with what is going on.

I think this addition would allow what is being done already to continue to be done and provide the inspection authority with something to inspect by other than just engineered drawings.

The rules as proposed should be adequate for medium voltage as well as low voltage as amps are amps and volts are volts.

Related Item
Public Input No. 1303-NFPA 70-2014 [New Part after IX. ]

Submitter Information Verification

Submitter Full Name: PAUL GUIDRY
Organization: FLUOR ENTERPRISES INC
Affiliation: Associated Builders and Contractors, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 14 14:40:32 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: No substantiation was provided in the original PI or in the PC to show that the tap rules in 240.21 are necessary or adequate for systems over 1000 volts.
**Public Comment No. 584-NFPA 70-2015 [ Part VI. ]**

**Part VI. Premises Powering of Communications Equipment over Communications Cables**

Informational Note: This Part addresses types of circuits intended to provide power over coaxial cables and communications wires and cables to remote communications equipment, including systems such as Power over Ethernet (PoE) IP telephones (VOIP). These premises-powering systems do not include circuits such as those that provide plain old telephone services (POTS), traditional CATV services, and similar legacy communications services.

### Additional Proposed Changes

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<tr>
<th>File Name</th>
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<tr>
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<td>UL FACT FINDING REPORT</td>
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</table>

**Statement of Problem and Substantiation for Public Comment**

This Public Comment would have been part of PC 1441 but Terra View wouldn't allow it. Please see the substantiation for PC 1441 and consider this PC and PC 1441 as a single comment.

See the attached UL Fact Finding Report on Power over Local Area Network Type Cables (4-Pair Data / Communications Cables) for supporting data.

**Related Item**

First Revision No. 4643-NFPA 70-2015 [Global Input]

### Submitter Information Verification

- **Submitter Full Name**: Terry Peters
- **Organization**: SPI
- **Affiliation**: SPI
- **Street Address**:
- **City**:
- **State**:
- **Zip**:
- **Submittal Date**: Wed Sep 09 15:42:02 EDT 2015

### Committee Statement

- **Committee Action**: Rejected but see related SR
- **Resolution**: SR-4564-NFPA 70-2015
- **Statement**: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Part VI. Premises Powering of Communications Equipment over Communications Wires and Cables, including Coaxial Cables

Informational Note: This Part addresses types of circuits intended to provide power over coaxial cables and premises powering circuits over communications wires and cables, to remote equipment, including systems such as Power over Ethernet (PoE). These premises-powering systems do not include circuits such as those that provide plain, coaxial cables. Plain old telephone services (POTS), traditional CATV services, and similar legacy communications services do not contain premises powering circuits.

Statement of Problem and Substantiation for Public Comment

The title needs to include the cable types being addressed, communications wire and cable, including coaxial cable. The informational note should not include intentions of an Article as this could be mis-leading or mis-interpreted. Powering may not be just to remote equipment, but may also be for source equipment. We also need to delete reference to “Power over Ethernet (PoE) or include all systems, which would be extensive and burdensome.

Related Item
First Revision No. 4643-NFPA 70-2015 [Global Input]

Submitter Information Verification

Submitter Full Name: Robert Jensen
Organization: dbi-Telecommunication Infrastr
Affiliation: BICSI
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 17 14:03:10 EDT 2015

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Part VI. Premises Powering of Communications Equipment over Communications Cables

Informational Note: This Part addresses types of circuits intended to provide power over coaxial cables and communications wires and cables to remote equipment, including systems such as Power over Ethernet (PoE) and IP telephones (VOIP). These premises-powering systems do not include circuits such as those that provide plain old telephone services (POTS), traditional CATV services, and similar legacy communications services.

840.160 Powering Circuits.

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment.

The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

(A) Power Limitations.

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

Informational Note: The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-1-2014, Information Technology Equipment - Safety - Part 21: Remote Power Feeding.

Informational Note No. 2: A cable used for simultaneously communicating with and powering of communications equipment could be connected to a power source capable of providing up to the Class 2 limit in Chapter 9, Table 11B, that is, 100 VA of power per pair.

(B) Ampacity.

The maximum current carried by each communications conductor shall conform to Table 840.160(A). Informational Note: The ampacity of the small wire gauges is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems, and UL 60950-1-2014, Information Technology Equipment - Safety - Part 21: Remote Power Feeding.

