Public Input No. 3085, Assigned to Code-Making Panel 1, Refer to Code-Making Panels 2 - 18

Public Input No. 3085-NFPA 70-2023 [Global Input]

This Global Public Input is for all Technical Committees and review their informational notes and the requirements in the NEC Style Manual Section 2.1.10 for informational notes.

Statement of Problem and Substantiation for Public Input

This Global Public Input is for all Technical Committees and review their informational notes and the requirements in the NEC Style Manual Section 2.1.10 for informational notes.
2.1.10.3 Format. Informational notes shall be structured as shown in the example, using the word “See” followed by the reference standard, the title of the standard and section if used, and an explanation for the reference.
Example:
"See" "Referenced Standard", "Standard Title", "Section Number", "Explanation of the reference"
Informational Note: See NFPA 101, Life Safety Code, 7.8, for illumination of means of egress.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
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Submittal Date: Tue Aug 29 11:15:17 EDT 2023
Committee: NEC-P01

Public Input No. 3086, Assigned to Code-Making Panel 2, Refer to Code Making Panels 3 - 18

Public Input No. 3086-NFPA 70-2023 [Global Input]

This Global Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document.
Articles may need to be revised to comply with the NEC Style Manual Section 2.2 for Numbering Conventions.

Statement of Problem and Substantiation for Public Input

This Global Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document.
Articles may need to be revised to comply with the NEC Style Manual Section 2.2 for Numbering Conventions. The Changes in 2.2.1 are requirements that may need to be revised.
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning
requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

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Submittal Date: Tue Aug 29 11:17:37 EDT 2023
Committee: NEC-P02

Public Input No. 3099, Assigned to Code-Making Panel 15, Refer to Code-Making Panels 3, 4, 6, 10, 11, 12, 13, 14, 16, 17 and 18

Public Input No. 3099-NFPA 70-2023 [Global Input]

Add Informational Notes to Scopes identifying Article specific and/or important definitions in one of the following formats:

Format A – the style used in NFPA Link's Enhanced Content material:

Informational Note No. x: Definitions. Each of the following terms has a definition in Article 100 that is unique to its use in "Article xxx":

Term 1

Term 2

Term 3

…

If needed:

Informational Note No. y: Definitions. Each of the following terms has a definition in Article 100 that appears in several articles but is important in its use in "Article xxx":

Term a

Term b

Term c

…

Format B – the style used in several places within the NEC itself:

Informational Note: See Article 100 for definitions of Term 1, Term 2, and Term 3 . . .

Statement of Problem and Substantiation for Public Input

The change to locations of definitions in the 2023 Edition of the NEC was controversial for many people because it reduced usability. Even though other NFPA codes and standards use this structure and was stated as a justification to the change in the 'NEC Style Manual' (some NFPA codes and standards include definitions within articles *), many believe this relocation leads to confusion among users, especially for those articles that are specialty topics – i.e., the articles in Chapters 5 through 8. There are over 37 pages of definitions in Article 100 to search through.

Common language terms often have more specific meanings within an article. One only needs to look at the multiple definitions for 'Portable Equipment' to get a sense of this issue. While the term 'Directly Controlled Emergency Luminaire' used in Article 700 seems self-explanatory, the actual definition is quite important. Without the proximate reference within Article 700, that distinction is not clear.

Article 200 does the following:
200.1 Scope.
This article provides requirements for the following:
(1) Identification of terminals
(2) Grounded conductors in premises wiring systems
(3) Identification of grounded conductors
Informational Note: See Article 100 for definitions of Grounded Conductor, Equipment Grounding Conductor, and Grounding Electrode Conductor.

Article 380 also adds a definition reference in an Informational Note to the scope.

There are approximately 30 references to Article 100 definitions within specific sections of the Code.

Under the current structure, important specialty definitions are lost in the sheer size of the Article 100 list. The usability of the NEC has been damaged, and users of specialty articles in Chapters 5 through 8 need help with this structure.

To restore the usability of the NEC, what is needed is a way to clearly identify and point to specialty definitions in a standardized location within articles (like we used to have with the .2 sections), while leaving the definitions themselves in Article 100. NFPA Link and the NEC Handbook add this information as Enhanced Content. Additionally, this "definition identification" model has proven its usability in other codes such as NFPA 1, NFPA 99, and NFPA 101. The NEC deserves no less.
* Example: NFPA 101 – Section 6.1.2.1 'Assembly Occupancy' is one of several definitions in an Article; and in this instance it is duplicated from 3.3.205.2]. In fact, there are multiple definitions throughout NFPA 101.

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Submittal Date: Tue Aug 29 11:45:19 EDT 2023

Committee: NEC-P15

Public Input No. 4050, Assigned to Code-Making Panel 10, Refer to Code-Making Panels 1 - 9 and 11 - 18

Public Input No. 4050-NFPA 70-2023 [Global Input]

Review the terms regarding overcurrent protection and determine if the correct term is being used.

(1) Branch-Circuit Overcurrent Protective Device

(2) Current-Limiting Overcurrent Protective Device

(3) Current-Limiting

(4) Current-Limiting Overcurrent

(5) Overcurrent Protection

(6) Overcurrent Protection Device

(7) Overcurrent Protective Device

(8) Supplementary Overcurrent Protective Device

(9) Supplementary Overcurrent Protection

Statement of Problem and Substantiation for Public Input

The defined terms regarding overcurrent protection need to be reviewed by all code making panels and determine if the correct term is being used. The code has too many terms regarding overcurent protection, some that are defined and some that are not defined. These terms are often used interchangeably in the wrong context.

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Committee: NEC-P10

Public Input No. 4075, Assigned to Code-Making Panel 1, Refer to Code-Making Panels 3, 4, 13 and 14

Public Input No. 4075-NFPA 70-2023 [Global Input]

Anywhere that 2019 NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance* is referenced in the NEC as an informational note, that it be changed to: NFPA 70B, *Standard for Electrical Equipment Maintenance.*

Statement of Problem and Substantiation for Public Input

There are two problems this will correct:
1. NFPA 70B was elevated to a standard during the last revision cycle, unfortunately it was not completed prior to the Public Input deadline for the 2023 NEC so many of the references are outdated.
2. By removiong the date in the informational note reference, there will be built in shelf life as this will now imply the most recent edition of 70B is being referenced.

Submitter Information Verification

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Submittal Date: Wed Sep 06 15:44:53 EDT 2023
Committee: NEC-P01

Public Input No. 4287, Assigned to Code-Making Panel 1, Refer to Code-Making Panels 2 - 18

Public Input No. 4287-NFPA 70-2023 [Global Input]

Clearly identify any requirements which are not applicable to DC circuits by incorporating the recommended terminology as applicable:

“Applicable to…[ac][single-phase][three-phase][wye][delta] circuits only”.

“Not applicable to dc circuits”

“[Volts] ac only”

Other terminology that clearly applies to a specific ac (or dc) application, such as through a defined term or unique equipment.

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee DC Task Group consisting of Danish Zia, Jason Fisher, Randy Dollar, Larry Wildermuth, Scott Higgins, Scott Harding, Mark Earley, Jason Hopkins, Christopher Vance, Chad Kennedy and Derrick Atkins. This Public Input, along with other Public Inputs, was developed with the goal of improving usability and accuracy on requirements associated with DC circuits.

DC residential and commercial installations are emerging in the electrical infrastructure and are expected to be a growing alternative to the traditional AC utility fed building. Examples include the US DOE Grid-interactive Efficient Buildings project (Note 1), the Purdue University RENEWW house (Note 2), and a DC Microgrid community in Vermont (Note 3). These installations may involve buildings that are distributed entirely with DC, or with an AC/DC hybrid distribution.

Although DC electrical distribution topics are covered by the NEC, the focus of most residential and commercial installations and the Code has historically been AC power. Many requirements are written using AC terminology or referencing only AC technology, but without distinction as to whether the requirement is also applicable to DC circuits or installations. Usage of terms such as “2-wire” and “3-wire”, or listing AC only voltages as informative references without appropriate mandatory language or further clarification may not provide sufficient clarity as to whether a requirement applies to DC circuits. This may leave the AHJ and other users of the Code confused. This public input recommends that such requirements be reviewed and clarified using the recommended terminology proposed.

Note 1 - https://www.energy.gov/sites/default/files/2020/09/f79/bto-geb-project-summary-093020.pdf
Note 2 - https://engineering.purdue.edu/ME/News/2022/purdue-house-runs-entirely-on-dc-power
Note 3 - https://www.efficiencyvermont.com/Media/Default/docs/white-papers/Energy_Resilience.pdf

Submitter Information Verification

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Submittal Date:	Thu Sep 07 09:28:38 EDT 2023
Committee:	NEC-P01

Copyright Assignment

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

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

Public Input No. 4541-NFPA 70-2023 [Global Input]

. Revise 700.32(C) Informational Note and title of Figure for the Informational Note to read as follows:

700.32 Selective Coordination.

700.32(A) General. Emergency system(s) overcurrent protective devices (OCPDs) shall be selectively coordinated with all supply-side and load-side OCPDs.

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.

700.32(B) Replacements. Where emergency system(s) OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

700.32(C) Modifications. If modifications, additions, or deletions to the emergency system(s) occur, selective coordination of the emergency system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note: See Informational Note Figure 700.32~~(C)~~ for an example of how emergency system OCPDs selectively coordinate with all supply-side OCPDs.

~~OCPD D selectively coordinates with OCPDs C, F, E, B, and A.~~

~~OCPD C selectively coordinates with OCPDs F, E, B, and A.~~

~~OCPD F selectively coordinates with OCPD E.~~

~~OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not an emergency system OCPD.~~

[IMAGE]

Informational Note Figure 700.32~~(C)~~ Emergency System Selective Coordination.

OCPD D selectively coordinates with OCPDs C, F, E, B, and A.

OCPD C selectively coordinates with OCPDs F, E, B, and A.

OCPD F selectively coordinates with OCPD E.

OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not an emergency system OCPD.

Revise 701.32(C) Informational Note and title of Figure for the Informational Note to read as follows:

701.32 Selective Coordination.

701.32(A) General. Legally required standby system(s) overcurrent protective devices (OCPDs shall be selectively coordinated with all supply-side and load-side OCPDs.

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.

701.32(B) Replacements. Where legally required standby OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

701.32(C) Modifications. If modifications, additions, or deletions to the legally required standby system(s) occur, selective coordination of the legally required system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note: See Informational Note Figure 701.32~~(C)~~ for an example of how legally required standby system OCPDs selectively coordinate with all supply-side OCPDs.

~~**OCPD D selectively coordinates with OCPDs C, F, E, B, and A.**~~

~~**OCPD C selectively coordinates with OCPDs F, E, B, and A.**~~

~~**OCPD F selectively coordinates with OCPD E.**~~

~~**OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.**~~

[IMAGE]

Informational Note Figure 701.32~~(C)~~ Legally Required Standby System Selective Coordination.

OCPD D selectively coordinates with OCPDs C, F, E, B, and A.

OCPD C selectively coordinates with OCPDs F, E, B, and A.

OCPD F selectively coordinates with OCPD E.

OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.

Revise 708.54(C) Informational Note and title of Figure for the Informational Note to read as follows:

708.54(A) General. Critical operations power system(s) overcurrent protective devices (OCPDs) shall be selectively coordinated with all supply-side and load-side OCPDs.

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.

708.54(B) Replacements. Where critical operations power system(s) OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

708.54(C) Modifications. If modifications, additions, or deletions to the critical operations power system(s) occur, selective coordination of the critical operations power system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note: See Informational Note Figure 708.54~~(C)~~ for an example of how critical operations power system OCPDs selectively coordinate with all supply-side

OCPDs.

~~**OCPD D selectively coordinates with OCPDs C, F, E, B, and A.**~~

~~**OCPD C selectively coordinates with OCPDs F, E, B, and A.**~~

~~**OCPD F selectively coordinates with OCPD E.**~~

~~**OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not a critical operations power system OCPD.**~~

[IMAGE]

Informational Note Figure 708.54~~(C)~~ Critical Operations Power System Selective Coordination.

OCPD D selectively coordinates with OCPDs C, F, E, B, and A.

OCPD C selectively coordinates with OCPDs F, E, B, and A.

OCPD F selectively coordinates with OCPD E.

OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not a critical operations power system OCPD.

Additional Proposed Changes

File Name	Description	Approved
TIA_1692_70_23_11.pdf	NFPA TIA 23-11 Log No. 1692	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 23-11 (Log 1692) issued by the Standards Council on August 25, 2023 and per the NFPA Regs., needs to be reconsidered by the Technical Committee for the next edition of the Document.

Substantiation: For each article above: The informational note and figure currently only reference part (C)
of the section. When a new part (B) and (C) where added the section, the informational note was correctly
moved to the end of the section. The intent was to have this informational note and figure apply to the entire
section. However, the (C) was mistakenly added by NFPA Staff to the informational note and figure after
the first draft report and was not noticed by the CMP during the second draft stage of the process. NFPA was
contacted that this was an entry error by staff and asked to correct as an erratum. NFPA came back with the
recommendation to do a TIA to correct the entry error. This TIA seeks to remove the (C) from the informational note and figure, as recommended by NFPA.

Emergency Nature: The standard contains an error or an omission that was overlooked during the regular
revision process.

For each article above: The informational note and figure is intended to apply to all of this section. It now
can mistakenly be viewed to only apply when modifications are made to the emergency system. It is important to know that this informational note and figure applies for all emergency systems, replacements,
and modifications.

Submitter Information Verification

Submitter Full Name:	CMP on NEC-P13
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Submittal Date:	Tue Sep 12 18:51:39 EDT 2023
Committee:	NEC-P13

Tentative Interim Amendment

NFPA® 70®

National Electrical Code®

2023 Edition

Reference: 700.32(C), 701.32(C), and 708.54(C)
TIA 23-11
(SC 23-8-54 / TIA Log #1692)

Pursuant to Section 5 of the NFPA *Regulations Governing the Development of NFPA Standards*, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 70®, *National Electrical Code®*, 2023 edition. The TIA was processed by Code-Making Panel 13 and the Correlating Committee on National Electrical Code, and was issued by the Standards Council on August 25, 2023, with an effective date of September 14, 2023.

1. Revise 700.32(C) Informational Note and title of Figure for the Informational Note to read as follows:

700.32 Selective Coordination.

700.32(A) General. Emergency system(s) overcurrent protective devices (OCPDs) shall be selectively coordinated with all supply-side and load-side OCPDs.

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.

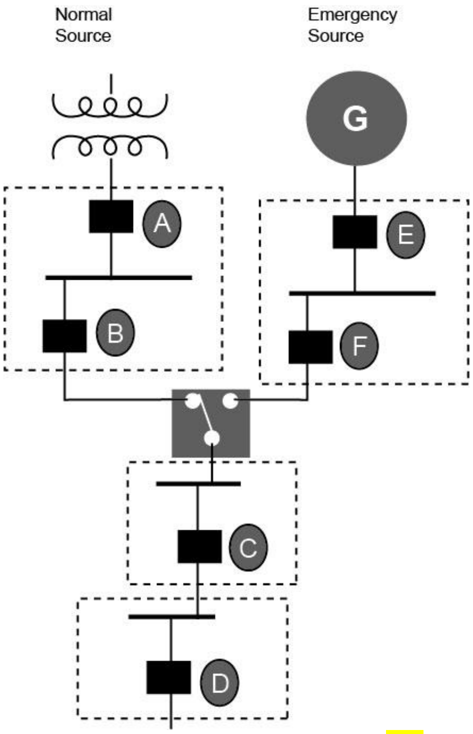
700.32(B) Replacements. Where emergency system(s) OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

700.32(C) Modifications. If modifications, additions, or deletions to the emergency system(s) occur, selective coordination of the emergency system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note: See Informational Note Figure 700.32~~(C)~~ for an example of how emergency system OCPDs selectively coordinate with all supply-side OCPDs.

~~OCPD D selectively coordinates with OCPDs C, F, E, B, and A.~~
~~OCPD C selectively coordinates with OCPDs F, E, B, and A.~~
~~OCPD F selectively coordinates with OCPD E.~~
~~OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not an emergency system OCPD.~~



Informational Note Figure 700.32~~(C)~~ Emergency System Selective Coordination.
OCPD D selectively coordinates with OCPDs C, F, E, B, and A.
OCPD C selectively coordinates with OCPDs F, E, B, and A.
OCPD F selectively coordinates with OCPD E.
OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not an emergency system OCPD.

2. Revise 701.32(C) Informational Note and title of Figure for the Informational Note to read as follows:

701.32 Selective Coordination.

701.32(A) General. Legally required standby system(s) overcurrent protective devices (OCPDs shall be selectively coordinated with all supply-side and load-side OCPDs.

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.

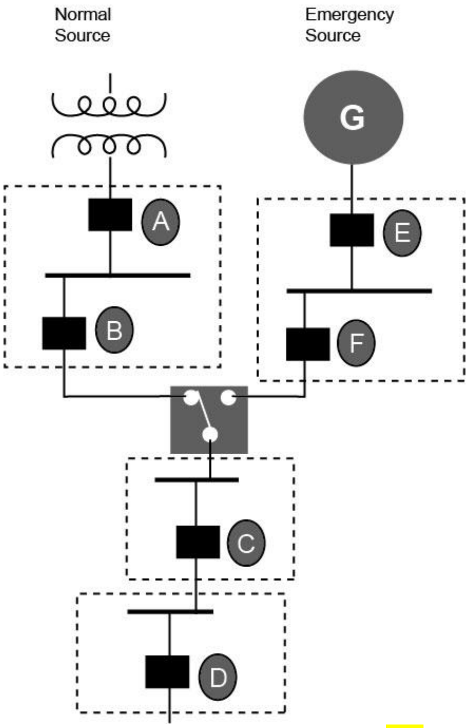
701.32(B) Replacements. Where legally required standby OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

701.32(C) Modifications. If modifications, additions, or deletions to the legally required standby system(s) occur, selective coordination of the legally required system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note: See Informational Note Figure 701.32~~(C)~~ for an example of how legally required standby system OCPDs selectively coordinate with all supply-side OCPDs.

~~OCPD D selectively coordinates with OCPDs C, F, E, B, and A.~~
~~OCPD C selectively coordinates with OCPDs F, E, B, and A.~~
~~OCPD F selectively coordinates with OCPD E.~~
~~OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.~~



Informational Note Figure 701.32~~(C)~~ Legally Required Standby System Selective Coordination.
OCPD D selectively coordinates with OCPDs C, F, E, B, and A.
OCPD C selectively coordinates with OCPDs F, E, B, and A.
OCPD F selectively coordinates with OCPD E.
OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.

3. Revise 708.54(C) Informational Note and title of Figure for the Informational Note to read as follows:

708.54(A) General. Critical operations power system(s) overcurrent protective devices (OCPDs) shall be selectively coordinated with all supply-side and load-side OCPDs.

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.

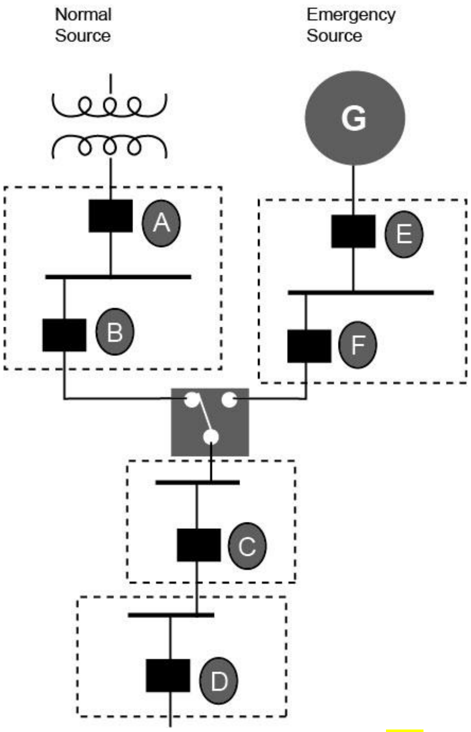
708.54(B) Replacements. Where critical operations power system(s) OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

708.54(C) Modifications. If modifications, additions, or deletions to the critical operations power system(s) occur, selective coordination of the critical operations power system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note: See Informational Note Figure 708.54~~(C)~~ for an example of how critical operations power system OCPDs selectively coordinate with all supply-side OCPDs.