Informational Note No. 2: A cable used for simultaneously communicating with and powering of communications equipment could be connected to a power source capable of providing up to the Class 2 limit in Chapter 9, Table 11B, that is, 100 VA of power per pair.
Cables Supplying Premises Power and Communications. Installations of cables used to supply power to communications equipment and to communicate with communications equipment shall comply with 840.160(B)(1) or (B)(2).

1. Types CMP, CMR, CMG and CM Cables. In addition to communications, Types CMP, CMR, CMG and CM cables shall be permitted to supply power to communications equipment in accordance with power limitations of 840.160(A) and the ampacity limitations of 840.160(C).

   Informational Note: One example of the use of Type CMR cables is a network of remote powered IP telephones using 24 AWG, 60°C Type CMR, Category 5e LAN (local area network) cables.

2. Types CMP-LP(xxA), CMR-LP(xxA), CMG-LP(xxA) and CM-LP(xxA) Cables. Types CMP-LP(xxA), CMR-LP(xxA), CMG-LP(xxA) and CM-LP(xxA) shall be permitted to supply power to communications equipment at a current level per conductor up to the marked ampere limit (xx) and to communicate with communications equipment. The installation of Types CMP-LP(xxA), CMR-LP(xxA), CMG-LP(xxA) and CM-LP(xxA) shall be in accordance with the installation requirements for Types CMP, CMR, CMG and CM, respectively, in Article 800, Part V, Installation Methods Within Buildings. LP cables shall also be permitted to be used within the bundle size and ampacity limitations of 840.160(C).

   Informational Note: One example of a limited power cable is a cable listed and marked Type CMP-LP(0.5A), 23 AWG. Type CMP-LP(0.5A) can be used in any location where a Type CMP can be used and the cable would be suitable for carrying up to 0.5 A per conductor regardless of bundle size. If used in a 7 cable group, Table 840.160(C) indicates that the same cable could carry up to 1.2 amperes per conductor because it is 23 AWG.

3. Current Limitations and Ampacity. The maximum current carried by each conductor in Types CMP, CMR, CMG and CM cables shall conform to the ampacity limits of Table 840.160(CA) for ambient temperatures up to 30°C (86°F). For ambient temperatures above 30°C (86°F), the correction factors of 310.15(B)(2) shall be permitted to be used. The maximum current carried by connectors shall not exceed the recognized current carrying limit of the connector.

   Informational Note: No.1: The ampacity of wire gauges smaller than 18AWG, including 26 to 22 AWG typically used in communications cables are not included in the ampacity tables in Article 310.

4. Installations of New Cables.

   New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in

   Informational Note No. 2: It is generally accepted that modular connectors such as RJ-45 are suitable for up to 1.3A, consequently the maximum permitted current in a conductor in a cable may be due to the current limits of the connector and not the ampacity of the cable conductors. Table 840.160(A).

5. Using Cables Without the “LP” Marking for Supplying Premises Power and Communications.

   New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other then 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

   Communications Conductor Ampacity Based

   Table 840.160(C), Ampacities of Each Conductor (in Amperes) in a 4-Pair Communications Cable, Based on Copper Conductors at Ambient Temperature of 30°C (86°F) with all Conductors in All Cables Carrying Current. 60°C (140°F), 75°C (167°F) and 90°C (194°F) Rated Cables.

(SEE ATTACHED FILE FOR Table 840.160(C))
### Committee Statement

<table>
<thead>
<tr>
<th>Committee Action:</th>
<th>Rejected but see related SR</th>
</tr>
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<tr>
<td>Resolution:</td>
<td>SR-4564-NFPA 70-2015</td>
</tr>
<tr>
<td>Statement:</td>
<td>The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.</td>
</tr>
</tbody>
</table>
Public Comment No. 636-NFPA 70-2015 [Sections Part VI., 840.160]

**Sections Part VI., 840.160**

**Premises Powering of Communications Equipment over Communications Cables**

**Informational Note:** This Part addresses types of circuits intended to provide power over coaxial cables and communications wires and cables to remote equipment, including systems such as Power over Ethernet (PoE). These premises-powering systems do not include circuits such as those that provide plain old telephone services (POTS), traditional CATV services, and similar legacy communications services.

**840.160 – Powering Circuits.**

Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B), and (C), as applicable.

**(A) – Power Limitations.**

The power circuits shall comply with the requirements of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc.

**Informational Note:** The 100 VA (100 W) power source maximum nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337.2010, *Requirements for Maximum Voltage, Current, and Power Levels in Network-Powered Transport Systems*, and UL 60950-1, *Information Technology Equipment Safety Part 21: Remote Power Feeding*.

**Table 840.160(A) Communications Conductor Ampacity Based on Copper Conductors at Ambient Temperature of 30°C (86°F), Conductor Temperature 60°C (140°F)**

<table>
<thead>
<tr>
<th>Conductor Size (AWG)</th>
<th>Ampacity of Each Conductor in a Single 4-Pair Multipair Communications Cable Installed Separated from All Other Cables</th>
<th>Ampacity of Each Conductor in a Multipair Communications Cable when More Than One Cable Is Installed Together or the Multipair Cable Is Larger Than 4 Pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td>24</td>
<td>1.3</td>
<td>0.6</td>
</tr>
<tr>
<td>22</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>20</td>
<td>2.7</td>
<td>1.5</td>
</tr>
</tbody>
</table>

**Informational Note:** The conductor size of existing communications cable, including “category X” type cables, can be as small as 26 AWG.

**(B) – Ampacity.**

The maximum current carried by each communications conductor shall conform to Table 840.160(A).

**Informational Note:** The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

**(C) – Installations of New Cables.**

New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP, or CM-LP, as applicable.

**(D) – Using Cables Without the “LP” Marking for Supplying Premises Power and Communications.**

New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other than 30°C (86°F), ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

**Additional Proposed Changes**

- **File Name**: Table_840.160_A_.docx
- **Description Approved**

**Statement of Problem and Substantiation for Public Comment**

The committee statement and original public input indicate that the problem being addressed is “each successive revision of the PoE standards delivers more power to the powered devices raising concern about overheating of the cables”. No incident data was provided nor any research data demonstrating this concern. Accordingly, it appears that an existing safety issue has not been shown. On related public comments (1837, 2366), CMP-3 correctly indicated that the public input does not meet the requirements of 4.3.4.1(d) of the Regulations Governing the Development of NFPA Standards in as much that technical substantiation was not provided in regard to the new cables for Class-2 or 3 circuits, new suffix “LP”. It appears that a standard for Listing “LP” cables has not yet been published and that research is ongoing.

Because no evidence of a hazard has been provided, and until sufficient data is provided and a consensus based product standard is available for suffix “LP” cables, it is premature to add these requirements to the Code.
Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-4564-NFPA 70-2015
Statement: The requirements proposed in the First Draft are outside the scope of Chapter 8 as well as the title and scope of Article 840. However, wording was added to direct the user to 725.144 for power delivery circuits that exceed 60 watts on communications cables.
Statement of Problem and Substantiation for Public Comment

Part VIII was supposed to be deleted according to the resolution logs. This section was erroneously retained. All energy storage language from Article 690 has been utilized in the new Article 706 - Energy Storage Systems. This deletion also includes all of 690.71, 690.72, and 690.74.

Related Item
First Revision No. 1012-NFPA 70-2015 [Sections Part VIII.. 690.71]

Submitter Information Verification

Submitter Full Name: Ward Bower
Organization: Solar Energy Industries Associ
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 14 15:56:47 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The panel decides to keep Part VIII for now and replace the content with a reference to Article 706 so that those who look to this section are properly directed to the appropriate Article.
Permit Conduit Fill Greater than 40% for Existing Runs

11) When installing 3 single conductor medium voltage shielded cables rated 5 kV or higher, with or without a ground conductor, in existing underground duct, the 40% fill limit may be exceeded provided there is 1/2" minimum clearance between the cables and duct.

Statement of Problem and Substantiation for Public Comment

The panels statement on my original proposal is confusing since this is cable in duct and lays on the bottom of the duct. Not sure how it would be confused with cable suspended in a raceway.

A fact finding Fact Finding Report is not needed since this has been common practice in NEC and non-NEC installations for as long as medium voltage cables have been around. Ampacity calculations were submitted with the proposal that demonstrated the cable will not run any hotter. Sound current engineering practices and current guidelines on cable jamming were also submitted. The proposal was well documented and based on sound engineering practice.

Limiting percent fill on existing runs for medium voltage cable only adds unnecessary excess cost and hardship to the end user.