~~OCPD D selectively coordinates with OCPDs C, F, E, B, and A.~~
~~OCPD C selectively coordinates with OCPDs F, E, B, and A.~~
~~OCPD F selectively coordinates with OCPD E.~~
~~OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not a critical operations power system OCPD.~~



Informational Note Figure 708.54~~(C)~~ Critical Operations Power System Selective Coordination.
OCPD D selectively coordinates with OCPDs C, F, E, B, and A.
OCPD C selectively coordinates with OCPDs F, E, B, and A.
OCPD F selectively coordinates with OCPD E.
OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not a critical operations power system OCPD.

Issue Date: August 25, 2023

Effective Date: September 14, 2023

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo)

Public Input No. 544-NFPA 70-2023 [Global Input]

The NEC should be updated so smart panels can support over their rated capacity if they dynamically shut down circuits so they won't exceed their rated capacity for more than a moment... As indicated in https://youtu.be/CVLLNjSLJTQ?t=985.

Statement of Problem and Substantiation for Public Input

This change would allow users to avoid expensive electric upgrades whole still maintaining safety.

Submitter Information Verification

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Submittal Date: Sat Apr 08 06:00:19 EDT 2023
Committee: NEC-P13

Public Input No. 3618-NFPA 70-2023 [Article 100]

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. An article number in parentheses following the definition indicates that the definition only applies to that article.

Informational Note: A definition that is followed by a reference in brackets has been extracted from one of the following standards. Only editorial changes were made to the extracted text to make it consistent with this *Code* .

(1) NFPA 30A-2021, *Code for Motor Fuel Dispensing Facilities and Repair Garages*

(2) NFPA 33-2021, *Standard for Spray Application Using Flammable or Combustible Materials*

(3) NFPA 75-2020, *Standard for the Fire Protection of Information Technology Equipment*

(4) NFPA 79-2021, *Electrical Standard for Industrial Machinery*

(5) NFPA 99-2021, *Health Care Facilities Code*

(6) NFPA *101*®-2022, *Life Safety Code*®

(7) NFPA 110-2019, *Standard for Emergency and Standby Power Systems*

(8) NFPA 303-2021, *Fire Protection Standard for Marinas and Boatyards*

(9) NFPA 307-2021, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves*

(10) NFPA 499-2021, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*

(11) NFPA 501-2022, *Standard on Manufactured Housing*

(12) NFPA 790-2021, *Standard for Competency of Third-Party Field Evaluation Bodies*

(13) NFPA 1192-2021, *Standard on Recreational Vehicles*

Accessible (as applied to equipment).

Capable of being reached for operation, renewal, and inspection. (CMP-1)

Accessible (as applied to wiring methods).

Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in or blocked by the structure, other electrical equipment, other building systems, or finish of the building. (CMP-1)

Accessible, Readily (Readily Accessible).

Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth. (CMP-1)

Informational Note: Use of keys is a common practice under controlled or supervised conditions and a common alternative to the ready access requirements under such supervised conditions as provided elsewhere in the *NEC* .

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. (520) (CMP-15)

Adjustable Speed Drive.

Power conversion equipment that provides a means of adjusting the speed of an electric motor. (CMP-11)

> 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. (CMP-11)

Aircraft Painting Hangar.

An aircraft hangar constructed for the express purpose of spraying, coating, and/or dipping applications and provided with dedicated ventilation supply and exhaust. (CMP-14)

Alternate Power Source.

One or more generator sets, or battery systems where permitted, intended to provide power during the interruption of the normal electrical service; or the public utility electrical service intended to provide power during interruption of service normally provided by the generating facilities on the premises. [**99:** 3.3.4] (517) (CMP-15)

Ambulatory Health Care Occupancy.

An occupancy used to provide services or treatment simultaneously to four or more patients that provides, on an outpatient basis, one or more of the following:

(1) Treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.

(2) Anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.

(3) Treatment for patients who, due to the nature of their injury or illness, are incapable of taking action for self-preservation under emergency conditions without the assistance of others.

[***101*** **:** 3.3.198.1] (517) (CMP-15)

Ampacity.

The maximum current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating. (CMP-6)

Amplifier (Audio Amplifier) (Pre-Amplifier).

Electronic equipment that increases the current or voltage, or both, of an audio signal intended for use by another piece of audio equipment. Amplifier is the term used to denote an audio amplifier. (640) (CMP-12)

Appliance.

Utilization equipment, generally other than industrial, that is fastened in place, stationary, or portable; is normally built in a standardized size or type; 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. (CMP-17)

Applicator.

The device used to transfer energy between the output circuit and the object or mass to be heated. (665) (CMP-12)

Approved.

Acceptable to the authority having jurisdiction. (CMP-1)

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. (CMP-2)

Array.

A mechanically and electrically integrated grouping of modules with support structure, including any attached system components such as inverter(s) or dc-to-dc converter(s) and attached associated wiring. (690) (CMP-4)

Askarel.

A generic term for a group of nonflammable synthetic chlorinated hydrocarbons used as electrical insulating media. (CMP-9)

> 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.

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

(CMP-14)

> Informational Note No. 1: Associated apparatus has identified intrinsically safe connections for intrinsically safe apparatus and also might 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.

> Informational Note No. 3: See ANSI/UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations*; ANSI/UL 60079-11, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i"*; and ANSI/ISA RP 12.06.01, *Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation — Part 1: Intrinsic Safety*, for additional information.

Associated Nonincendive Field Wiring Apparatus.

Apparatus in which the circuits are not necessarily nonincendive themselves but that affects the energy in nonincendive field wiring circuits and is relied on to maintain nonincendive energy levels. 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

(CMP-14)

Informational Note No. 1: Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and also might have connections for other electrical apparatus.

Informational Note No. 2: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*, for additional information.

Attachment Fitting, Weight-Supporting (WSAF) (Weight-Supporting Attachment Fitting).

A device that, by insertion into a weight-supporting ceiling receptacle, establishes a connection between the conductors of the attached utilization equipment and the branch-circuit conductors connected to the weight-supporting ceiling receptacle. (CMP-18)

Informational Note No. 1: A weight-supporting attachment fitting is different from an attachment plug because no cord is associated with the fitting. A weight-supporting attachment fitting in combination with a weight-supporting ceiling receptacle secures the associated utilization equipment in place and supports its weight.

Informational Note No. 2: See ANSI/NEMA WD 6, *American National Standard for Wiring Devices — Dimensional Specifications*, for the standard configuration of weight-supporting attachment fittings and related weight-supporting ceiling receptacles.

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. (CMP-18)

Audio Autotransformer.

A transformer with a single winding and multiple taps intended for use with an amplifier loudspeaker signal output. (640) (CMP-12)

Audio Signal Processing Equipment (Audio Equipment).

Electrically operated equipment that produces, processes, or both, electronic signals that, when appropriately amplified and reproduced by a loudspeaker, produce an acoustic signal within the range of normal human hearing (typically 20–20 kHz). Within Article 640, the terms equipment and audio equipment are assumed to be equivalent to audio signal processing equipment. (640) (CMP-12)

Informational Note: This equipment includes, but is not limited to, loudspeakers; headphones; pre-amplifiers; microphones and their power supplies; mixers; MIDI (musical instrument digital interface) equipment or other digital control systems; equalizers, compressors, and other audio signal processing equipment; and audio media recording and playback equipment, including turntables, tape decks and disk players (audio and multimedia), synthesizers, tone generators, and electronic organs. Electronic organs and synthesizers may have integral or separate amplification and loudspeakers. With the exception of amplifier outputs, virtually all such equipment is used to process signals (using analog or digital techniques) that have nonhazardous levels of voltage or current.

Audio System.

The totality of all equipment and interconnecting wiring used to fabricate a fully functional audio signal processing, amplification, and reproduction system. (640) (CMP-12)

Audio Transformer.

A transformer with two or more electrically isolated windings and multiple taps intended for use with an amplifier loudspeaker signal output. (640) (CMP-12)

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. (CMP-1)

> 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. (CMP-1)

Backup power. A term of art used in the field to describe any of several sources of power of varying capacity that energize manually or automatically when the normal source of power is interrupted: emergency, optional standby, legally required, essential, life safety, critical, and integrated

Bathroom.

An area including a sink with one or more of the following: a toilet, a urinal, a tub, a shower, a bidet, or similar plumbing fixtures. (CMP-2)

Battery.

A single cell or a group of cells connected together electrically in series, in parallel, or a combination of both. (CMP-13)

Battery, Flow. (Flow Battery)

An energy storage component that stores its active materials in the form of one or two electrolytes external to the reactor interface. When in use, the electrolytes are transferred between reactor and storage tanks. (706) (CMP-13)

> Informational Note: Three commercially available flow battery technologies are zinc air, zinc bromine, and vanadium redox, sometimes referred to as *pumped electrolyte ESS* .

Battery, Sealed. (Sealed Battery)

A 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. (CMP-13)

Battery, Stationary Standby. (Stationary Standby Battery)

A battery that spends the majority of the time on continuous float charge or in a high state of charge, in readiness for a discharge event. (CMP-13)

> Informational Note: Uninterruptible Power Supply (UPS) batteries are an example that falls under this definition.

Battery-Powered Lighting Units.

Individual unit equipment for backup illumination consisting of a rechargeable battery; a battery-charging means; provisions for one or more lamps mounted on the equipment, or with terminals for remote lamps, or both; and a relaying device arranged to energize the lamps automatically upon failure of the supply to the unit equipment. (517) (CMP-15)

Berth.

The water space to be occupied by a boat or other vessel alongside or between bulkheads, piers, piles, fixed and floating docks, or any similar access structure. [**303:** 3.3.2] (555) (CMP-7)

Informational Note: See the definition of *Slip* for additional information.

Bipolar Circuit.

A dc circuit that is comprised of two monopole circuits, each having an opposite polarity connected to a common reference point. (CMP-4)

Block.

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street. (800) (CMP-16)

Boatyard.

A facility used for constructing, repairing, servicing, hauling from the water, storing (on land and in water), and launching of boats. [**303:** 3.3.3] (555) (CMP-7)

Bodies of Water, Artificially Made. (Artificially Made Bodies of Water)

Bodies of water that have been constructed or modified to fit some decorative or commercial purpose such as, but not limited to, aeration ponds, fish farm ponds, storm retention basins, treatment ponds, and irrigation (channel) facilities. Water depths may vary seasonally or be controlled. (682) (CMP-17)

Bodies of Water, Natural. (Natural Bodies of Water)

Bodies of water such as lakes, streams, ponds, rivers, and other naturally occurring bodies of water, which may vary in depth throughout the year. (682) (CMP-17)

Bonded (Bonding).

Connected to establish electrical continuity and conductivity. (CMP-5)

Bonding Conductor (Bonding Jumper).

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

Bonding Jumper, Equipment. (Equipment Bonding Jumper)

The connection between two or more portions of the equipment grounding conductor. (CMP-5)

Bonding Jumper, Main. (Main Bonding Jumper)

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

Bonding Jumper, Supply-Side. (Supply-Side Bonding Jumper)

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

Bonding Jumper, System. (System Bonding Jumper)

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. (CMP-5)

Border Light.

A permanently installed overhead strip light. (520) (CMP-15)

Bottom Shield.

A protective layer that is installed between the floor and flat conductor cable (Type FCC) to protect the cable from physical damage and may or may not be incorporated as an integral part of the cable. (324) (CMP-6)

Branch Circuit (Branch-Circuit).

The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s). (CMP-2)

Branch Circuit, Appliance. (Appliance Branch Circuit)

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. (CMP-2)

Branch Circuit, General-Purpose. (General-Purpose Branch Circuit)

A branch circuit that supplies two or more receptacles or outlets for lighting and appliances. (CMP-2)

Branch Circuit, Individual. (Individual Branch Circuit)

A branch circuit that supplies only one utilization equipment. (CMP-2)

Branch Circuit, Motor. (Motor Branch Circuit)

The circuit conductors, including equipment, between the motor branch-circuit short-circuit and ground-fault protective device and an individual motor. (CMP-11)

Branch Circuit, Multiwire. (Multiwire Branch Circuit)

A branch circuit that consists of two or more ungrounded conductors that have a voltage between them, and a neutral conductor that has equal voltage between it and each ungrounded conductor of the circuit and that is connected to the neutral conductor of the system. (CMP-2)

Branch-Circuit Selection Current (BCSC).

The value in amperes to be used instead of the rated-load current in determining the ratings of motor branch-circuit conductors, disconnecting means, controllers, and branch-circuit short-circuit and ground-fault protective devices wherever the running overload protective device permits a sustained current greater than the specified percentage of the rated-load current. The value of branch-circuit selection current will always be equal to or greater than the marked rated-load current. (440) (CMP-11)

Breakout Assembly.

An adapter used to connect a multipole connector containing two or more branch circuits to multiple individual branch-circuit connectors. (520) (CMP-15)

Broadband.

Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types. (CMP-16)

Building.

A structure that stands alone or that is separated from adjoining structures by fire walls. (CMP-1)

Building, Floating. (Floating Building)

A building that floats on water, is moored in a permanent location, and has a premises wiring system served through connection by permanent wiring to an electrical supply system not located on the premises. (CMP-7)

Building, Manufactured. (Manufactured Building)

Any building that is of closed construction and is made or assembled in manufacturing facilities on or off the building site for installation, or for assembly and installation on the building site, other than manufactured homes, mobile homes, park trailers, or recreational vehicles. (545) (CMP-7)

Building Component.

Any subsystem, subassembly, or other system designed for use in or integral with or as part of a structure, which can include structural, electrical, mechanical, plumbing, and fire protection systems, and other systems affecting health and safety. (545) (CMP-7)

Building System.

Plans, specifications, and documentation for a system of manufactured building or for a type or a system of building components, which can include structural, electrical, mechanical, plumbing, and fire protection systems, and other systems affecting health and safety, and including such variations thereof as are specifically permitted by regulation, and which variations are submitted as part of the building system or amendment thereto. (545) (CMP-7)

Bulkhead.

A vertical structural wall, usually of stone, timber, metal, concrete, or synthetic material, constructed along, and generally parallel to, the shoreline to retain earth as an extension of the upland, and often to provide suitable water depth at the waterside face. [**303:** 3.3.5] (555) (CMP-7)

Bull Switch.

An externally operated wall-mounted safety switch that can contain overcurrent protection and is designed for the connection of portable cables and cords. (530) (CMP-15)

Bundled.

Cables or conductors that are tied, wrapped, taped, or otherwise periodically bound together. (520) (CMP-15)

Busbar.

A noninsulated conductor electrically connected to the source of supply and physically supported on an insulator providing a power rail for connection to utilization equipment, such as sensors, actuators, A/V devices, low-voltage luminaire assemblies, and similar electrical equipment. (393) (CMP-18)

Busbar Support.

An insulator that runs the length of a section of suspended ceiling bus rail that serves to support and isolate the busbars from the suspended grid rail. (393) (CMP-18)

Busway.

A raceway consisting of a metal enclosure containing factory-mounted, bare or insulated conductors, which are usually copper or aluminum bars, rods, or tubes. (CMP-8)

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. (CMP-9)

Cable, Abandoned. (Abandoned Cable)

Installed cable that is not terminated at equipment other than a termination fitting or a connector and is not identified for future use with a tag. (CMP-16)

> Informational Note: See 640.6(B), 645.5(G), 722.25, 760.25, 770.25, and 800.25 for requirements covering the removal of abandoned cables.

Cable, Armored (Type AC). (Armored Cable)

A fabricated assembly of insulated conductors in a flexible interlocked metallic armor. (CMP-6)

Cable, Circuit Integrity (CI). (Circuit Integrity Cable)

Cable(s) marked with the suffix "-CI" used for remote-control, signaling, power-limited, fire alarm, optical fiber, or communications systems that supply critical circuits to ensure survivability for continued circuit operation for a specified time under fire conditions. (CMP-3)

Informational Note: See 728.4 for power circuits installed for survivability.

Cable, Coaxial. (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. (CMP-16)

Cable, Festoon. (Festoon Cable)

Single- and multiple-conductor cable intended for use and installation where flexibility is required. (610) (CMP-12)

Cable, Flat Conductor (Type FCC). (Flat Conductor Cable)

Three or more separate flat copper conductors placed horizontally edge-to-edge and enclosed within an insulating assembly. (324) (CMP-6)

Cable, Instrumentation Tray (Type ITC). (Instrumentation Tray Cable)

A factory assembly of two or more insulated conductors, with or without an equipment grounding conductor(s), enclosed in a nonmetallic sheath. (CMP-3)

Cable, Integrated Gas Spacer (Type IGS). (Integrated Gas Spacer Cable)

A factory assembly of one or more conductors, each individually insulated and enclosed in a loose fit, nonmetallic flexible conduit as an integrated gas spacer cable rated 0 volts through 600 volts. (CMP-6)

Cable, Limited Use. (Limited-Use Cable)

Cables that are intended to be used with protection such as a raceway or for specific restricted applications. (722) (CMP-3)

Cable, Medium Voltage(Type MV). (Medium Voltage Cable)

A single or multiconductor solid dielectric insulated cable rated 2001 volts up to and including 35,000 volts, nominal. (CMP-6)

Cable, Metal Clad (Type MC). (Metal Clad Cable)

A factory assembly of one or more insulated circuit conductors with or without optical fiber members enclosed in an armor of interlocking metal tape, or a smooth or corrugated metallic sheath. (CMP-6)

Cable, Metallic Conductor. (Metallic Conductor Cable)

A factory assembly of two or more conductors having an overall covering. (CMP-16)

Cable, Mineral-Insulated, Metal-Sheathed (Type MI). (Mineral-Insulated, Metal-Sheathed Cable)

A factory assembly of one or more conductors insulated with a highly compressed refractory mineral insulation and enclosed in a liquidtight and gastight continuous copper or alloy steel sheath. (CMP-6)

Cable, Nonmetallic-Sheathed.

A factory assembly of two or more insulated conductors enclosed within an overall nonmetallic jacket. (CMP-6)

Cable, Nonmetallic-Sheathed (Type NM).

Insulated conductors enclosed within an overall nonmetallic jacket. (CMP-6)

Cable, Nonmetallic-Sheathed (Type NMC).

Insulated conductors enclosed within an overall, corrosion resistant, nonmetallic jacket. (CMP-6)

Cable, Optical Fiber. (Optical Fiber Cable)

A factory assembly or field assembly of one or more optical fibers having an overall covering. (CMP-16)

> 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.

Cable, Optical Fiber, Conductive. (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. (CMP-16)

Cable, Optical Fiber, Hybrid. (Hybrid Optical Fiber Cable)

A cable containing optical fibers and current-carrying electrical conductors. (CMP-16)

Cable, Optical Fiber, Nonconductive. (Nonconductive Optical Fiber Cable)

A factory assembly of one or more optical fibers having an overall covering and containing no electrically conductive materials. (CMP-16)

Cable, Optical Fiber, Protected. (Protected Optical Fiber Cable)

Optical fiber cable protected from releasing optical radiation into the atmosphere during normal operating conditions and foreseeable malfunctions by additional armoring, conduit, cable tray, or raceway. (CMP-14)

> Informational Note: See ANSI/UL 60079-28, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation* , for additional information.

Cable, Portable Power Feeder. (Portable Power Feeder Cable)

One or more flexible shielded insulated power conductors enclosed in a flexible covering rated from 2001 to 25,000 volts. (CMP-6)

Cable, Power and Control Tray (Type TC). (Power and Control Tray Cable)

A factory assembly of two or more insulated conductors, with or without associated bare or covered equipment grounding conductors, under a nonmetallic jacket. (CMP-6)

Cable, Power-Limited Tray (Type PLTC). (Power-Limited Tray Cable)

A factory assembly of two or more insulated conductors rated at 300 volts, with or without associated bare or insulated equipment grounding conductors, under a nonmetallic jacket. (CMP-3)

Cable, Service. (Service Cable)

Service conductors made up in the form of a cable. (CMP-10)

Cable, Service Entrance. (Service Entrance Cable)

A single conductor or multiconductor cable provided with an overall covering, primarily used for services. (CMP-6)

Cable, Service Entrance (Type SE).