Related Item

Public Input No. 3871-NFPA 70-2014 [New Section after Table]

Submitter Information Verification

Submitter Full Name: Joseph Zimnoch
Organization: The Okonite Company
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 24 15:38:50 EDT 2015

Committee Statement

Committee Action: Rejected
Resolution: The committee reaffirms that substantial technical information is required to add language that permits medium voltage cable to exceed 40 percent fill in both metal and non metallic ducts. No additional information was provided with the comment. A Fact Finding Report is a recognized method to investigate and validate this type of technical information.
Table 8 Conductor Properties

<table>
<thead>
<tr>
<th>Size (AWG or kcmil)</th>
<th>Area</th>
<th>Conductor Properties</th>
<th>Direct-Current Resistance at 75°C (167°F)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Stranding</td>
<td>Overall</td>
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<tr>
<td></td>
<td></td>
<td>Diameter (mm)</td>
<td>Diameter (in.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>m</td>
<td>in.</td>
</tr>
<tr>
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<td>0.823</td>
<td>0.016</td>
<td>0.063</td>
</tr>
<tr>
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<td>0.016</td>
<td>0.063</td>
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<tr>
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<td>0.024</td>
<td>0.090</td>
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<td>0.062</td>
<td>0.024</td>
<td>0.090</td>
</tr>
</tbody>
</table>

Notes:
1. These resistance values are valid only for the parameters as given. Using conductors having coated strands, different stranding type, and,
even with a different temperature, changes the resistance.
2. Equation for temperature change: $R_2 = R_1 [1 + a (T_2 - T_1)]$, where $a_{Cu} = 0.00323$, $a_{Al} = 0.00330$ at 75°C.
3. Conductors with compact and compressed stranding have about 9 percent and 3 percent, respectively, smaller bare conductor diameters than those shown. See Table 5A for actual cable dimensions.
4. The IACS conductivities used: bare copper = 100%, aluminum = 61%.
5. Class B stranding is listed as well as solid for some sizes. Its overall diameter and area are those of its cross-sectional circle.

Informational Note: The construction information is in accordance with NEMA WC 7 2009-2013, or ANSI/JUL.

Statement of Problem and Substantiation for Public Comment

Referenced current NEMA edition, and updated NBS Handbooks to NIST Special Publication in Table 8 Note 5, informational note.

Related Public Comments for This Document

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<tr>
<th>Public Comment</th>
<th>Relationship</th>
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<tr>
<td>Public Comment No. 43-NFPA 70-2015 [Section No. B.310.15(B)(2)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<tr>
<td>Public Comment No. 47-NFPA 70-2015 [Section No. 770.44(B)]</td>
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<td>Public Comment No. 49-NFPA 70-2015 [Section No. 800.44(B)]</td>
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<td>Public Comment No. 50-NFPA 70-2015 [Section No. 800.90(A)]</td>
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<td>Public Comment No. 51-NFPA 70-2015 [Section No. 800.182(A)]</td>
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<td>Public Comment No. 67-NFPA 70-2015 [Section No. 620.24(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 68-NFPA 70-2015 [Section No. 620.51(A)]</td>
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<td>Public Comment No. 69-NFPA 70-2015 [Section No. 620.91 [Excluding any Sub-Sections]]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 70-NFPA 70-2015 [Section No. 645.5(E)(2)]</td>
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<td>Public Comment No. 71-NFPA 70-2015 [Section No. 646.7(C)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 85-NFPA 70-2015 [Section No. 110.24(A)]</td>
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<td>Public Comment No. 86-NFPA 70-2015 [Section No. 110.16(B)]</td>
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<td>Public Comment No. 92-NFPA 70-2015 [Section No. 110.28]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 110-NFPA 70-2015 [Section No. 500.6(A)(4)]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Public Comment No. 112-NFPA 70-2015 [Section No. 505.5]</td>
<td>Referenced current SDO standard name, and edition.</td>
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<td>Referenced current SDO standard name, and edition.</td>
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Related Item
Public Input No. 2345-NFPA 70-2014 [Section No. Table]

Submitter Information Verification

Submitter Full Name: Aaron Adamczyk
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:

Committee Statement

Committee Action: Rejected
| Resolution: | The current table is based on the references cited in the informational note. To revise the informational note to the recommended referenced material the table would have to be reviewed and possibly be revised based on the recommended references. |