Service-entrance cable having a flame-retardant, moisture-resistant covering. (CMP-6)

Cable, Service Entrance (Type USE).

Service-entrance cable, identified for underground use, having a moisture-resistant covering, but not required to have a flame-retardant covering. (CMP-6)

Cable, Type P.

A factory assembly of one or more insulated flexible tinned copper conductors, with associated equipment grounding conductor(s), with or without a braided metallic armor and with an overall nonmetallic jacket. (CMP-6)

Cable, Under Carpet. (Under Carpet Cable)

Cables that are intended to be used under carpeting, floor covering, modular tiles, and planks. (722) (CMP-3)

Cable, Underground Feeder and Branch-Circuit (Type UF). (Underground Feeder and Branch-Circuit Cable)

A factory assembly of one or more insulated conductors with an integral or an overall covering of nonmetallic material suitable for direct burial in the earth. (CMP-6)

Cable Assembly, Flat (Type FC). (Flat Cable Assembly)

An assembly of parallel conductors formed integrally with an insulating material web specifically designed for field installation in surface metal raceway. (CMP-6)

Cable Bundle.

A group of cables that are tied together or in contact with one another in a closely packed configuration for at least 1.0 m (40 in.). (CMP-3)

> Informational Note: Random or loose installation of individual cables can result in less heating. Combing of the cables can result in less heat dissipation and more signal cross talk between cables.

Cable Connector.

A connector designed to join flat conductor cables (Type FCC) without using a junction box. (324) (CMP-6)

Cable Connector [as applied to hazardous (classified) locations].

An electrical device that is part of a cable assembly and that, by insertion of two mating configurations, establishes a connection between the conductors of the cable assembly and the conductors of a fixed piece of equipment. (CMP-14)

> Informational Note No. 1: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for information on the use of cable connectors.

> Informational Note No. 2: Cable connectors in other than hazardous (classified) locations are referred to as male and female fittings.

> Informational Note No. 3: See ANSI/UL 2238, *Cable Assemblies and Fittings for Industrial Control and Signal Distribution* , and ANSI/UL 2237, *Multi-Point Interconnection Power Cable Assemblies for Industrial Machinery* , for examples of standards on male and female fittings in other than hazardous (classified) locations.

Cable Joint.

A connection consisting of an insulation system and a connector where two (or more) medium voltage (Type MV) cables are joined together. (CMP-6)

Cable Management System.

An apparatus designed to control and organize lengths of cable or cord. (CMP-12)

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. (CMP-16)

Cable Sheath.

A single or multiple layers of a protective covering that holds and protects the conductors or optical fibers, or both, contained inside. (CMP-16)

Cable System, Fire-Resistive. (Fire-Resistive Cable System)

A cable and components used to ensure survivability of critical circuits for a specified time under fire conditions. (CMP-3)

Cable System, Flat Conductor. (Flat Conductor Cable System)

A complete wiring system for branch circuits that is designed for installation under carpet squares. (324) (CMP-6)

> Informational Note: The FCC system includes Type FCC cable and associated shielding, connectors, terminators, adapters, boxes, and receptacles.

Cable Termination.

A connection consisting of an insulation system and a connector and installed on a medium voltage (Type MV) cable to connect from a cable to a device, such as equipment. (CMP-6)

Cable Tray System.

A unit or assembly of units or sections and associated fittings forming a structural system used to securely fasten or support cables and raceways. (CMP-8)

Cablebus.

An assembly of units or sections with insulated conductors having associated fittings forming a structural system used to securely fasten or support conductors and conductor terminations in a completely enclosed, ventilated, protective metal housing. This assembly is designed to carry fault current and to withstand the magnetic forces of such current. (CMP-8)

> Informational Note: Cablebus is ordinarily assembled at the point of installation from the components furnished or specified by the manufacturer in accordance with instructions for the specific job.

Cell (as applied to batteries).

The basic electrochemical unit, characterized by an anode and a cathode, used to receive, store, and deliver electrical energy. (CMP-13)

Cell, Sealed. (Sealed Cell)

A cell 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. (CMP-13)

Cell Line.

An assembly of electrically interconnected electrolytic cells supplied by a source of direct-current power. (CMP-12)

Cell Line Attachments and Auxiliary Equipment.

A term that includes, but is not limited to, auxiliary tanks; process piping; ductwork; structural supports; exposed cell line conductors; conduits and other raceways; pumps, positioning equipment, and cell cutout or bypass electrical devices. Auxiliary equipment includes tools, welding machines, crucibles, and other portable equipment used for operation and maintenance within the electrolytic cell line working zone. In the cell line working zone, auxiliary equipment includes the exposed conductive surfaces of ungrounded cranes and crane-mounted cell-servicing equipment. (668) (CMP-12)

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. (CMP-13)

Charger Power Converter.

The device used to convert energy from the power grid to a high-frequency output for wireless power transfer. (625) (CMP-12)

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. (406) (CMP-18)

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. (CMP-10)

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

Circuit Breaker, Adjustable. (Adjustable Circuit Breaker)

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. (CMP-10)

Circuit Breaker, Instantaneous Trip. (Instantaneous Trip Circuit Breaker)

A qualifying term indicating that no delay is purposely introduced in the tripping action of the circuit breaker. (CMP-10)

Circuit Breaker, Inverse Time. (Inverse Time Circuit Breaker)

A qualifying term indicating that there is a delay purposely introduced in the tripping action of the circuit breaker, and the delay decreases as the magnitude of the current increases. (CMP-10)

Circuit Breaker, Nonadjustable. (Nonadjustable Circuit Breaker)

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. (CMP-10)

Class 1 Circuit.

The portion of the wiring system between the load side of the Class 1 power source and the connected equipment. (CMP-3)

Class 2 Circuit.

The portion of the wiring system between the load side of a Class 2 power source and the connected equipment. Due to its power limitations, a Class 2 circuit considers safety from a fire initiation standpoint and provides acceptable protection from electric shock. (CMP-3)

Class 3 Circuit.

The portion of the wiring system between the load side of a Class 3 power source and the connected equipment. Due to its power limitations, a Class 3 circuit considers safety from a fire initiation standpoint. Since higher levels of voltage and current than for Class 2 are permitted, additional safeguards are specified to provide protection from an electric shock hazard that could be encountered. (CMP-3)

Class 4 Circuit.

The portion of the wiring system between the load side of a Class 4 transmitter and the Class 4 receiver or Class 4 utilization equipment, as appropriate. Due to the active monitoring and control of the voltage and current provided, a Class 4 circuit considers safety from a fire initiation standpoint and provides acceptable protection from electric shock. (726) (CMP-3)

> Informational Note: A Class 4 circuit is also commonly referred to as a fault-managed power circuit.

Class 4 Device.

Any active device connected to the Class 4 circuit; examples include a Class 4 transmitter, a Class 4 receiver, or Class 4 utilization equipment. (CMP-3)

Class 4 Power System.

An actively monitored and controlled system consisting of one or more Class 4 transmitters and one or more Class 4 receivers connected by a cabling system. (CMP-3)

Class 4 Receiver.

A device that accepts Class 4 power and converts it for use by utilization equipment. (CMP-3)

Class 4 Transmitter.

A device that sources Class 4 power. (726) (CMP-3)

> Informational Note: A Class 4 transmitter is different from traditional power sources in that it monitors the line for faults (both line-to-line and line-to-ground) and ceases power transmission if a fault is sensed.

Class 4 Utilization Equipment.

Devices that are directly powered by a Class 4 transmitter without the need for a separate Class 4 receiver (the receiver is integrated into the equipment). (CMP-3)

Closed Construction.

Any building, building component, assembly, or system manufactured in such a manner that all concealed parts of processes of manufacture cannot be inspected after installation at the building site without disassembly, damage, or destruction. (545) (CMP-7)

Clothes Closet.

A nonhabitable room or space intended primarily for storage of garments and apparel. (CMP-1)

Clothes Closet Storage Space.

The area within a clothes closet in which combustible materials can be kept. (410) (CMP-18)

Collector Rings.

An assembly of slip rings for transferring electric energy from a stationary to a rotating member. (675) (CMP-7)

Combiner (DC). (dc Combiner) (Direct-Current Combiner)

An enclosure that includes devices used to connect two or more PV system dc circuits in parallel. (690) (CMP-4)

Combustible Dust.

Solid particles that are 500 μm or smaller (i.e., material passing a U.S. No. 35 Standard Sieve as defined in ASTM E11-17, *Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves*) that can form an explosible mixture when suspended in air at standard atmospheric pressure and temperature. [**499:** 3.3.3] (CMP-14)

> Informational Note: See ASTM E1226, *Standard Test Method for Explosibility of Dust Clouds* ; ISO 6184-1, *Explosion protection systems — Part 1: Determination of explosion indices of combustible dusts in air* ; or ANSI/UL 80079-20-2, *Explosive Atmospheres — Part 20-2: Material Characteristics — Combustible Dusts Test Methods* , for procedures for determining the explosibility of dusts. Historically, explosibility has been described as presenting a flash fire or explosion hazard. It could be understood that potential hazards due to the formation of an explosible mixture when suspended in air at standard atmospheric pressure and temperature would include ignition.

Combustible Gas Detection System.

A protection technique utilizing stationary gas detectors in industrial establishments. (CMP-14)

Commissioning.

The process, procedures, and testing used to set up and verify the initial performance, operational controls, safety systems, and sequence of operation of electrical devices and equipment, prior to it being placed into active service. (CMP-13)

Communications Circuit.

A metallic, fiber, or wireless circuit that provides voice/data (and associated power) for communications-related services between communications equipment. (CMP-16)

Communications Circuit, Network-Powered Broadband. (Network-Powered Broadband Communications Circuit)

The circuit extending from the communications utility's or service provider's serving terminal or tap up to and including the network interface unit (NIU). (830) (CMP-16)

> Informational Note: A typical one-family dwelling network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

Communications Circuit, Premises. (Premises Communications Circuit)

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment. (840) (CMP-16)

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. (CMP-16)

> Informational Note: As the telecommunications network transitions to a more data-centric network, computers, routers, servers, and their powering equipment, are becoming essential to the transmission of audio, video, and data and are finding increasing application in communications equipment installations.

Communications Service Provider.

An organization, business, or individual that offers communications service to others. (CMP-16)

Community Antenna Television Circuit (CATV).

The circuit that extends community antenna television systems for audio, video, data, and interactive services from the service provider's network terminal to the appropriate customer equipment. (CMP-16)

Concealable Nonmetallic Extension.

A listed assembly of two, three, or four insulated circuit conductors within a nonmetallic jacket, an extruded thermoplastic covering, or a sealed nonmetallic covering. The classification includes surface extensions intended for mounting directly on the surface of walls or ceilings and concealed with paint, texture, joint compound, plaster, wallpaper, tile, wall paneling, or other similar materials. (CMP-6)

Concealed.

Rendered inaccessible by the structure or finish of the building. (CMP-1)

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

Concealed Knob-and-Tube Wiring.

A wiring method using knobs, tubes, and flexible nonmetallic tubing for the protection and support of single insulated conductors. (CMP-6)

Conductor, Bare. (Bare Conductor)

A conductor having no covering or electrical insulation whatsoever. (CMP-6)

Conductor, Copper-Clad Aluminum. (Copper-Clad Aluminum Conductor)

Conductor drawn from a copper-clad aluminum rod, with the copper metallurgically bonded to an aluminum core. (CMP-6)

Conductor, Covered. (Covered Conductor)

A conductor encased within material of composition or thickness that is not recognized by this *Code* as electrical insulation. (CMP-6)

Conductor, Insulated. (Insulated Conductor)

A conductor encased within material of composition and thickness that is recognized by this *Code* as electrical insulation. (CMP-6)

Conductor, Insulated. (Insulated Conductor)

Overhead service conductor encased in a polymeric material adequate for the applied nominal voltage and any conductor types described in 310.4. (396) (CMP-6)

> Informational Note: See ICEA S-76-474-2011, *Standard for Neutral Supported Power Cable Assemblies with Weather-Resistant Extruded Insulation Rated 600 Volts*, for information about overhead service conductors.

Conductors, Outdoor Overhead. (Outdoor Overhead Conductors)

Single conductors, insulated, covered, or bare, installed outdoors on support structures in free air. (395) (CMP-6)

Conduit, Flexible Metal (FMC). (Flexible Metal Conduit)

A raceway of circular cross section made of helically wound, formed, interlocked metal strip. (CMP-8)

Conduit, High Density Polyethylene (HDPE). (High Density Polyethylene Conduit)

A nonmetallic raceway of circular cross section, with associated couplings, connectors, and fittings for the installation of electrical conductors. (CMP-8)

Conduit, Intermediate Metal (IMC). (Intermediate Metal Conduit)

A steel threadable raceway of circular cross section designed for the physical protection and routing of conductors and cables and for use as an equipment grounding conductor when installed with its integral or associated coupling and appropriate fittings. (CMP-8)

Conduit, Liquidtight Flexible Metal (LFMC). (Liquidtight Flexible Metal Conduit)

A raceway of circular cross section having an outer liquidtight, nonmetallic, sunlight-resistant jacket over an inner flexible metal core with associated couplings, connectors, and fittings for the installation of electric conductors. (CMP-8)

Conduit, Liquidtight Flexible Nonmetallic (LFNC). (Liquidtight Flexible Nonmetallic Conduit)

A raceway of circular cross section of various types as follows:

(1) A smooth seamless inner core and cover bonded together and having one or more reinforcement layers between the core and covers, designated as LFNC-A

(2) A smooth inner surface with integral reinforcement within the raceway wall, designated as LFNC-B

(3) A corrugated internal and external surface without integral reinforcement within the raceway wall, designated as LFNC-C

(CMP-8)

> Informational Note: FNMC is an alternative designation for LFNC.

Conduit, Nonmetallic Underground with Conductors (NUCC). (Nonmetallic Underground Conduit with Conductors)

A factory assembly of conductors or cables inside a nonmetallic, smooth wall raceway with a circular cross section. (CMP-8)

Conduit, Reinforced Thermosetting Resin (RTRC). (Reinforced Thermosetting Resin Conduit)

A rigid nonmetallic raceway of circular cross section, with integral or associated couplings, connectors, and fittings for the installation of electrical conductors and cables. (CMP-8)

Conduit, Rigid Metal (RMC). (Rigid Metal Conduit)

A threadable raceway of circular cross section designed for the physical protection and routing of conductors and cables and for use as an equipment grounding conductor when installed with its integral or associated coupling and appropriate fittings. (CMP -8)

Conduit, Rigid Polyvinyl Chloride (PVC). (Rigid Polyvinyl Chloride Conduit)

A rigid nonmetallic raceway of circular cross section, with integral or associated couplings, connectors, and fittings for the installation of electrical conductors and cables. (CMP-8)

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. (CMP-9)

Connector.

An electromechanical fitting. (393) (CMP-18)

Connector, Intercell. (Intercell Connector)

An electrically conductive bar or cable used to connect adjacent cells. (CMP-13)

Connector, Intertier. (Intertier Connector)

An electrical conductor used to connect two cells on different tiers of the same rack or different shelves of the same rack. (CMP-13)

Connector, Load. (Load Connector)

An electromechanical connector used for power from the busbar to utilization equipment. (393) (CMP-18)

Connector, Pendant. (Pendant Connector)

An electromechanical or mechanical connector used to suspend low-voltage luminaire or utilization equipment below the grid rail and to supply power to connect from the busbar to utilization equipment. (393) (CMP-18)

Connector, Power Feed. (Power Feed Connector)

An electromechanical connector used to connect the power supply to a power distribution cable, to connect directly to the busbar, or to connect from a power distribution cable to the busbar. (393) (CMP-18)

Connector, Pressure (Solderless). (Pressure Connector)

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. (CMP-1)

Connector, Rail to Rail. (Rail to Rail Connector)

An electromechanical connector used to interconnect busbars from one ceiling grid rail to another grid rail. (393) (CMP-18)

Connector Strip.

A metal wireway containing pendant or flush receptacles. (520) (CMP-15)

Container (as applied to batteries).

A single-cell or multicell vessel or jar that holds the plates, electrolyte, and other elements of a single unit in a battery. (CMP-13)

Continuous Load.

A load where the maximum current is expected to continue for 3 hours or more. (CMP-2)

Control.

The predetermined process of connecting, disconnecting, increasing, or reducing electric power. (750) (CMP-13)

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. (CMP-11)

Control Circuits, Fault-Tolerant External. (Fault-Tolerant External Control Circuits)

Those control circuits either entering or leaving the fire pump controller enclosure, which if broken, disconnected, or shorted will not prevent the controller from starting the fire pump from all other internal or external means and may cause the controller to start the pump under these conditions. (695) (CMP-13)

Control Device, Emergency Lighting. (Emergency Lighting Control Device)

A separate or integral device intended to perform one or more emergency lighting control functions. (700) (CMP-13)

> Informational Note: See UL 924, *Emergency Lighting and Power Equipment*, for information covering emergency lighting control devices.

Control Drawing.

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. (CMP-14)

> Informational Note: See the following standards for additional information:
>
> (1) ANSI/ISA/UL 120202, *Recommendations for the Preparation, Content, and Organization of Intrinsic Safety Control Drawings*
>
> (2) ANSI/UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations*
>
> (3) ANSI/UL 60079-11, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i"*
>
> (4) ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*
>
> (5) ANSI/ISA RP 12.06.01, *Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation — Part 1: Intrinsic Safety*

Control Room.

An enclosed control space outside the hoistway, intended for full bodily entry, that contains the elevator motor controller. The room could also contain electrical and/or mechanical equipment used directly in connection with the elevator or dumbwaiter but not the electric driving machine or the hydraulic machine. (620) (CMP-12)

Control Space.

A space inside or outside the hoistway intended to be accessed with or without full bodily entry that contains the elevator motor controller. This space could also contain electrical and/or mechanical equipment used directly in connection with the elevator, dumbwaiter, escalator, moving walk, or platform lift, but not the electrical driving machine or the hydraulic machine. (620) (CMP-12)

Control System.

The overall system governing the starting, stopping, direction of motion, acceleration, speed, and retardation of the moving member. (620) (CMP-12)

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. (CMP-1)

Controller, Motion. (Motion Controller)

The electrical device(s) for that part of the control system that governs the acceleration, speed, retardation, and stopping of the moving member. (620) (CMP-12)

Informational Note: The motor control function may be integral to the motion controller.

Controller, Motor. (Motor Controller)

Any switch or device that is normally used to start and stop a motor by making and breaking the motor circuit current. (CMP-11)

Controller, Operation. (Operation Controller)

The electrical device(s) for that part of the control system that initiates the starting, stopping, and direction of motion in response to a signal from an operating device. (620) (CMP-12)

Converter, DC-to-DC. (DC-to-DC Converter)

A device that can provide an output dc voltage and current at a higher or lower value than the input dc voltage and current. (CMP-4)

Converter Circuit, DC-to-DC. (DC-to-DC Converter Circuit)

The dc circuit conductors connected to the output of a dc-to-dc converter. (CMP-4)

Converting Device.

That part of the heating equipment that converts input mechanical or electrical energy to the voltage, current, and frequency used for the heating applicator. A converting device consists of equipment using line frequency, all static multipliers, oscillator-type units using vacuum tubes, inverters using solid-state devices, or motor-generator equipment. (665) (CMP-12)

Cooking Unit, Counter-Mounted. (Counter-Mounted Cooking Unit)

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. (CMP-2)

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 available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents. (CMP-10)

Cord, Flexible. (Flexible Cord)

Two or more flexible insulated conductors enclosed in a flexible covering. (CMP-6)

Cord Connector.

A contact device terminated to a flexible cord that accepts an attachment plug or other insertion device. (CMP-6)

Cord Connector [as applied to hazardous (classified) locations].

A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and might include an explosionproof, a dust-ignitionproof, or a flameproof seal. (CMP-14)

Cord Set.

A length of flexible cord having an attachment plug at one end and a cord connector at the other end. (CMP-6)

Corrosive Environment.

Areas or enclosures without adequate ventilation, where electrical equipment is located and pool sanitation chemicals are stored, handled, or dispensed . (680) (CMP-17).

> Informational Note No. 1: See *Advisory: Swimming Pool Chemical: Chlorine* , OSWER 90-008.1, June 1990, available from the EPA National Service Center for Environmental Publications (NSCEP) as sanitation chemicals and pool water are considered to pose a risk of corrosion (gradual damage or destruction of materials) due to the presence of oxidizers (e.g., calcium hypochlorite, sodium hypochlorite, bromine, chlorinated isocyanurates) and chlorinating agents that release chlorine when dissolved in water.

> Informational Note No. 2: See ANSI/APSP-11, *Standard for Water Quality in Public Pools and Spas* , ANSI/ASHRAE 62.1, Table 6-4 Minimum Exhaust Rates, and *2021 International Swimming Pool and Spa Code (ISPSC)* , Section 324, including associated definitions and requirements concerning adequate ventilation of indoor spaces such as equipment and chemical storage rooms, which can reduce the likelihood of the accumulation of corrosive vapors. Chemicals such as chlorine cause severe corrosive and deteriorating effects on electrical connections, equipment, and enclosures when stored and kept in the same vicinity.

Counter (Countertop).

A fixed or stationary surface typically intended for food preparation and serving, personal lavation, or laundering or a similar surface that presents a routine risk of spillage of larger quantities of liquids upon outlets mounted directly on or in the surface. (CMP-2)

> Informational Note No. 1: See UL 498, *Receptacles and Attachment Plugs* , and UL 943, *Ground-Fault Circuit Interrupters* , which establish the performance evaluation criteria and construction criteria.

> Informational Note No. 2: See 406.5(E) , 406.5(G)(1) , and 406.5(H) for information on receptacles for counters and countertops distinguished from receptacles for work surfaces.

Crane.

A mechanical device used for lifting or moving boats. [**303:** 3.3.6] (555) (CMP-7)

Critical Branch.

A system of feeders and branch circuits supplying power for task illumination, fixed equipment, select receptacles, and select power circuits serving areas and functions related to patient care that are automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source. [**99:** 3.3.30] (517) (CMP-15)

Critical Operations Areas, Designated (DCOA). (Designated Critical Operations Areas)

Areas within a facility or site designated as requiring critical operations power. (CMP-13)

Critical Operations Data System.

An information technology equipment system that requires continuous operation for reasons of public safety, emergency management, national security, or business continuity. (645) (CMP-12)

Critical Operations Power Systems (COPS).

Power systems for facilities or parts of facilities that require continuous operation for the reasons of public safety, emergency management, national security, or business continuity. (CMP-13)

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. (CMP-9)

Data Center, Modular (MDC). (Modular Data Center)

Prefabricated units, rated 1000 volts or less, consisting of an outer enclosure housing multiple racks or cabinets of information technology equipment (ITE) (e.g., servers) and various support equipment, such as electrical service and distribution equipment, HVAC systems, and the like. (646) (CMP-12)

> Informational Note: A typical construction may use a standard ISO shipping container or other structure as the outer enclosure, racks or cabinets of ITE, service-entrance equipment and power distribution components, power storage such as a UPS, and an air or liquid cooling system. Modular data centers are intended for fixed installation, either indoors or outdoors, based on their construction and resistance to environmental conditions. MDCs can be configured as an all-in-one system housed in a single equipment enclosure or as a system with the support equipment housed in separate equipment enclosures.

DC Plugging Box.

A dc device consisting of one or more 2-pole, 2-wire, nonpolarized, non-grounding-type receptacles intended to be used on dc circuits only. (530) (CMP-15)

Dead-Front.

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

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. (CMP-2)

Dental Office.

A building or part thereof in which the following occur:

(1) Examinations and minor treatments/procedures performed under the continuous supervision of a dental professional;

(2) Use of limited to minimal sedation and treatment or procedures that do not render the patient incapable of self-preservation under emergency conditions; and

(3) No overnight stays for patients or 24-hour operations.

[**99:** 3.3.38] (CMP-15)

Device.

A unit of an electrical system, other than a conductor, that carries or controls electric energy as its principal function. (CMP-1)

Dielectric Heating.

Heating of a nominally insulating material due to its own dielectric losses when the material is placed in a varying electric field. (665) (CMP-12)

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. (CMP-1)

Distribution Point (Center Yard Pole) (Meter Pole).

An electrical supply point from which service drops, service conductors, feeders, or branch circuits to buildings or structures utilized under single management are supplied. (547) (CMP-7)

Informational Note: The service point is typically located at the distribution point.

Diversion Controller (Diversion Charge Controller) (Diversion Load Controller).

Equipment that regulates the output of a source or charging process by diverting power to direct-current or alternating-current loads or to an interconnected utility service. (CMP-13)

Diversion Load.

A load connected to a diversion charge controller or diversion load controller, also known as a dump load. (CMP-4)

Docking Facility.

A covered or open, fixed or floating structure that provides access to the water and to which boats are secured. [**303:** 3.3.7] (555) (CMP-7)

Dormitory Unit.

A building or a space in a building in which group sleeping accommodations are provided for more than 16 persons who are not members of the same family in one room, or a series of closely associated rooms, under joint occupancy and single management, with or without meals, but without individual cooking facilities. (CMP 2)

Drop Box.

A box containing pendant- or flush-mounted receptacles attached to a multiconductor cable via strain relief or a multipole connector. (520) (CMP-15)

Dust-Ignitionproof.

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. (CMP-14)

Informational Note No. 1: See ANSI/UL 1203, *Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations* , for additional information on dust-ignitionproof enclosures.

Informational Note No. 2: See NEMA 250, *Enclosures for Electrical Equipment (1000 Volts Maximum)* , for additional information on dust-ignitionproof enclosures that are sometimes marked additionally marked Type 9.

Dusttight.

Enclosures constructed so that dust will not enter under specified test conditions. (CMP-14)

Informational Note No. 1: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for additional information.

Informational Note No. 2: See NEMA 250, *Enclosures for Electrical Equipment (1000 Volts Maximum),* and ANSI/UL 50E, *Enclosures for Electrical Equipment, Environmental Considerations* , for additional information on enclosure Types 3, 3X, 3S, 3SX, 4, 4X, 5, 6, 6P, 12, 12K, and 13 that are considered dusttight.

Duty, Continuous. (Continuous Duty)

Operation at a substantially constant load for an indefinitely long time. (CMP-1)

Duty, Intermittent. (Intermittent Duty)

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

Duty, Periodic. (Periodic Duty)

Intermittent operation in which the load conditions are regularly recurrent. (CMP-1)

Duty, Short-Time. (Short-Time Duty)

Operation at a substantially constant load for a short and definite, specified time. (CMP-1)

Duty, Varying. (Varying Duty)

Operation at loads, and for intervals of time, both of which may be subject to wide variation. (CMP-1)

Dwelling, One-Family. (One-Family Dwelling)

A building that consists solely of one dwelling unit. (CMP-1)

Dwelling, Two-Family. (Two-Family Dwelling)

A building that consists solely of two dwelling units. (CMP-1)

Dwelling, Multifamily. (Multifamily Dwelling)

A building that contains three or more dwelling units. (CMP-1)

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. (CMP-2)

Electric-Discharge Lighting.

Systems of illumination utilizing fluorescent lamps, high-intensity discharge (HID) lamps, or neon tubing. (CMP-18)

Electric Power Production and Distribution Network.

Power production, distribution, and utilization equipment and facilities, such as electric utility systems that are connected to premises wiring and are external to and not controlled by a system that operates in interactive mode. (CMP-13)

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. (CMP-18)

Electric Supply Stations.

Locations containing the generating stations and substations, including their associated generator, storage battery, transformer, and switchgear areas. (CMP-4)

Electric Vehicle (EV).

An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array, or other source of electric current. Plug-in hybrid electric vehicles (PHEV) are electric vehicles having a second source of motive power. (CMP-12)

> Informational Note: Off-road, self-propelled electric mobile machines, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, and boats are not considered electric vehicles.

Electric Vehicle Connector.

A device that, when electrically coupled (conductive or inductive) to an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of power transfer and information exchange. (625) (CMP-12)

> Informational Note: See 625.48 for further information on interactive systems.

Electric Vehicle Power Export Equipment (EVPE).

The equipment, including the outlet on the vehicle, that is used to provide electrical power at voltages greater than or equal to 30 Vac or 60 Vdc to loads external to the vehicle, using the vehicle as the source of supply. (625) (CMP-12)

> Informational Note: Electric vehicle power export equipment and electric vehicle supply equipment or wireless power transfer equipment are sometimes contained in one piece of equipment, sometimes referred to as a bidirectional electric vehicle supply equipment (EVSE) or bidirectional wireless power transfer equipment (WPTE).

Electric Vehicle Supply Equipment (EVSE).

Equipment for plug-in charging, including the ungrounded, grounded, and equipment grounding conductors, and the electric vehicle connectors, attachment plugs, personnel protection system, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle. (625) (CMP-12)

> Informational Note: Electric vehicle power export equipment and electric vehicle supply equipment or wireless power transfer equipment (WPTE) are sometimes contained in one piece of equipment, sometimes referred to as a bidirectional EVSE or bidirectional WPTE.

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. (CMP-16)

Electrical Datum Plane.

A specified vertical distance above the normal high-water level at which electrical equipment can be installed and electrical connections can be made. (CMP-7)

Electrical Ducts.

Electrical conduits, or other raceways round in cross section, that are suitable for use underground or embedded in concrete. (CMP-6)

Electrical Life Support Equipment.

Electrically powered equipment whose continuous operation is necessary to maintain a patient's life. [**99** :3.3.45] (517) (CMP-15)

Electrical Resistance Trace Heating "60079-30-1".

Type of protection for the purpose of producing heat on the principle of electrical resistance and typically composed of one or more metallic conductors and/or an electrically conductive material, suitably electrically insulated and protected. (CMP-14)

> Informational Note: See ANSI/UL 60079-30-1, *Explosive Atmospheres — Part 30-1: Electrical Resistance Trace Heating — General and Testing Requirements* , for additional information.

Electrically Connected.

A connection capable of carrying current as distinguished from connection through electromagnetic induction. (668) (CMP-12)

Electrified Truck Parking Space.

A truck parking space that has been provided with an electrical system that allows truck operators to connect their vehicles while stopped and to use off-board power sources in order to operate on-board systems such as air conditioning, heating, and appliances, without any engine idling. (626) (CMP-12)

> Informational Note: An electrified truck parking space also includes dedicated parking areas for heavy-duty trucks at travel plazas, warehouses, shipper and consignee yards, depot facilities, and border crossings. It does not include areas such as the shoulders of highway ramps and access roads, camping and recreational vehicle sites, residential and commercial parking areas used for automotive parking or other areas where ac power is provided solely for the purpose of connecting automotive and other light electrical loads, such as engine block heaters, and at private residences.

Electrified Truck Parking Space Wiring Systems.

All of the electrical wiring, equipment, and appurtenances related to electrical installations within an electrified truck parking space, including the electrified parking space supply equipment. (626) (CMP-12)

Electrolyte.

The medium that provides the ion transport mechanism between the positive and negative electrodes of a cell. (CMP-13)

Electrolytic Cell.

A tank or vat in which electrochemical reactions are caused by applying electric energy for the purpose of refining or producing usable materials. (668) (CMP-12)

Electrolytic Cell Line Working Zone.

The space envelope wherein operation or maintenance is normally performed on or in the vicinity of exposed energized surfaces of electrolytic cell lines or their attachments. (668) (CMP-12)

Electronic Power Converter.

A device that uses power electronics to convert one form of electrical power into another form of electrical power. (CMP-4)

> Informational Note: Examples of electronic power converters include, but are not limited to, inverters, dc-to-dc converters, and electronic charge controllers. These devices have limited current capabilities based on the device ratings at continuous rated power.

Electronically Protected.

A motor provided with electronic control that is an integral part of the motor and protects the motor against dangerous overheating due to failure of the electronic control, overload, and failure to start. (430) (CMP-11)

Emergency Luminaire, Battery-Equipped. (Battery-Equipped Emergency Luminaire)

A luminaire with a rechargeable battery, a battery charging means, and an automatic load control relay. (CMP-13)

Emergency Luminaire, Directly Controlled. (Directly Controlled Emergency Luminaire)

A luminaire supplied by the facility emergency power system and with a control input for dimming or switching that provides an emergency illumination level upon loss of normal power. (700) (CMP-13)

> Informational Note: See ANSI/UL 924, *Emergency Lighting and Power Equipment*, for information covering directly controlled emergency luminaires.

Emergency Power Supply (EPS).

The source(s) of electric power of the required capacity and quality for an emergency power supply system (EPSS). (CMP-13)

Emergency Power Supply System (EPSS).

A complete functioning EPS system coupled to a system of conductors, disconnecting means and overcurrent protective devices, transfer switches, and all control, supervisory, and support devices up to and including the load terminals of the transfer equipment needed for the system to operate as a safe and reliable source of electric power. [**110:** 3.3.4] (CMP-13)

Emergency Systems.

Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction. These systems are intended to automatically supply illumination, power, or both, to designated areas and equipment in the event of failure of the normal supply or in the event of accident to elements of a system intended to supply, distribute, and control power and illumination essential for safety to human life. (CMP-13)

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. (CMP-14)

Informational Note: See ANSI/UL 60079-18, *Explosive atmospheres — Part 18: Equipment protection by encapsulation “m”,* for additional information.

Enclosed.

Surrounded by a case, housing, fence, or wall(s) that prevents persons from accidentally contacting energized parts. (CMP-1)

Enclosed-Break.

Having electrical make-or-break contacts such that, if an internal explosion of the flammable gas or vapor that can enter it occurs, the device will withstand the internal explosion without suffering damage and without communicating the internal explosion to the external flammable gas or vapor.(CMP-14)

Informational Note: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for additional information.

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. (CMP-1)

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

Energized.

Electrically connected to, or is, a source of voltage. (CMP-1)

Energized, Likely to Become. (Likely to Become Energized)

Conductive material that could become energized because of the failure of electrical insulation or electrical spacing. (CMP-5)

Energy Management System (EMS).

A system consisting of any of the following: a monitor(s), communications equipment, a controller(s), a timer(s), or other device(s) that monitors and/or controls an electrical load or a power production or storage source. (CMP-13)

Energy Storage System (ESS).

One or more devices installed as a system capable of storing energy and providing electrical energy into the premises wiring system or an electric power production and distribution network. (CMP-13)

> Informational Note No. 1: An ESS(s) can include but is not limited to batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). An ESS(s) can include inverters or converters to change voltage levels or to make a change between an ac or a dc system.

> Informational Note No. 2: These systems differ from a stationary standby battery installation where a battery spends the majority of the time on continuous float charge or in a high state of charge, in readiness for a discharge event.

Entertainment Device.

A mechanical or electromechanical device that provides an entertainment experience. (522) (CMP-15)

> Informational Note: These devices can include animated props, show action equipment, animated figures, and special effects, coordinated with audio and lighting to provide an entertainment experience.

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. (CMP-1)

Equipment, Mobile. (Mobile Equipment)

Equipment with electrical components that is suitable to be moved only with mechanical aids or is provided with wheels for movement by a person(s) or powered devices. (513) (CMP-14)

Equipment, Portable. (Portable Equipment)

Equipment fed with portable cords or cables intended to be moved from one place to another. (640) (CMP-12)

Equipment, Portable. (Portable Equipment)

Equipment with electrical components suitable to be moved by a single person without mechanical aids. (511) (CMP-14)

Equipment, Portable. (Portable Equipment)

Equipment fed with portable cords or cables intended to be moved from one place to another. (520) (CMP-15)

Equipment, Portable. (Portable Equipment)

Equipment intended to be moved from one place to another. (530) (CMP-15)

Equipment, Signal. (Signal Equipment)

Includes audible and visual equipment such as chimes, gongs, lights, and displays that convey information to the user. (620) (CMP-12)

Equipment Branch.

A system of feeders and branch circuits arranged for delayed, automatic, or manual connection to the alternate power source and that serves primarily 3-phase power equipment. [**99** :3.3.50] (517) (CMP-15)

Equipment Protection Level (EPL).

Level of protection assigned to equipment based on its likelihood of becoming a source of ignition, and distinguishing the differences between explosive gas atmospheres and explosive dust atmospheres. (CMP-14)

> Informational Note: See ANSI/UL 60079-0, *Explosive Atmospheres — Part 0: Equipment — General Requirements* , for additional information.

Equipment Rack.

A framework for the support, enclosure, or both, of equipment; can be portable or stationary. (640) (CMP-12)

Informational Note: See EIA/ECA 310-E-2005, *Cabinets, Racks, Panels and Associated Equipment*, for examples of equipment racks.

Equipotential Plane.

Conductive parts bonded together to reduce voltage gradients in a designated area. (682) (CMP-17)

Equipotential Plane.

Conductive elements that are connected together to minimize voltage differences. (CMP-7)

Essential Electrical System.

A system comprised of alternate power sources and all connected distribution systems and ancillary equipment, designed to ensure continuity of electrical power to designated areas and functions of a health care facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system. [**99** :3.3.52] (517) (CMP-15)

Explosionproof Equipment.

Equipment enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that might occur within it, that is capable 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. (CMP-14)

Informational Note No. 1: See ANSI/UL 1203, *Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations*, for additional information.

Informational Note No. 2: See NEMA 250, *Enclosures for Electrical Equipment (1000 Volts Maximum)*, for additional information on explosionproof enclosures that are sometimes additionally marked Type 7.

Exposed (as applied to live parts).

Capable of being inadvertently touched or approached nearer than a safe distance by a person. (CMP-1)

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. (CMP-1)

Exposed (Optical Fiber Cable 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 might result. (CMP-16)

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. (CMP-16)

Exposed Conductive Surfaces.

Those surfaces that are capable of carrying electric current and that are unprotected, uninsulated, unenclosed, or unguarded, permitting personal contact. [**99:** 3.3.54] (517) (CMP-15)

Informational Note: Paint, anodizing, and similar coatings are not considered suitable insulation, unless they are listed for such use.

Externally Operable.

Capable of being operated without exposing the operator to contact with live parts. (CMP-1)

Facility, On-Site Power Production. (On-Site Power Production Facility)

The normal supply of electric power for the site that is expected to be constantly producing power. (695) (CMP-13)

Fastened-in-Place.

Mounting means of equipment in which the fastening means are specifically designed to permit removal without the use of a tool. (625) (CMP-12)

Fault-Managed Power (FMP).

A powering system that monitors for faults and controls current delivered to ensure fault energy is limited. (726) (CMP-3)

> Informational Note No. 1: The monitoring and control systems differentiate fault-managed power from electric light and power circuits; therefore, alternative requirements to those of Chapters 1 through 4 are given regarding minimum wire sizes, ampacity adjustment and correction factors, overcurrent protection, insulation requirements, and wiring methods and materials.

> Informational Note No. 2: A fault-managed power circuit is also commonly referred to as a Class 4 circuit.

Fault Current.

The current delivered at a point on the system during a short-circuit condition. (CMP-10)

Fault Current, Available. (Available Fault Current)

The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. (CMP-10)

> Informational Note: A short-circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground fault. See Informational Note Figure 100.1 .

Figure Informational Note Figure 100.1 Available Fault Current.

Fault Protection Device.

An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both, for a low-power network-powered broadband communications circuit and provide acceptable protection from electric shock. (830) (CMP-16)

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. (CMP-10)

Feeder Assembly.

The overhead or under-chassis feeder conductors, including the equipment grounding conductor, together with the necessary fittings and equipment; or the power-supply cord assembly for a mobile home, recreational vehicle, or park trailer, identified for the delivery of energy from the source of electrical supply to the panelboard within the mobile home, recreational vehicle, or park trailer. (CMP-7)

Festoon Lighting.

A string of outdoor lights that is suspended between two points. (CMP-18)

Fibers/Flyings, Combustible. (Combustible Fibers/Flyings)

Fibers/flyings, where any dimension is greater than 500 μm in nominal size, which can form an explosible mixture when suspended in air at standard atmospheric pressure and temperature. [**499:** 3.3.4.1] (CMP-14)

Informational Note No. 1: This definition and Informational Notes No. 2 and No. 3 have been extracted from NFPA 499-2021, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas* . The NFPA 499 reference is in brackets. Only editorial changes were made to the extracted text to make it consistent with this *Code* .

Informational Note No. 2: Section 500.5(D) defines a Class III location. Combustible fibers/flyings can be similar in physical form to ignitible fibers/flyings and protected using the same electrical equipment installation methods. Examples of fibers/flyings include flat platelet-shaped particulate, such as metal flake, and fibrous particulate, such as particle board core material. If the smallest dimension of a combustible material is greater than 500 μm, it is unlikely that the material would be combustible fibers/flyings, as determined by test. Finely divided solids with lengths that are large compared to their diameter or thickness usually do not pass through a 500 μm sieve, yet when tested could potentially be determined to be explosible. [**499:** A.3.3.4.1]

Informational Note No. 3: See ASTM E1226, *Standard Test Method for Explosibility of Dust Clouds* , ISO 6184-1, *Explosion protection systems — Part 1: Determination of explosion indices of combustible dusts in air* , or ISO/IEC/UL 80079-20-2, *Explosive atmospheres — Part 20-2: Material characteristics — Combustible dusts test methods* , for procedures for determining the explosibility of dusts. A material that is found to not present an explosible mixture could still be an ignitible fiber/flying, as defined in this article. Historically, the explosibility condition has been described as presenting a flash fire or explosion hazard. It could be understood that the potential hazard due to the formation of an explosible mixture when suspended in air at standard atmospheric pressure and temperature would include ignition. [**499:** A.3.3.4.1]

Fibers/Flyings, Ignitible. (Ignitible Fibers/Flyings)

Fibers/flyings where any dimension is greater than 500 μm in nominal size, which are not likely to be in suspension in quantities to produce an explosible mixture, but could produce an ignitible layer fire hazard. [**499:** 3.3.4.2] (CMP-14)

> Informational Note No. 1: This definition and Informational Note No. 2 have been extracted from NFPA 499-2021, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas* . The NFPA 499 reference is in brackets. Only editorial changes were made to the extracted text to make it consistent with this *Code* .

> Informational Note No. 2: Section 500.5 of this *Code* prescribes a Class III location as one where ignitible fibers/flyings are present, but not likely to be in suspension in the air in quantities sufficient to produce ignitible mixtures. This description addresses fibers/flyings that do not present a flash-fire hazard or explosion hazard by test. This could be because those fibers/flyings are too large or too agglomerated to be suspended in air in sufficient concentration, or at all, under typical test conditions. Alternatively, this could be because they burn so slowly that, when suspended in air, they do not propagate combustion at any concentration. In this document the zone classification system includes ignitible fibers/flyings as a fire hazard in a layer, which is not addressed in the IEC zone system (see IEC 60079-10-2, *Explosive atmospheres — Part 10-2: Classification of areas — Explosive dust atmospheres*). Where these are present, the user could also consider installation in accordance with Article 503 of this *Code* . [**499:** A.3.3.4.2]

Field Evaluation Body (FEB).

An organization or part of an organization that performs field evaluations of electrical or other equipment. [**790:** 3.3.4] (CMP-1)

> Informational Note: See NFPA 790-2021, *Standard for Competency of Third-Party Field Evaluation Bodies* , provides guidelines for establishing the qualification and competency of a body performing field evaluations of electrical products and assembles with electrical components.

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. [**790:** 3.3.6] (CMP-1)

Fire Alarm Circuit.

The portion of the wiring system between the load side of the overcurrent device or the power-limited supply and the connected equipment of all circuits powered and controlled by the fire alarm system. Fire alarm circuits are classified as either non–power-limited or power-limited. (CMP-3)

Fire Alarm Circuit, Non-Power-Limited (NPLFA). (Non-Power-Limited Fire Alarm Circuit)

A fire alarm circuit powered by a source that is not power limited. (CMP-3)

> Informational Note: See 760.41 and 760.43 for requirements for non-power-limited fire alarm circuits.

Fire Alarm Circuit, Power-Limited (PLFA). (Power-Limited Fire Alarm Circuit)

A fire alarm circuit powered by a power-limited source . (CMP-3)

> Informational Note: See 760.121 for requirements on power-limited fire alarm circuits.

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. (CMP-1)

Fixed (as applied to equipment).

Equipment that is fastened or otherwise secured at a specific location. (680) (CMP-17)

Fixed-in-Place.

Mounting means of equipment using fasteners that require a tool for removal. (625) (CMP-12)

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. (CMP-14)

> Informational Note: See ANSI/UL 60079-1, *Explosive Atmospheres — Part 1: Equipment Protection by Flameproof Enclosures “d”,* for additional information.

Flammable Anesthetics.

Gases or vapors, such as fluroxene, cyclopropane, divinyl ether, ethyl chloride, ethyl ether, and ethylene, that could form flammable or explosive mixtures with air, oxygen, or reducing gases such as nitrous oxide. (517) (CMP-15)

Flexible Bus Systems.

An assembly of flexible insulated bus, with a system of associated fittings used to secure, support, and terminate the bus. (CMP-8)

> Informational Note: Flexible bus systems are engineered systems for a specific site location and are ordinarily assembled at the point of installation from the components furnished or specified by the manufacturer.

Flexible Insulated Bus.

A flexible rectangular conductor with an overall insulation. (CMP-8)

Flywheel ESS (FESS).

A mechanical ESS composed of a spinning mass referred to as a rotor and an energy conversion mechanism such as a motor-generator that converts the mechanical energy to electrical energy. (706) (CMP-13)

> Informational Note: There are primarily two types of rotor constructions, solid metal mass design and composite fiber design.

Footlight.

A border light installed on or in the stage. (520) (CMP-15)

Forming Shell.

A structure designed to support a wet-niche luminaire assembly and intended for mounting in a pool or fountain structure. (680) (CMP-17)

Fountain.

An ornamental structure or recreational water feature from which one or more jets or streams of water are discharged into the air, including splash pads, ornamental pools, display pools, and reflection pools. The definition does not include drinking water fountains or water coolers. (680) (CMP-17)

Frame.

Chassis rail and any welded addition thereto of metal thickness of 1.35 mm (0.053 in.) or greater. (551) (CMP-7)

Free Air (as applied to conductors).

Open or ventilated environment that allows for heat dissipation and air flow around an installed conductor. (CMP-6)

Fuel Cell.

An electrochemical system that consumes fuel to produce an electric current. In such cells, the main chemical reaction used for producing electric power is not combustion. However, there may be sources of combustion used within the overall cell system, such as reformers/fuel processors. (CMP-4)

Fuel Cell System.

The complete aggregate of equipment used to convert chemical fuel into usable electricity and typically consisting of a reformer, stack, power inverter, and auxiliary equipment. (CMP-4)

Fuse.

An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it. (CMP-10)

> 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.

Fuse, Electronically Actuated. (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. (CMP-10)

Fuse, Expulsion. (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. (CMP-10)

Fuse, Nonvented Power. (Nonvented Power Fuse)

A fuse without intentional provision for the escape of arc gases, liquids, or solid particles to the atmosphere during circuit interruption. (CMP-10)

Fuse, Power. (Power Fuse)

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. (CMP-10)

Fuse, Vented Power. (Vented Power Fuse)

A fuse with provision for the escape of arc gases, liquids, or solid particles to the surrounding atmosphere during circuit interruption. (CMP-10)

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. (CMP-1)

> Informational Note: See 511.1 for commercial garages, repair and storage.

Garage, Major Repair. (Major Repair Garage)

A building or portions of a building where major repairs, such as engine overhauls, painting, body and fender work, welding or grinding, and repairs that require draining or emptying of the motor vehicle fuel tank are performed on motor vehicles, including associated floor space used for offices, parking, or showrooms. [**30A:** 3.3.12.1] (CMP-14)

Garage, Minor Repair. (Minor Repair Garage)

A building or portions of a building used for lubrication, inspection, and minor automotive maintenance work, such as engine tune-ups, replacement of parts, fluid changes (e.g., oil, antifreeze, transmission fluid, brake fluid, air-conditioning refrigerants), brake system repairs, tire rotation, and similar routine maintenance work, including the associated floor space used for offices, parking, or showrooms. [**30A:** 3.3.12.2] (CMP-14)

General-Purpose Cables, Cable Routing Assemblies, and Raceways.

Cables, cable routing assemblies, and raceways are suitable for general-purpose applications and are resistant to the spread of fire. (722) (CMP-3)

Generating Capacity, Inverter. (Inverter Generating Capacity)

The sum of parallel-connected inverter maximum continuous output power at 40°C in watts, kilowatts, volt-amperes, or kilovolt-amperes. (CMP-4)

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. (CMP-4)

Generator (Generator Set).

A machine that converts mechanical energy into electrical energy by means of a prime mover and alternator and/or inverter. (CMP-13)

Generator, On-Site Standby. (On-Site Standby Generator)

A facility producing electric power on site as the alternate supply of electric power. It differs from an on-site power production facility in that it is not constantly producing power. (695) (CMP-13)

Grid Bus Rail.

A combination of the busbar, the busbar support, and the structural suspended ceiling grid system. (393) (CMP-18)

Ground.

The earth. (CMP-5)

Ground Fault.

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

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 ground-fault current exceeds the values established for a Class A device. (CMP-2)

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

Ground-Fault Circuit Interrupter, Special Purpose (SPGFCI). (Special Purpose Ground-Fault Circuit Interrupter)

A device intended for the detection of ground-fault currents, used in circuits with voltage to ground greater than 150 volts, that functions to de-energize a circuit or portion of a circuit within an established period of time when a ground-fault current exceeds the values established for Class C, D, or E devices. (CMP-2)

> Informational Note: See UL 943C, *Outline of Investigation for Special Purpose Ground-Fault Circuit Interrupters* , for information on Classes C, D, or E 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, grounded conductors, equipment, or the earth to the electrical supply source. (CMP-5)

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

Ground-Fault Current Path, Effective. (Effective Ground-Fault Current Path)

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

Ground-Fault Detector-Interrupter, dc (GFDI).

A device that provides protection for PV system dc circuits by detecting a ground fault and could interrupt the fault path in the dc circuit. (690) (CMP-4)

Informational Note: See UL 1741, *Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources* , and UL 62109, *Standard for Power Converters for use in Photovoltaic Power Systems* , for further information on GFDI equipment.

Ground-Fault Protection of Equipment (GFPE).

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. (CMP-5)

Grounded (Grounding).

Connected (connecting) to ground or to a conductive body that extends the ground connection. (CMP-5)

Grounded, Functionally. (Functionally Grounded)

A system that has an electrical ground reference for operational purposes that is not solidly grounded. (CMP-4)

Informational Note: A functionally grounded system is often connected to ground through an electronic means internal to an inverter or charge controller that provides ground-fault protection. Examples of operational purposes for functionally grounded systems include ground-fault detection and performance-related issues for some power sources.

Grounded, Solidly. (Solidly Grounded)

Connected to ground without inserting any resistor or impedance device. (CMP-5)

Grounded Conductor.

A system or circuit conductor that is intentionally grounded. (CMP-5)

Informational Note: Although an equipment grounding conductor is grounded, it is not considered a grounded conductor.

Grounded System, Impedance. (Impedance Grounded System)

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

Grounding Conductor, Equipment (EGC). (Equipment Grounding Conductor)

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

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

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

Grounding Conductor, Impedance. (Impedance Grounding Conductor)

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

Grounding Electrode.

A conducting object through which a direct connection to earth is established. (CMP-5)

Grounding Electrode Conductor (GEC).

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. (CMP-5)

Grouped.

Cables or conductors positioned adjacent to one another but not in continuous contact with each other. (520) (CMP-15)

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. (CMP-1)

Guest Room.

An accommodation combining living, sleeping, sanitary, and storage facilities within a compartment. (CMP-2)

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. (CMP-2)

Gutter, Metal Auxiliary. (Metal Auxiliary Gutter)

A sheet metal enclosure used to supplement wiring spaces at meter centers, distribution centers, switchgear, switchboards, and similar points of wiring systems. The enclosure has hinged or removable covers for housing and protecting electrical wires, cable, and busbars. The enclosure is designed for conductors to be laid or set in place after the enclosures have been installed as a complete system. (CMP-8)

Gutter, Nonmetallic Auxiliary. (Nonmetallic Auxiliary Gutter)

A flame-retardant, nonmetallic enclosure used to supplement wiring spaces at meter centers, distribution centers, switchgear, switchboards, and similar points of wiring systems. The enclosure has hinged or removable covers for housing and protecting electrical wires, cable, and busbars. The enclosure is designed for conductors to be laid or set in place after the enclosures have been installed as a complete system. (CMP-8)

Habitable Room.

A room in a building for living, sleeping, eating, or cooking, but excluding bathrooms, toilet rooms, closets, hallways, storage or utility spaces, and similar areas. (CMP-2)

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. (CMP-9)

Hazard Current.

For a given set of connections in an isolated power system, the total current that would flow through a low impedance if it were connected between either isolated conductor and ground. [99:3.3.72] (517) (CMP-15)

Hazard Current, Fault. (Fault Hazard Current)

The hazard current of a given isolated power system with all devices connected except the line isolation monitor. [**99:** 3.3.72.1] (517) (CMP-15)

Monitor Hazard Current.

The hazard current of the line isolation monitor alone. [**99:** 3.3.72.2] (517) (CMP-15)

Total Hazard Current.

The hazard current of a given isolated system with all devices, including the line isolation monitor, connected. [**99:** 3.3.72.3] (517) (CMP-15)

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. (CMP-8)

Health Care Facilities.

Buildings, portions of buildings, or mobile enclosures in which human medical, dental, psychiatric, nursing, obstetrical, or surgical care is provided. [**99:** 3.3.73] (CMP-15)

> Informational Note: Examples of health care facilities include, but are not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory care centers, whether permanent or movable.

Health Care Facility's Governing Body.

The person or persons who have the overall legal responsibility for the operation of a health care facility. [**99:** 3.3.74] (517) (CMP-15)

Heating Equipment.

Any equipment that is used for heating purposes and whose heat is generated by induction or dielectric methods. (665) (CMP-12)

Heating Panel.

A complete assembly provided with a junction box or a length of flexible conduit for connection to a branch circuit. (CMP-17)

Heating Panel Set.

A rigid or nonrigid assembly provided with nonheating leads or a terminal junction assembly identified as being suitable for connection to a wiring system. (CMP-17)

Heating System.

A complete system consisting of components such as heating elements, fastening devices, nonheating circuit wiring, leads, temperature controllers, safety signs, junction boxes, raceways, and fittings. (426) (CMP-17)

Heating System, Impedance. (Impedance Heating System)

A system in which heat is generated in an object, such as a pipe, rod, or combination of such objects serving as a heating element, by causing current to flow through such objects by direct connection to an ac voltage source from an isolating transformer. In some installations the object is embedded in the surface to be heated or constitutes the exposed component to be heated. (CMP-17)

Heating System, Induction. (Induction Heating System)

A system in which heat is generated in a pipeline or vessel wall by inducing current in the pipeline or vessel wall from an external isolated ac field source. (CMP-17)

Heating System, Skin Effect. (Skin-Effect Heating System)

A system in which heat is generated on the inner surface of a ferromagnetic envelope embedded in or fastened to the surface to be heated.

> Informational Note: Typically, an electrically insulated conductor is routed through and connected to the envelope at the other end. The envelope and the electrically insulated conductor are connected to an ac voltage source from an isolating transformer. (CMP-17)

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. (CMP-11)

Hoistway.

Any shaftway, hatchway, well hole, or other vertical opening or space in which an elevator or dumbwaiter is designed to operate. (CMP-12)

Hospital.

A building or portion thereof used on a 24-hour basis for the medical, psychiatric, obstetrical, or surgical care of four or more inpatients. [***101*** : 3.3.152] (CMP-15)

Host Sign.

A sign or outline lighting system already installed in the field that is designated for field conversion of the illumination system with a retrofit kit. (600) (CMP-18)

Hydromassage Bathtub.

A permanently installed bathtub equipped with a recirculating piping system, pump, and associated equipment. It is designed so it can accept, circulate, and discharge water upon each use. (680) (CMP-17)

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. (CMP-1)

> 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).

Equipment that is visible and not more than 15 m (50 ft) distant from other equipment is *in sight from* that other equipment. (CMP-1)

> Informational Note: See 110.29 for additional information.

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 to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks. (CMP-14)

> Informational Note: See ANSI/UL 60079-7, *Explosive Atmospheres — Part 7: Equipment Protection by Increased Safety "e",* for additional information.

Induction Heating (Induction Melting) (Induction Welding).

The heating, melting, or welding of a nominally conductive material due to its own I2R losses when the material is placed in a varying electromagnetic field. (665) (CMP-12)

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. (CMP-11)

> Informational Note: The industrial control panel does not include the controlled equipment.

Industrial Installation, Supervised. (Supervised Industrial Installation)

The industrial portions of a facility where all of the following conditions are met:

(1) Conditions of maintenance and engineering supervision ensure that only qualified persons monitor and service the system.

(2) The premises wiring system has 2500 kVA or greater of load used in industrial process(es), manufacturing activities, or both, as calculated in accordance with Article 220.

(3) The premises has at least one service or feeder that is more than 150 volts to ground and more than 300 volts phase-to-phase.

This definition excludes installations in buildings used by the industrial facility for offices, warehouses, garages, machine shops, and recreational facilities that are not an integral part of the industrial plant, substation, or control center. (240) (CMP-10)

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 and do not process communications circuits. (CMP-12)

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

Information Technology Equipment Room.

A room within the information technology equipment area that contains the information technology equipment. [**75:** 3.3.15] (CMP-12)

Innerduct.

A nonmetallic raceway placed within a larger raceway. (CMP-16)

Insulated Bus Pipe (IBP).

A cylindrical solid or hollow conductor with a solid insulation system, having conductive grading layers and a grounding layer imbedded in the insulation, and provided with an overall covering of insulating or metallic material. IBP is also referred to as tubular covered conductor (TCC). (CMP-8)

Insulated Bus Pipe System.

An assembly that includes bus pipe, connectors, fittings, mounting structures, and other fittings and accessories. (CMP-8)

Insulating End.

An insulator designed to electrically insulate the end of a flat conductor cable (Type FCC). (324) (CMP-6)

Interactive Mode.

The operating mode for power production equipment or microgrids that operate in parallel with and are capable of delivering energy to an electric power production and distribution network or other primary source. (CMP-4)

> Informational Note: Interactive mode is an operational mode of both interactive systems and of equipment such as interactive inverters.

Interrupting Rating.

The highest current at rated voltage that a device is identified to interrupt under standard test conditions. (CMP-10)

> 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 (IBT).

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

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. (CMP-14)

> Informational Note: See ANSI/UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations* ; and ANSI/UL 60079-11, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i",* for additional information.

Intrinsically Safe Apparatus.

Apparatus in which all the circuits are intrinsically safe. (CMP-14)

> Informational Note No. 1: See ANSI/UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations* , and ANSI/UL 60079-11, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i"* , for additional information.

> Informational Note No. 2: See ANSI/ISA RP 12.06.01, *Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation — Part 1: Intrinsic Safety* , for installation information.

Intrinsically Safe Circuit.

A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions. (CMP-14)

> Informational Note: See ANSI/UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations* , and ANSI/UL 60079-11, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i"* , for test conditions.

Intrinsically Safe Circuits, Different. (Different Intrinsically Safe Circuits)

Intrinsically safe circuits in which the possible interconnections have not been evaluated and identified as intrinsically safe. (CMP-14)

Informational Note: See ANSI/UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations* , and ANSI/UL 60079-11, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i"* , for additional information.

Intrinsically Safe System.

An assembly of interconnected intrinsically safe apparatus, associated apparatus, and interconnecting cables, in which those parts of the system that might be used in hazardous (classified) locations are intrinsically safe circuits. (CMP-14)

Informational Note No. 1: An intrinsically safe system might include more than one intrinsically safe circuit.

Informational Note No. 2: See ANSI/UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations* ; ANSI/UL 60079-11, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i"* ; and ANSI/UL 60079-25, *Explosive Atmospheres — Part 25: Intrinsically Safe Electrical Systems* , for additional information.

Informational Note No. 3: See ANSI/ISA RP 12.06.01, *Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation — Part 1: Intrinsic Safety* , for installation information.

Invasive Procedure.

Any procedure that penetrates the protective surfaces of a patient's body (i.e., skin, mucous membrane, cornea) and that is performed with an aseptic field (procedural site). [Not included in this category are placement of peripheral intravenous needles or catheters used to administer fluids and/or medications, gastrointestinal endoscopies (i.e., sigmoidoscopies), insertion of urethral catheters, and other similar procedures.] [**99:** 3.3.91] (517) (CMP-15)

Inverter.

Equipment that changes dc to ac. (CMP-4)

Inverter, Interactive. (Interactive Inverter)

Inverter equipment having the capability to operate only in interactive mode. (CMP-13)

Inverter, Multimode. (Multimode Inverter)

Inverter equipment capable of operating in both interactive and island modes. (CMP-4)

Inverter, Stand-alone. (Stand-alone Inverter)

Inverter equipment having the capabilities to operate only in island mode. (CMP-4)

Inverter Input Circuit.

Conductors connected to the dc input of an inverter. (CMP-13)

Inverter Output Circuit.

Conductors connected to the ac output of an inverter. (CMP-13)

Inverter Utilization Output Circuit.

Conductors between the multimode or stand-alone inverter and utilization equipment. (706) (CMP-13)

Irrigation Machine.

An electrically driven or controlled machine, with one or more motors, not hand-portable, and used primarily to transport and distribute water for agricultural purposes. (675) (CMP-7)

Irrigation Machine, Center Pivot. (Center Pivot Irrigation Machine)

A multimotored irrigation machine that revolves around a central pivot and employs alignment switches or similar devices to control individual motors. (675) (CMP-7)

Island Mode.

The operating mode for power production equipment or microgrids that allows energy to be supplied to loads that are disconnected from an electric power production and distribution network or other primary power source. (CMP-4)

Isolated (as applied to location).

Not readily accessible to persons unless special means for access are used. (CMP-1)

Isolated Power System.

A system comprising an isolation transformer or its equivalent, a line isolation monitor, and its ungrounded circuit conductors. [**99:** 3.3.93] (517) (CMP-15)

Isolation Transformer.

A transformer of the multiple-winding type, with the primary and secondary windings physically separated, that inductively couples its ungrounded secondary winding to the grounded feeder system that energizes its primary winding. [**99:** 3.3.94] (517) (CMP-15)

Kitchen.

An area with a sink and permanent provisions for food preparation and cooking. (CMP-2)

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. (CMP-1)

> Informational Note: If 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 may appear on the smallest unit container in which the product is packaged.

Laundry Area.

An area containing or designed to contain a laundry tray, clothes washer, or clothes dryer. (CMP-2)

Leakage-Current Detector-Interrupter (LCDI).

A device provided in a power supply cord or cord set that senses leakage current flowing between or from the cord conductors and interrupts the circuit at a predetermined level of leakage current. (440) (CMP-11)

LED Sign Illumination System.

A complete lighting system for use in signs and outline lighting consisting of light-emitting diode (LED) light sources, power supplies, wire, and connectors to complete the installation. (600) (CMP-18)

Legally Required Standby Systems.

Those systems required and so classed as legally required standby by municipal, state, federal, or other codes or by any governmental agency having jurisdiction. These systems are intended to automatically supply power to selected loads (other than those classed as emergency systems) in the event of failure of the normal source. (CMP-13)

Life Safety Branch.

A system of feeders and branch circuits supplying power for lighting, receptacles, and equipment essential for life safety that is automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source. [**99:** 3.3.97] (517) (CMP-15)

Lighting Assembly, Cord-and-Plug-Connected. (Cord-and-Plug-Connected Lighting Assembly)

A lighting assembly consisting of a luminaire intended for installation in the wall of a spa, hot tub, or storable pool, and a cord-and-plug-connected transformer or power supply. (680) (CMP-17)

Lighting Assembly, Through-Wall. (Through-Wall Lighting Assembly)

A lighting assembly intended for installation above grade, on or through the wall of a pool, consisting of two interconnected groups of components separated by the pool wall. (680) (CMP-17)

Lighting Outlet.

An outlet intended for the direct connection of a lampholder or luminaire. (CMP-18)

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. (CMP-18)

Limited Care Facility.

A building or portion of a building used on a 24-hour basis for the housing of four or more persons who are incapable of self-preservation because of age; physical limitation due to accident or illness; or limitations such as intellectual disability/developmental disability, mental illness, or chemical dependency. [***101:*** 3.3.93.2] (CMP-15)

Limited Finishing Workstation.

A power-ventilated apparatus that is capable of confining the vapors, mists, residues, dusts, or deposits that are generated by a limited spray application process. Such apparatus is not a spray booth or spray room, as herein defined. [**33:** 3.3.23.1] (CMP-14)

> Informational Note: See NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials* , Section 14.3, for information on limited finishing workstations.

Line Isolation Monitor.

A test instrument designed to continually check the balanced and unbalanced impedance from each line of an isolated circuit to ground and equipped with a built-in test circuit to exercise the alarm without adding to the leakage current hazard. [**99:** 3.3.99] (517) (CMP-15)

Liquid Immersion “o”.

Type of protection where electrical equipment is immersed in a protective liquid so that an explosive atmosphere that might be above the liquid or outside the enclosure cannot be ignited. (CMP-14)

> Informational Note: See ANSI/UL 60079-6, *Explosive Atmospheres — Part 6: Equipment Protection by Liquid Immersion “o”* , for additional information.

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. (CMP-1)

> 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. (CMP-1)

Load Management.

The process within an energy management system that limits the total electrical load on an electrical supply system to a set value by adjusting or controlling the individual loads. (625) (CMP-12)

> Informational Note: Load management is sometimes called *demand-side management* (DSM).

Location, Anesthetizing. (Anesthetizing Location)

Any space within a facility that has been designated for the administration of any flammable or nonflammable inhalation anesthetic agent during examination or treatment, including the use of such agents for relative analgesia. (517) (CMP-15)

Location, Anesthetizing, Flammable. (Flammable Anesthetizing Location)

Any area of the facility that has been designated to be used for the administration of any flammable inhalation anesthetic agents in the normal course of examination or treatment. (517) (CMP-15)

Location, Damp. (Damp Location)

Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture. (CMP-1)

> 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. (Dry Location)

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. (CMP-1)

Location, Remote. (Remote Location)

A location, other than a motion picture or television studio, where a production is filmed or recorded. (530) (CMP-15)

Location, Wet. (Wet Location)

A location that is one or more of the following:

(1) Unprotected and exposed to weather

(2) Subject to saturation with water and other liquids

(3) Underground

(4) In concrete slabs or masonry in direct contact with the earth

(CMP-1)

Informational Note: A vehicle washing area is an example of a wet location saturated with water or other liquids.

Location, Wet Procedure. (Wet Procedure Location)

The area in a patient care space where a procedure is performed that is normally subject to wet conditions while patients are present, including standing fluids on the floor or drenching of the work area, either of which condition is intimate to the patient or staff. [**99:** 3.3.187] (517) (CMP-15)

Informational Note: Routine housekeeping procedures and incidental spillage of liquids do not define a wet procedure location. [**99:** A.3.3.187]

Locations, Hazardous (Classified). [Hazardous (Classified) Locations]

Locations where fire or explosion hazards might exist due to flammable gases, flammable liquid–produced vapors, combustible liquid–produced vapors, combustible dusts, combustible fiber/flyings, or ignitible fibers/flyings. (CMP-14)

Locations, Unclassified. (Unclassified Locations)

Locations determined to be neither Class I, Division 1; Class I, Division 2; Zone 0; Zone 1; 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. (CMP-14)

Long-Time Rating.

A rating based on an operating interval of 5 minutes or longer. (660) (CMP-12)

Long-Time Rating (Standby Power).

A rating based on an operating interval of 5 minutes or longer. (517) (CMP-15)

Loudspeaker (Speaker).

Equipment that converts an ac electric signal into an acoustic signal. (640) (CMP-12)

Low-Voltage Contact Limit.

A voltage not exceeding the following values:

(1) 15 volts (RMS) for sinusoidal ac

(2) 21.2 volts peak for nonsinusoidal ac

(3) 30 volts for continuous dc

(4) 12.4 volts peak for dc that is interrupted at a rate of 10 to 200 Hz

(680) (CMP-17)

Low-Voltage Suspended Ceiling Power Distribution System.

A system that serves as a support for a finished ceiling surface and consists of a busbar and busbar support system to distribute power to utilization equipment supplied by a Class 2 power supply. (393) (CMP-18)

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. (CMP-18)

Luminaire, Dry-Niche. (Dry-Niche Luminaire)

A luminaire intended for installation in the floor or wall of a pool, spa, or fountain in a niche that is sealed against the entry of water. (680) (CMP-17)

Luminaire, No-Niche. (No-Niche Luminaire)

A luminaire intended for installation above or below the water without a niche. (680) (CMP-17)

Luminaire, Wet-Niche. (Wet-Niche Luminaire)

A luminaire intended for installation in a forming shell mounted in a pool or fountain structure where the luminaire will be completely surrounded by water. (680) (CMP-17)

Machine Room.

An enclosed machinery space outside the hoistway, intended for full bodily entry, that contains the electrical driving machine or the hydraulic machine. The room could also contain electrical and/or mechanical equipment used directly in connection with the elevator or dumbwaiter. (620) (CMP-12)

Machine Room and Control Room, Remote. (Remote Machine Room and Control Room)

A machine room or control room that is not attached to the outside perimeter or surface of the walls, ceiling, or floor of the hoistway. (620) (CMP-12)

Machinery, Industrial (Industrial Machine). (Industrial Machinery)

A power-driven machine (or a group of machines working together in a coordinated manner), not portable by hand while working, that is used to process material by cutting; forming; pressure; electrical, thermal, or optical techniques; lamination; or a combination of these processes. It can include associated equipment used to transfer material or tooling, including fixtures, to assemble/disassemble, to inspect or test, or to package. The associated electrical equipment, including the logic controller(s) and associated software or logic together with the machine actuators and sensors, are considered as part of the industrial machine. (CMP-12)

Machinery Space.

A space inside or outside the hoistway, intended to be accessed with or without full bodily entry, that contains the elevator, dumbwaiter, platform lift, or stairway chairlift equipment and could also contain equipment used directly in connection with the elevator, dumbwaiter, platform lift, or stairway chairlift. (620) (CMP-12)

Machinery Space and Control Space, Remote. (Remote Machinery Space and Control Space)

A machinery space or control space that is not within the hoistway, machine room, or control room and that is not attached to the outside perimeter or surface of the walls, ceiling, or floor of the hoistway. (620) (CMP-12)

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 m^2 (320 ft^2) or more 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 includes 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:** 1.2.12] (CMP-7)

Informational Note No. 1: Unless otherwise indicated, the term *mobile home* includes manufactured home and excludes park trailers.

Informational Note No. 2: See the applicable building code for definition of the term *permanent foundation* .

Informational Note No. 3: 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.

Manufactured Wiring System.

A system containing component parts that are assembled in the process of manufacture and cannot be inspected at the building site without damage or destruction to the assembly and used for the connection of luminaires, utilization equipment, continuous plug-in type busways, and other devices. (604) (CMP-7)

Marina.

A facility, generally on the waterfront, that stores and services boats in berths, on moorings, and in dry storage or dry stack storage. [**303:** 3.3.13] (555) (CMP-7)

Maximum Output Power.

The maximum power delivered by an amplifier into its rated load as determined under specified test conditions. (640) (CMP-12)

Informational Note: The maximum output power can exceed the manufacturer's rated output power for the same amplifier.

Maximum Output Power.

The maximum 1 minute average power output a wind turbine produces in normal steady-state operation (instantaneous power output can be higher). (694) (CMP-4)

Maximum Voltage.

The greatest difference in potential produced between any two conductors of a wind turbine circuit. (694) (CMP-4)

Maximum Water Level.

The highest level that water can reach before it spills out. (680) (CMP-17)

Medical Office.

A building or part thereof in which the following occur:

(1) Examinations and minor treatments/procedures performed under the continuous supervision of a medical professional;

(2) The use of limited to minimal sedation and treatment or procedures that do not render the patient incapable of self-preservation under emergency conditions; and

(3) No overnight stays for patients or 24-hour operations.

[**99:** 3.3.110] (CMP-15)

Membrane Enclosure.

A temporary enclosure used for the spraying of workpieces that cannot be moved into a spray booth where open spraying is not practical due to proximity to other operations, finish quality, or concerns such as the collection of overspray. (CMP-14)

> Informational Note: See NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials* , Chapter 18, for information on the construction and use of membrane enclosures.

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

(CMP-6)

Messenger Wire (Messenger).

A wire that is run along with or integral with a cable or conductor to provide mechanical support for the cable or conductor. (CMP-6)

Metal Shield Connections.

Means of connection for flat conductor cables (Type FCC) 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. (324) (CMP-6)

Microgrid.

An electric power system capable of operating in island mode and capable of being interconnected to an electric power production and distribution network or other primary source while operating in interactive mode, which includes the ability to disconnect from and reconnect to a primary source and operate in island mode. (CMP-4)

> Informational Note No. 1: See IEEE 1547, *IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interface* ; IEEE 2030.7, *IEEE Standard for the Specification of Microgrid Controllers* ; IEEE 2030.8, *IEEE Standard for the Testing of Microgrid Controllers* ; and UL1008B, *Outline for Source Interconnection* , for additional information about microgrids.

> Informational Note No. 2: Examples of power sources in microgrids include such items as photovoltaic systems, generators, fuel cell systems, wind electric systems, energy storage systems, electric vehicles that are used as a source of supply, and electrical power conversion from other energy sources.

Microgrid, Health Care (Health Care Microgrid System). (Health Care Microgrid)

A group of interconnected loads and distributed energy resources within clearly defined boundaries that acts as a single controllable entity with respect to the utility. [**99:** 3.3.75] (517) (CMP-15)

Microgrid Control System (MCS).

A structured control system that manages microgrid operations, functionalities for utility interoperability, islanded operations, and transitions. (CMP-4)

> Informational Note: MCS differ from multiple standby generators or uninterruptible power supplies that are evaluated and rated to operate as a single source of backup power upon loss of the primary power source. MCS functions include coordination, transitions, and interoperability between multiple power sources.

Microgrid Interconnect Device (MID).

A device that enables a microgrid system to separate from and reconnect to an interconnected primary power source. (CMP-4)

Mixer.

Equipment used to combine and level match a multiplicity of electronic signals, such as from microphones, electronic instruments, and recorded audio. (640) (CMP-12)

Mobile.

X-ray equipment mounted on a permanent base with wheels and/or casters for moving while completely assembled. (660) (CMP-12)

Mobile Home.

A factory-assembled structure or structures transportable in one or more sections that are built on a permanent chassis and designed to be used as a dwelling without a permanent foundation where connected to the required utilities and that include the plumbing, heating, air-conditioning, and electrical systems contained therein. (CMP-7)

> Informational Note: Unless otherwise indicated, the term *mobile home* includes manufactured home and excludes park trailers.

Mobile Home Lot.

A designated portion of a mobile home park designed for the accommodation of one mobile home and its accessory buildings or structures for the exclusive use of its occupants. (550) (CMP-7)

Mobile Home Park.

A contiguous parcel of land that is used for the accommodation of mobile homes that are intended to be occupied. (550) (CMP-7)

Module, AC. (AC Module)

A complete, environmentally protected unit consisting of solar cells, inverter, and other components, designed to produce ac power. (690) (CMP-4)

Module System, AC. (AC Module System)

An assembly of ac modules, wiring methods, materials, and subassemblies that are evaluated, identified, and defined as a system. (690) (CMP-4)

Momentary Rating.

A rating based on an operating interval that does not exceed 5 seconds. (660) (CMP-12)

Momentary Rating (Maximum Power).

A rating based on an operating interval that does not exceed 5 seconds. (517) (CMP-15)

Monitor.

An electrical or electronic means to observe, record, or detect the operation or condition of the electric power system or apparatus. (750) (CMP-13)

Monopole Circuit.

An electrical subset of a PV system that has two conductors in the output circuit, one positive (+) and one negative (−). (690) (CMP-4)

Monorail.

Overhead track and hoist system for moving material around the boatyard or moving and launching boats. [**303:** 3.3.16] (555) (CMP-7)

Mooring(s).

Any place where a boat is wet stored or berthed. [**303:** 3.3.17] (555) (CMP-7)

Motion Picture Studio (Television Studio).

A building, group of buildings, other structures, and outdoor areas designed, constructed, permanently altered, designated, or approved for the purpose of motion picture or television production. (530) (CMP-15)

Motor Control Center.

An assembly of one or more enclosed sections having a common power bus and principally containing motor control units. (CMP-11)

Motor Fuel Dispensing Facility.

That portion of a property where motor fuels are stored and dispensed from fixed equipment into the fuel tanks of motor vehicles or marine craft or into approved containers, including all equipment used in connection therewith. [**30A:** 3.3.11] (CMP-14)

> Informational Note: See 511.1 with respect to electrical wiring and equipment for other areas used as lubritoriums, service rooms, repair rooms, offices, salesrooms, compressor rooms, and similar locations.

Multi-Circuit Cable Outlet Enclosure.

An enclosure containing one or more multi-circuit plugs, receptacles, or both. (520) (CMP-15)

Multioutlet Assembly.

A surface, flush, or freestanding assemblage with a raceway and fittings or other enclosure provided with one or more receptacles, for the purpose of supplying power to utilization equipment. (CMP-18)

Nacelle.

An enclosure housing the alternator and other parts of a wind turbine. (694) (CMP-4)

Neon Tubing.

Electric-discharge luminous tubing, including cold cathode luminous tubing, that is manufactured into shapes to illuminate signs, form letters, parts of letters, skeleton tubing, outline lighting, other decorative elements, or art forms and filled with various inert gases. (600) (CMP-18)

Network Interface Unit (NIU).

A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors. (CMP-16)

Network Terminal.

A device that converts network-provided signals (optical, electrical, or wireless) into component signals, including voice, audio, video, data, wireless, optical, and interactive services, and is considered a network device on the premises that is connected to a communications service provider and is powered at the premises. (CMP-16)

Neutral Conductor.

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

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. (CMP-5)

> 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. (CMP-1)

Nonincendive Circuit.

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. (CMP-14)

> Informational Note: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for additional information.

Nonincendive Component.

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 such a component is not intended to exclude the flammable atmosphere or contain an explosion. (CMP-14)

> Informational Note: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for additional information.

Nonincendive Equipment.

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. (CMP-14)

> Informational Note: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for additional information.

Nonincendive Field Wiring.

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. (CMP-14)

> Informational Note: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for additional information.

Nonincendive Field Wiring Apparatus.

Apparatus intended to be connected to nonincendive field wiring. (CMP-14)

> Informational Note: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for additional information.

Nonlinear Load.

A load where the wave shape of the steady-state current does not follow the wave shape of the applied voltage. (CMP-1)

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

Nonmetallic Extension.

An assembly of two insulated conductors within a nonmetallic jacket or an extruded thermoplastic covering. The classification includes surface extensions intended for mounting directly on the surface of walls or ceilings. (CMP-6)

Nonsparking.

Constructed to minimize the risk of arcs or sparks capable of creating an ignition hazard during conditions of normal operation. (CMP-14)

> Informational Note: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for additional information.

Normal/Emergency Power Source.

A power source on the output side of a transfer switch or uninterruptible power supply that is automatically available upon loss of normal power. (700) (CMP-13).

Normal High-Water Level (as applies to electrical datum plane distances).

Natural or Artificially Made Shorelines: An elevation delineating the highest water level that has been maintained for a sufficient period of time to leave evidence upon the landscape, commonly the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial.

Rivers and Streams: The elevation of the top of the bank of the channel. Streams, rivers, and tributaries that are prone to flooding and effects of water runoff shall consider the “bankfull stage” where an established gauge height at a given location along a river or stream, above which a rise in water surface will cause the river or stream to overflow the lowest natural stream bank somewhere in the corresponding reach.

Flood Control Bodies of Water: The flood pool maximum water surface elevation of a reservoir, equal to the elevation of the spillway.

Nonflood Control Bodies of Water: The flowage easement boundary in which the highest water surface elevation defined by the area existing between governmental-owned property line(s) and a contour line with perpetual rights to flood the area in connection with the operation of the reservoir.

(CMP-7)

Nurses’ Station.

A space intended to provide a center of nursing activity for a group of nurses serving bed patients, where patient calls are received, nurses dispatched, nurses’ notes written, inpatient charts prepared, and medications prepared for distribution to patients. Where such activities are carried on in more than one location within a nursing unit, all such separate spaces are considered a to be parts of the nurses’ station. (517) (CMP-15)

Nursing Home.

A building or portion of a building used on a 24-hour basis for the housing and nursing care of four or more persons who, because of mental or physical incapacity, might be unable to provide for their own needs and safety without the assistance of another person.
[***101*** **:** 3.3.150.2] (CMP-15)

Office Furnishing.

Cubicle panels, partitions, study carrels, workstations, desks, shelving systems, and storage units that may be mechanically and electrically interconnected to form an office furnishing system. (CMP-18)

Oil Immersion.

Electrical equipment immersed in a protective liquid so that an explosive atmosphere that might be above the liquid or outside the enclosure cannot be ignited. (CMP-14)

> Informational Note: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for additional information.

Open Wiring on Insulators.

An exposed wiring method using cleats, knobs, tubes, and flexible tubing for the protection and support of single insulated conductors run in or on buildings. (CMP-6)

Operating Device.

The car switch, pushbuttons, key or toggle switch(s), or other devices used to activate the operation controller. (620) (CMP-12)

Operator.

The individual responsible for starting, stopping, and controlling an amusement ride or supervising a concession. (525) (CMP-15)

Optical Radiation.

Electromagnetic radiation at wavelengths in vacuum between the region of transition to X-rays and the region of transition to radio waves that is approximately between 1 nm and 1000 μm. (CMP-14)

> Informational Note: See ANSI/UL 60079-28, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation* , for information on types of protection that can be applied to minimize the risk of ignition in explosive atmospheres from optical radiation in the wavelength range from 380 nm to 10 μm.

Optical Radiation, Inherently Safe “op is”. (Inherently Safe Optical Radiation “op is”)

Type of protection to minimize the risk of ignition in explosive atmospheres from optical radiation where visible or infrared radiation is incapable of producing sufficient energy under normal or specified fault conditions to ignite a specific explosive atmosphere. (CMP-14)

> Informational Note: See ANSI/UL 60079-28, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation* , for additional information.

Optical Radiation, Protected “op pr”. (Protected Optical Radiation “op pr”)

Type of protection to minimize the risk of ignition in explosive atmospheres from optical radiation where visible or infrared radiation is confined inside optical fiber or other transmission medium under normal constructions or constructions with additional mechanical protection based on the assumption that there is no escape of radiation from the confinement. (CMP-14)

> Informational Note: See ANSI/UL 60079-28, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation* , for additional information.

Optical System With Interlock "op sh".

Type of protection to minimize the risk of ignition in explosive atmospheres from optical radiation where visible or infrared radiation is confined inside optical fiber or other transmission medium with interlock cutoff provided to reliably reduce the unconfined beam strength to safe levels within a specified time in case the confinement fails and the radiation becomes unconfined. (CMP-14)

Informational Note: See ANSI/UL 60079-28, *Explosive Atmospheres — Part 28: Protection of Equipment and Transmission Systems Using Optical Radiation* , for additional information.

Optional Standby Systems.

Those systems intended to supply power to public or private facilities or property where life safety does not depend on the performance of the system. These systems are intended to supply on-site generated or stored power to selected loads either automatically or manually. (CMP-13)

Organ, Electronic. (Electronic Organ)

A musical instrument that imitates the sound of a pipe organ by producing sound electronically. (CMP-12)

Informational Note: Most new electronic organs produce sound digitally and are called digital organs.

Organ, Pipe. (Pipe Organ)

A musical instrument that produces sound by driving pressurized air (called *wind*) through pipes selected via a keyboard. (CMP-12)

Organ, Pipe Sounding Apparatus. (Pipe Organ Sounding Apparatus) (Pipe Organ Chamber).

The sound-producing part of a pipe organ, including, but not limited to, pipes, chimes, bells, the pressurized air- (wind-) producing equipment (blower), associated controls, and power equipment. (CMP-12)

Outlet.

A point on the wiring system at which current is taken to supply utilization equipment. (CMP-1)

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. (CMP-18)

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. (CMP-18)

Output Cable to the Electric Vehicle.

An assembly consisting of a length of flexible EV cable and an electric vehicle connector (supplying power to the electric vehicle). (625) (CMP-12)

Output Cable to the Primary Pad.

A multiconductor, shielded cable assembly consisting of conductors to carry the high-frequency energy and any status signals between the charger power converter and the primary pad. (625) (CMP-12)

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. (CMP-10)

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. (Branch-Circuit Overcurrent Protective Device)

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. (CMP-10)

Overcurrent Protective Device, Current-Limiting. (Current-Limiting Overcurrent Protective Device)

A device that, when interrupting currents in its current-limiting range, reduces the current flowing in the faulted circuit to a magnitude substantially less than that obtainable in the same circuit if the device were replaced with a solid conductor having comparable impedance. (240) (CMP-10)

Overcurrent Protective Device, Supplementary. (Supplementary Overcurrent Protective Device)

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. (CMP-10)

Overhead Gantry.

A structure consisting of horizontal framework, supported by vertical columns spanning above electrified truck parking spaces, that supports equipment, appliances, raceway, and other necessary components for the purpose of supplying electrical, HVAC, internet, communications, and other services to the spaces. (626) (CMP-12)

Overload.

Operation of equipment in excess of normal, full-load rating, or of a conductor in excess of its 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. (CMP-10)

Packaged Therapeutic Tub or Hydrotherapeutic Tank Equipment Assembly.

A factory-fabricated unit consisting of water-circulating, heating, and control equipment mounted on a common base, intended to operate a therapeutic tub or hydrotherapeutic tank. Equipment can include pumps, air blowers, heaters, lights, controls, sanitizer generators, and so forth. (680) (CMP-17)

Panelboard.

A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet, enclosure, or cutout box placed in or against a wall, partition, or other support; and accessible only from the front. (CMP-9)

Panelboard, Enclosed. (Enclosed Panelboard)

An assembly of buses and connections, overcurrent devices, and control apparatus with or without switches or other equipment, installed in a cabinet, cutout box, or enclosure suitable for a panelboard application. (CMP-9)

Park Electrical Wiring Systems.

All of the electrical wiring, luminaires, equipment, and appurtenances related to electrical installations within a mobile home park, including the mobile home service equipment. (550) (CMP-7)

Park Trailer.

A unit that is built on a single chassis mounted on wheels and has a gross trailer area not exceeding 37 m^2 (400 ft^2) in the set-up mode. (552) (CMP-7)

Part-Winding Motors.

A part-winding start induction or synchronous motor is one that is arranged for starting by first energizing part of its primary (armature) winding and, subsequently, energizing the remainder of this winding in one or more steps. A standard part-winding start induction motor is arranged so that one-half of its primary winding can be energized initially, and, subsequently, the remaining half can be energized, both halves then carrying equal current. (CMP 11)

> Informational Note: A hermetic refrigerant motor-compressor is not considered a standard part-winding start induction motor.

Passenger Transportation Facilities.

Any area open to the public associated with passenger transportation such as an airport, bus terminal, highway rest stop and service area, marina, seaport, ferry slip, subway station, train station, or port of entry. (CMP-18)

Patient Bed Location.

The location of a patient sleeping bed, or the bed or procedure table of a Category 1 space. [**99:** 3.3.138] (CMP-15)

Patient Care–Related Electrical Equipment.

Electrical equipment appliance that is intended to be used for diagnostic, therapeutic, or monitoring purposes in a patient care vicinity. [**99:** 3.3.139] (517) (CMP-15)

Patient Care Space Category.

Any space of a health care facility wherein patients are intended to be examined or treated. [**99:** 3.3.140] (517) (CMP-15)

> Informational Note No. 1: The health care facility's governing body designates patient care space in accordance with the type of patient care anticipated.
>
> Informational Note No. 2: Business offices, corridors, lounges, day rooms, dining rooms, or similar areas typically are not classified as patient care spaces. [**99:** A.3.3.140]

Category 1 Space (Category 1).

Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [**99:** 3.3.140.1] (CMP-15)

> Informational Note: These spaces, formerly known as critical care rooms, 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.3.3.140.1]

Category 2 Space (Category 2).

Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [**99:** 3.3.140.2] (CMP-15)

> Informational Note: These spaces were formerly known as general care rooms. Examples include, but are not limited to, inpatient bedrooms, dialysis rooms, in vitro fertilization rooms, procedural rooms, and similar rooms. [**99:** A.3.3.140.2]

Category 3 Space (Category 3).

Space in which the failure of equipment or a system is not likely to cause injury to patients, staff, or visitors but can cause discomfort. [**99:** 3.3.140.3] (517) (CMP-15)

> Informational Note: These spaces, formerly known as basic care rooms, 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.3.3.140.3]

Category 4 Space (Category 4).

Space in which failure of equipment or a system is not likely to have a physical impact on patient care. [**99:** 3.3.140.4] (517) (CMP-15)

> Informational Note: These spaces were formerly known as support rooms. 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.3.3.140.4]

Patient Care Vicinity.

A space, within a location intended for the examination and treatment of patients, extending 1.8 m (6 ft) beyond the normal location of the bed, chair, table, treadmill, or other device that supports the patient during examination and treatment and extending vertically to 2.3 m (7 ft 6 in.) above the floor. [**99:** 3.3.141] (517) (CMP-15)

Patient Equipment Grounding Point.

A jack or terminal that serves as the collection point for redundant grounding of electric appliances serving a patient care vicinity or for grounding other items in order to eliminate electromagnetic interference problems. [**99:** 3.3.142] (517) (CMP-15)

Performance Area.

The stage and audience seating area associated with a temporary stage structure, whether indoors or outdoors, constructed of scaffolding, truss, platforms, or similar devices, that is used for the presentation of theatrical or musical productions or for public presentations. (520) (CMP-15)

Permanent Amusement Attraction.

A ride device, entertainment device, or a combination of both that is installed such that portability or relocation is impracticable. (522) (CMP-15)

Permanently Installed Decorative Fountains and Reflection Pools.

Those that are constructed in the ground, on the ground, or in a building in such a manner that the fountain cannot be readily disassembled for storage, whether or not served by electrical circuits of any nature. These units are primarily constructed for their aesthetic value and are not intended for swimming or wading. (680) (CMP-17)

Personnel Protection System (as applied to EVSE).

A system of personnel protection devices and constructional features that when used together provide protection against electric shock of personnel. (625) (CMP-12)

Phase, Manufactured. (Manufactured Phase)

The phase that originates at the phase converter and is not solidly connected to either of the single-phase input conductors. (CMP-13)

Phase Converter.

An electrical device that converts single-phase power to 3-phase electric power. (CMP-13)

> Informational Note: Phase converters have characteristics that modify the starting torque and locked-rotor current of motors served, and consideration is required in selecting a phase converter for a specific load.

Phase Converter, Rotary. (Rotary-Phase Converter)

A device that consists of a rotary transformer and capacitor panel(s) that permits the operation of 3-phase loads from a single-phase supply. (455) (CMP-13)

Phase Converter, Static. (Static-Phase Converter)

A device without rotating parts, sized for a given 3-phase load to permit operation from a single-phase supply. (455) (CMP-13)

Photovoltaic Cell (PV). (Solar Cell).

The basic photovoltaic device that generates dc electricity when exposed to light. (CMP-4)

Pier.

A structure extending over the water and supported on a fixed foundation (fixed pier), or on flotation (floating pier), that provides access to the water. [**303:** 3.3.18] (CMP-7)

Pier, Fixed. (Fixed Pier)

Pier constructed on a permanent, fixed foundation, such as on piles, that permanently establishes the elevation of the structure deck with respect to land. [**303:** 3.3.18.2] (CMP-7)

Pier, Floating. (Floating Pier)

Pier designed with inherent flotation capability that allows the structure to float on the water surface and rise and fall with water level changes. [**303:** 3.3.18.3] (CMP-7)

Pipeline.

A length of pipe including pumps, valves, flanges, control devices, strainers, and/or similar equipment for conveying fluids. (CMP-17)

Plenum.

A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system. (CMP-3)

Plenum Cable, Cable Routing Assemblies, and Raceways.

Cables, cable routing assemblies, and raceways that have adequate fire-resistant and low smoke-producing characteristics and are suitable for use in ducts, plenums, and other spaces used for environmental air. (722) (CMP-3)

Point of Entrance.

The point within a building at which the wire or cable emerges from an external wall, from the roof, or from a concrete floor slab. (CMP-16)

Pool.

Manufactured or field-constructed equipment designed to contain water on a permanent or semipermanent basis and used by persons for swimming, wading, immersion, or therapeutic purposes, but not including bodies of water incorporated as part of an industrial process or lakes, lagoons, surf parks, or other natural and man-made bodies of water that may incorporate swimming and swimming areas. (680) (CMP-17)

> Informational Note: Natural and man-made bodies of water, which includes lakes, lagoons, surf parks, or other similar bodies of water, are addressed in Article 682.

Pool, Immersion. (Immersion Pool)

A pool for ceremonial or ritual immersion of users, which is designed and intended to have its contents drained or discharged. (680) (CMP-17)

Pool, Permanently Installed Swimming, Wading, Immersion, and Therapeutic. (Permanently Installed Swimming, Wading, Immersion, and Therapeutic Pools)

Those that are constructed or installed in the ground or partially in the ground, and all pools installed inside of a building, whether or not served by electrical circuits of any nature. (680) (CMP-17)

Pool, Storable; used for Swimming, Wading, or Immersion (Storable Immersion Pool). (Storable Pool)

Pools installed entirely on or above the ground that are intended to be stored when not in use and are designed for ease of relocation, regardless of water depth. (680) (CMP-17)

Pool Cover, Electrically Operated. (Electrically Operated Pool Cover)

Motor-driven equipment designed to cover and uncover the water surface of a pool by means of a flexible sheet or rigid frame. (680) (CMP-17)

Pool Lift, Electrically Powered. (Electrically Powered Pool Lift)

An electrically powered lift that provides accessibility for people with disabilities to and from a pool or spa. (680) (CMP-17)

Portable.

A device intended for indoor or outdoor use that is designed to be hand-carried from location to location, or easily transported without the use of other devices or equipment. (625) (CMP-12)

Portable.

X-ray equipment designed to be hand-carried. (660) (CMP-12)

Portable (as applied to equipment).

Equipment that is actually moved or can easily be moved from one place to another in normal use. (680) (CMP-17)

Portable Power Distribution Unit.

A power distribution box containing receptacles and overcurrent devices. (520) (CMP-15)

> Informational Note: See ANSI/UL 1640, *Portable Power-Distribution Equipment* , for information on portable power distribution units.

Portable Structures.

Units designed to be moved including, but not limited to, amusement rides, attractions, concessions, tents, trailers, trucks, and similar units. (525) (CMP-15)

Portable Substation.

A portable assembly, usually mounted on a trailer, containing primary and secondary switchgear and a transformer. (530) (CMP-15)

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. (CMP-14)

> Informational Note: See ANSI/UL 60079-5, *Explosive Atmospheres — Part 5: Equipment protection by powder filling “q”* , for additional information.

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. (CMP-7)

Power Outlet, Marina. (Marina Power Outlet)

An enclosed assembly that can include equipment such as receptacles, circuit breakers, fused switches, fuses, watt-hour meters, panelboards, and monitoring means identified for marina use. (555) (CMP-7)

Power Production Equipment.

Electrical generating equipment supplied by any source other than a utility service, up to the source system disconnecting means. (CMP-4)

> Informational Note: Examples of power production equipment include such items as generators, solar photovoltaic systems, and fuel cell systems.

Power Source Output Conductors.

The conductors between power production equipment and the service or other premises wiring. (CMP-4)

Power Supply.

A Class 2 power supply connected between the branch-circuit power distribution system and the busbar low-voltage suspended ceiling power distribution system. (393) (CMP-18)

Power-Supply Cord.

An assembly consisting of an attachment plug and a length of flexible cord connected to utilization equipment. (CMP-6)

Premises.

The land and buildings located on the user’s side of the point of demarcation between the communications service provider and the user. (800) (CMP-16)

Premises-Powered.

Using power provided locally from the premises. (CMP-16)

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 one of the following:

(1) Wiring from the service point or power source to the outlets

(2) 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. (CMP-1)

> 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.

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 ignitible fibers/flyings. (CMP-14)

Pressurized Enclosure “p”.

Type of protection for electrical equipment that uses the technique of guarding against the ingress of the external atmosphere, which might be explosive, into an enclosure by maintaining a protective gas therein at a pressure above that of the external atmosphere. (CMP-14)

> Informational Note: See ANSI/UL-60079-2, *Explosive Atmospheres — Part 2: Equipment protection by pressurized enclosures “p”,* for additional information.

Pressurized Room "p".

A room volume protected by pressurization and of sufficient size to permit the entry of a person who might occupy the room. (CMP-14)

> Informational Note: See ANSI/UL 60079-13, *Explosive Atmospheres — Part 13: Equipment protection by pressurized room "p" and artificially ventilated room "v"* , for information on the requirements for rooms intended for human entry where pressurization is used as a means of reducing the risk of explosion.

Primary Pad.

A device external to the EV that transfers power via the contactless coupling as part of a wireless power transfer system. (625) (CMP-12)

Primary Source.

An electric utility or another source of power that acts as the main forming and stabilizing source in an electric power system. (CMP-4)

Prime Mover.

The machine that supplies the mechanical horsepower to a generator. (CMP-13)

Process Seal.

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. (CMP-14)

> Informational Note: See ANSI/UL 122701, *Requirements for Process Sealing Between Electrical Systems and Flammable or Combustible Process Fluids* , for additional information.

Production Areas.

Areas where portable electrical equipment is used to implement the capture of images. (530) (CMP-15)

Projector, Nonprofessional. (Nonprofessional Projector)

Those types of projectors that do not comply with the definition of *Professional-Type Projector* . (540) (CMP-15)

Projector, Professional-Type. (Professional-Type Projector)

A type of projector using 35- or 70-mm film that has a minimum width of 35 mm (1 $3/8$ in.) and has on each edge 212 perforations per meter (5.4 perforations per inch), or a type using carbon arc, xenon, or other light source equipment that develops hazardous gases, dust, or radiation. (540) (CMP-15)

Proscenium.

The wall and arch that separates the stage from the auditorium (i.e., house). (520) (CMP-15)

Protection by Enclosure "t".

Type of protection for explosive dust atmospheres where electrical equipment is provided with an enclosure providing dust ingress protection and a means to limit surface temperatures. (CMP-14)

> Informational Note: See ANSI/UL 60079-31, *Explosive Atmospheres — Part 31: Equipment Dust Ignition Protection by Enclosure "t"* , for additional information.

Psychiatric Hospital.

A building used exclusively for the psychiatric care, on a 24-hour basis, of four or more inpatients. (517) (CMP-15)

Purged and Pressurized.

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 ignitible fiber. (CMP-14)

> Informational Note: See NFPA 496, *Standard for Purged and Pressurized Enclosures for Electrical Equipment* , for additional information.

Purpose-Built.

A custom luminaire, a piece of lighting equipment, or an effect that is constructed for a specific purpose and is not serially manufactured or available for general sale. (530) (CMP-15)

PV DC Circuit (PV System DC Circuit).

Any dc conductor in PV source circuits, PV string circuits, and PV dc-to-dc converter circuits. (690) (CMP-4)

PV DC Circuit, Source. (PV Source Circuit)

The PV dc circuit conductors between modules in a PV string circuit, and from PV string circuits or dc combiners, to dc combiners, electronic power converters, or a dc PV system disconnecting means. (690) (CMP-4)

PV DC Circuit, String. (PV String Circuit)

The PV source circuit conductors of one or more series-connected PV modules. (690) (CMP-4)

PV Module (Module).

A complete, environmentally protected unit consisting of solar cells and other components designed to produce dc power. (CMP-4)

PV (Photovoltaic) System (PV System) (Photovoltaic System).

The total components, circuits, and equipment up to and including the PV system disconnecting means that, in combination, convert solar energy into electric energy. (CMP-4)

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. (CMP-1)

> Informational Note: See NFPA *70E* -2021, *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* . (CMP-8)

Raceway Cell.

A single enclosed tubular space in a cellular metal or concrete floor member, the axis of the cell being parallel to the axis of the floor member. (CMP-8)

Raceway, Cellular Metal Floor. (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. (CMP-8)

Raceway, Communications. (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 plenum, riser, and general-purpose applications. (CMP-16)

Raceway, Strut-Type Channel. (Strut-Type Channel Raceway)

A metal raceway that is intended to be mounted to the surface of or suspended from a structure, with associated accessories for the installation of electrical conductors and cables. (CMP-8)

Raceway, Surface Metal. (Surface Metal Raceway)

A metal raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors. (CMP-8)

Raceway, Surface Nonmetallic. (Surface Nonmetallic Raceway)

A nonmetallic raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors. (CMP-8)

Raceway, Underfloor. (Underfloor Raceway)

A raceway and associated components designed and intended for installation beneath or flush with the surface of a floor for the installation of cables and electrical conductors. (CMP-8)

Rail.

The structural support for the suspended ceiling system typically forming the ceiling grid supporting the ceiling tile and listed utilization equipment, such as sensors, actuators, A/V devices, and low-voltage luminaires and similar electrical equipment. (393) (CMP-18)

Rainproof.

Constructed, protected, or treated so as to prevent rain from interfering with the successful operation of the apparatus under specified test conditions. (CMP-1)

Raintight.

Constructed or protected so that exposure to a beating rain will not result in the entrance of water under specified test conditions. (CMP-1)

Rated-Load Current (RLC).

The current of a hermetic refrigerant motor-compressor resulting when it is operated at the rated load, rated voltage, and rated frequency of the equipment it serves. (440) (CMP-11)

Rated Output Power.

The amplifier manufacturer’s stated or marked output power capability into its rated load. (640) (CMP-12)

Rated Power.

The output power of a wind turbine at its rated wind speed. (694) (CMP-4)

> Informational Note: See IEC 61400-12-1, *Power Performance Measurements of Electricity Producing Wind Turbines* , for the method for measuring wind turbine power output.

Receptacle.

A contact device installed at the outlet for the connection of an attachment plug, or for the direct connection of electrical utilization equipment designed to mate with the corresponding contact device. A single receptacle is a single contact device with no other contact device on the same yoke or strap. A multiple receptacle is two or more contact devices on the same yoke or strap. (CMP-18)

> Informational Note: A duplex receptacle is an example of a multiple receptacle that has two receptacles on the same yoke or strap.

Receptacle, Weight-Supporting Ceiling (WSCR). (Weight-Supporting Ceiling Receptacle)

A contact device installed at an outlet box for the connection and support of luminaries or ceiling-suspended (paddle) fans using a weight-supporting attachment fitting (WSAF). (CMP-18)

> Informational Note: See ANSI/NEMA WD 6, *American National Standard for Wiring Devices — Dimensional Specifications* , for the standard configuration of weight-supporting ceiling receptacles and related weight-supporting attachment fittings.

Receptacle Outlet.

An outlet where one or more receptacles are installed. (CMP-18)

Reconditioned.

Electromechanical systems, equipment, apparatus, or components that are restored to operating conditions. This process differs from normal servicing of equipment that remains within a facility, or replacement of listed equipment on a one-to-one basis. (CMP-1)

> Informational Note: The term *reconditioned* is frequently referred to as *rebuilt* , *refurbished* , or *remanufactured* .

Recreational Vehicle (RV) (Camping Trailer) (Motor Home) (Travel Trailer) (Truck Camper).

A vehicle or slide-in camper that is primarily designed as temporary living quarters for recreational, camping, or seasonal use; has its own motive power or is mounted on or towed by another vehicle; is regulated by the National Highway Traffic Safety Administration as a vehicle or vehicle equipment; does not require a special highway use permit for operation on the highways; and can be easily transported and set up on a daily basis by an individual. [**1192:** 3.3.52] (551) (CMP-7)

> Informational Note: See NFPA 1192, *Standard on Recreational Vehicles* , Informative Annex A, for product types and definitions for motor homes and towable recreational vehicles.

Recreational Vehicle Park.

Any parcel or tract of land under the control of any person, organization, or governmental entity wherein two or more recreational vehicle, recreational park trailer, and/or other camping sites are offered for use by the public or members of an organization for overnight stays. (551) (CMP-7)

Recreational Vehicle Site.

A specific area within a recreational vehicle park or campground that is set aside for use by a camping unit. (551) (CMP-7)

Recreational Vehicle Site Supply Equipment.

A power outlet assembly located near the point of entrance of supply conductors to a recreational vehicle site and intended to constitute the disconnecting means for connected recreational vehicles. (551) (CMP-7)

Recreational Vehicle Stand.

That area of a recreational vehicle site intended for the placement of a recreational vehicle. (551) (CMP-7)

Reference Grounding Point.

The ground bus of the panelboard or isolated power system panel supplying the patient care room. [**99:** 3.3.158] (517) (CMP-15)

Relative Analgesia.

A state of sedation and partial block of pain perception produced in a patient by the inhalation of concentrations of nitrous oxide insufficient to produce loss of consciousness (conscious sedation). (517) (CMP-15)

Relay, Automatic Load Control. (Automatic Load Control Relay)

An emergency lighting control device used to set normally dimmed or normally-off switched emergency lighting equipment to full power illumination levels in the event of a loss of the normal supply by bypassing the dimming/switching controls, and to return the emergency lighting equipment to normal status when the device senses the normal supply has been restored. (700) (CMP-13)

> Informational Note: See ANSI/UL 924, *Emergency Lighting and Power Equipment* , for the requirements covering automatic load control relays.

Remote-Control Circuit.

Any electrical circuit that controls any other circuit through a relay or an equivalent device. (CMP-3)

Remote Disconnect Control.

An electric device and circuit that controls a disconnecting means through a relay or equivalent device. (645) (CMP-12)

Resistance Heating Element.

A specific separate element to generate heat that is stand-alone, externally attached to, embedded in, integrated with, or internal to the object to be heated. (CMP-17)

> Informational Note: Tubular heaters, strip heaters, heating cable, heating tape, heating blankets, immersion heaters, and heating panels are examples of resistance heaters.

Restricted Industrial Establishment [as applied to hazardous (classified) locations].

Establishment with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation. (CMP-14)

Retrofit Kit.

A complete subassembly of parts and devices for field conversion of utilization equipment. (CMP-18)

Retrofit Kit, General Use. (General Use Retrofit Kit)

A kit consisting of primary parts, which does not include all the parts for a complete subassembly but includes a list of required parts and installation instructions to complete the subassembly in the field. (600) (CMP-18)

Retrofit Kit, Sign Specific. (Sign Specific Retrofit Kit)

A kit consisting of the necessary parts and hardware to allow for field installation in a host sign, based on the included installation instructions. (600) (CMP-18)

Reverse Polarity Protection (Backfeed Protection).

A system that prevents two interconnected power supplies, connected positive to negative, from passing current from one power source into a second power source. (393) (CMP-18)

Ride Device.

A device or combination of devices that carry, convey, or direct a person(s) over or through a fixed or restricted course within a defined area for the primary purpose of amusement or entertainment. (522) (CMP-15)

Riser Cable, Cable Routing Assemblies, and Raceways.

Cables, cable routing assemblies, and raceways that have fire-resistant characteristics capable of preventing the carrying of fire from floor to floor and are suitable for use in a vertical run in a shaft or from floor to floor. (722) (CMP-3)

Safe Zone.

Low probability of damage other than a slight swelling of the capacitor case, as identified by the case rupture curve of the capacitor. (460) (CMP-11)

Safety Circuit.

The part of a control system containing one or more devices that perform a safety-related function. [**79:** 3.3.95] (CMP-12)

> Informational Note: See NFPA 79-2021, *Electrical Standard for Industrial Machinery. Safety-related control system* and *safety interlock circuit* are common terms that can be used to refer to the safety circuit in other standards. The safety circuit can include hard-wired, communication, and software-related components.

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. (CMP-1)

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

Sealed [as applied to hazardous (classified) locations].

Constructed such that equipment is sealed effectively against entry of an external atmosphere and is not opened during normal operation or for any maintenance activities. (CMP-14)

> Informational Note: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for additional information.

Sealed, Hermetically. (Hermetically Sealed)

Sealed against the entrance of an external atmosphere, such that the seal is made by fusion of metal to metal, ceramic to metal, or glass to metal. (CMP-14)

> Informational Note: See ANSI/UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations* , for additional information.

Section Sign.

A sign or outline lighting system, shipped as subassemblies, that requires field-installed wiring between the subassemblies to complete the overall sign. The subassemblies are either physically joined to form a single sign unit or are installed as separate remote parts of an overall sign. (600) (CMP-18)

Selected Receptacles.

A minimal number of receptacles selected by the health care facility's governing body as necessary to provide essential patient care and facility services during loss of normal power. [**99:** 3.3.164] (517) (CMP-15)

Self-Contained Therapeutic Tubs or Hydrotherapeutic Tanks.

A factory-fabricated unit consisting of a therapeutic tub or hydrotherapeutic tank with all water-circulating, heating, and control equipment integral to the unit. Equipment may include pumps, air blowers, heaters, light controls, sanitizer generators, and so forth. (680) (CMP-17)

Separable Power Supply Cable Assembly.

A flexible cord or cable, including ungrounded, grounded, and equipment grounding conductors, provided with a cord connector, an attachment plug, and all other fittings, grommets, or devices installed for the purpose of delivering energy from the source of electrical supply to the truck or transport refrigerated unit (TRU) flanged surface inlet. (626) (CMP-12)

Separately Derived System.

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

Service.

The conductors and equipment connecting the serving utility to the wiring system of the premises served. (CMP-10)

Service Conductors.

The conductors from the service point to the service disconnecting means. (CMP-10)

Service Conductors, Overhead. (Overhead Service Conductors)

The overhead conductors between the service point and the first point of connection to the service-entrance conductors at the building or other structure. (CMP-10)

Service Conductors, Underground. (Underground Service Conductors)

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. (CMP-10)

> 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 serving utility and the service point. (CMP-10)

Service-Entrance Conductor Assembly.

Multiple single-insulated conductors twisted together without an overall covering, other than an optional binder intended only to keep the conductors together. (CMP-6)

Service-Entrance Conductors.

The service conductors between the terminals of the service equipment to the service drop, overhead service conductors, service lateral, or underground service conductors. (CMP-10)

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

Service Equipment.

The necessary equipment, consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the serving utility and intended to constitute the main control and disconnect of the serving utility. (CMP-10)

Service Equipment, Mobile Home. (Mobile Home Service Equipment)

The equipment containing the disconnecting means, overcurrent protective devices, and receptacles or other means for connecting a mobile home feeder assembly. (550) (CMP-7)

Service Lateral.

The underground conductors between the utility electric supply system and the service point. (CMP-10)

Service Point.

The point of connection between the facilities of the serving utility and the premises wiring. (CMP-10)

> 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.

Servicing.

The process of following a manufacturer's set of instructions or applicable industry standards to analyze, adjust, or perform prescribed actions upon equipment with the intention to preserve or restore the operational performance of the equipment. (CMP-1)

Informational Note: Servicing often encompasses maintenance and repair activities.

Shore Power.

The electrical equipment required to power a floating vessel including, but not limited to, the receptacle and cords. (555) (CMP-7)

Shoreline.

The farthest extent of standing water under the applicable conditions that determine the electrical datum plane for the specified body of water. (682) (CMP-17)

Short Circuit.

An abnormal connection (including an arc) of relatively low impedance, whether made accidentally or intentionally, between two or more points of different potential. (CMP-10)

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. (CMP-10)

Show Window.

Any window, including windows above doors, 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. (CMP-2)

Sign, Photovoltaic (PV) Powered (PV Powered Sign). [Photovoltaic (PV) Powered Sign]

A complete sign powered by solar energy consisting of all components and subassemblies for installation either as an off-grid stand-alone, on-grid interactive, or non-grid interactive system. (600) (CMP-18)

Sign Body.

A portion of a sign that may provide protection from the weather but is not an electrical enclosure. (600) (CMP-18)

Signaling Circuit.

Any electrical circuit that energizes signaling equipment. (CMP-3)

Simple Apparatus.

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. (CMP-14)

Informational Note No. 1: The following are examples of simple apparatus:

(1) Passive components; for example, switches, instrument connectors, plugs and sockets, 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

Informational Note No. 2: See ANSI/UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations*, and ANSI/UL 60079-11, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i"*, for additional information.

Single-Pole Separable Connector.

A device that is installed at the ends of portable, flexible, single-conductor cable that is used to establish connection or disconnection between two cables or one cable and a single-pole, panel-mounted separable connector. (CMP-18)

Site-Isolating Device.

A pole-mounted disconnecting means installed at the distribution point for the purposes of isolation, system maintenance, emergency disconnection, or connection of optional standby systems. (547) (CMP-7)

Skeleton Tubing.

Neon tubing that is itself the sign or outline lighting and is not attached to an enclosure or sign body. (600) (CMP-18)

Slip.

A berthing space between or adjacent to piers, wharves, or docks; the water areas associated with boat occupation. [**303:** 3.3.21] (555) (CMP-7)

Informational Note: See the definition of *Berth* for additional information.

Solid-State Phase-Control Dimmer.

A solid-state dimmer where the wave shape of the steady-state current does not follow the wave shape of the applied voltage such that the wave shape is nonlinear. (CMP-15)

Solid-State Sine Wave Dimmer.

A solid-state dimmer where the wave shape of the steady-state current follows the wave shape of the applied voltage such that the wave shape is linear. (CMP-15)

Spa or Hot Tub.

A hydromassage pool, or tub for recreational or therapeutic use, not located in health care facilities, designed for immersion of users, and usually having a filter, heater, and motor-driven blower. It may be installed indoors or outdoors, on the ground or supporting structure, or in the ground or supporting structure. Generally, they are not designed or intended to have its contents drained or discharged after each use. (680) (CMP-17)

Spa or Hot Tub, Packaged Equipment Assembly. (Packaged Spa or Hot Tub Equipment Assembly)

A factory-fabricated unit consisting of water-circulating, heating, and control equipment mounted on a common base, intended to operate a spa or hot tub. Equipment can include pumps, air blowers, heaters, lights, controls, sanitizer generators, and so forth. (680) (CMP-17)

Spa or Hot Tub, Self-Contained. (Self-Contained Spa or Hot Tub)

Factory-fabricated unit consisting of a spa or hot tub vessel with all water-circulating, heating, and control equipment integral to the unit. Equipment can include pumps, air blowers, heaters, lights, controls, sanitizer generators, and so forth. (680) (CMP-17)

Spa or Hot Tub, Storable. (Storable Spa or Hot Tub)

Spas or hot tubs installed entirely on or above the ground that are intended to be stored when not in use and are designed for ease of relocation. (680) (CMP-17)

Space.

A portion of the health care facility designated by the health care facility's governing body that serves a specific purpose. [**99:** 3.3.171] (517) (CMP-15)

Special Permission.

The written consent of the authority having jurisdiction. (CMP-1)

Special Protection “s”.

Type of protection that permits design, assessment, and testing of equipment that cannot be fully assessed within a recognized type of protection or combination of recognized types of protection because of functional or operational limitations, but that can be demonstrated to provide the necessary equipment protection level (EPL). (CMP-14)

> Informational Note: See ANSI/UL 60079-33, *Explosive Atmospheres — Part 33: Equipment Protection by Special Protection “s”* , for additional information.

Special-Purpose Multi-Circuit Cable System.

A portable branch-circuit distribution system consisting of one or more trunk cables and optional breakout assemblies or multi-circuit outlet enclosures. (520) (CMP-15)

Spider (Cable Splicing Block).

A device that contains busbars that are insulated from each other for the purpose of splicing or distributing power to portable cables and cords that are terminated with single-pole busbar connectors. (530) (CMP-15)

Spin Down.

A shutdown condition of the FESS, where energy is being dissipated and the flywheel rotor is slowing down to a stop. (706) (CMP-13)

> Informational Note: A complete stop of a flywheel rotor cannot occur instantaneously because of the high kinetic energy of the rotor, but rather occurs over time as a result of friction forces acting on the rotor.

Splash Pad.

A fountain intended for recreational use by pedestrians and designed to contain no more than 25 mm (1 in.) of water depth. This definition does not include showers intended for hygienic rinsing prior to use of a pool, spa, or other water feature. (680) (CMP-17)

Spray Area.

Any fully enclosed, partly enclosed, or unenclosed area in which 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; and

(4) exhaust ducts from solvent concentrator (pollution abatement) units. [**33:** 3.3.2.3] (CMP-14)

Informational Note No. 1: Unenclosed spray areas are locations outside of buildings or are localized operations within a larger room or space. Such areas 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.

Informational Note No. 2: See definitions for *limited finishing workstation* and *membrane enclosure* for additional information.

Spray Area, Outdoor. (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 as defined in this *Code* . [**33:** 3.3.2.3.1] (CMP-14)

Spray Area, Unenclosed. (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] (CMP-14)

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:** 3.3.19] (CMP-14)

Informational Note: A spray booth is an enclosure or insert within a larger room used for spraying, coating, and/or dipping applications. A spray booth can be fully enclosed or have open front or face and can include a 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 with a specified fire resistance rating used exclusively for open spraying of flammable or combustible materials. [**33:** 3.3.20] (CMP-14)

Stage Effect (Special Effect).

An electrical or electromechanical piece of equipment used to simulate a distinctive visual or audible effect, such as a wind machine, lightning simulator, or sunset projector. (CMP-15)

Stage Equipment.

Equipment at any location on the premises integral to the stage production including, but not limited to, equipment for lighting, audio, special effects, rigging, motion control, projection, or video. (520) (CMP-15)

Stage Lighting Hoist.

A motorized lifting device that contains a mounting position for one or more luminaires, with wiring devices for connection of luminaires to branch circuits, and integral flexible cables to allow the luminaires to travel over the lifting range of the hoist while energized. (520) (CMP-15)

Stage Property.

An article or object used as a visual element in a motion picture or television production, except painted backgrounds (scenery) and costumes. (530) (CMP-15)

Stage Set.

A specific area set up with temporary scenery and properties designed and arranged for a particular scene in a motion picture or television production. (CMP-15)

Stage Switchboard, Fixed. (Fixed Stage Switchboard)

A permanently installed switchboard, panelboard, or rack containing dimmers or relays with associated overcurrent protective devices, or overcurrent protective devices alone, used primarily to feed stage equipment. (CMP-15)

Stage Switchboard, Portable. (Portable Stage Switchboard)

A portable rack or pack containing dimmers or relays with associated overcurrent protective devices, or overcurrent protective devices alone, used to feed stage equipment. (520) (CMP-15)

Stand Lamp.

A portable stand that contains a general-purpose luminaire or lampholder with guard for the purpose of providing general illumination on a stage, in an auditorium, or in a studio. (520) (CMP-15)

Stand-Alone System.

A system that is not connected to an electric power production and distribution network. (CMP-4)

Stationary (as applied to equipment).

Equipment that is not moved from one place to another in normal use. (680) (CMP-17)

Storage, Dry Stack. (Dry Stack Storage)

A facility, either covered or uncovered, constructed of horizontal and vertical structural members designed to allow placement of small boats in defined slots arranged both horizontally and vertically. [**303:** 3.3.24.2] (555) (CMP-7)

Stored-Energy Power Supply System (SEPSS).

A complete functioning EPSS powered by a stored-energy electrical source. (CMP-13)

Stranding, Compact. (Compact Stranding)

A conductor stranding method in which each layer of strands is pressed together to minimize the gaps between the strands so the overall diameter of the finished conductor is less than a concentric stranded conductor and less than a compressed stranded conductor. (CMP-6)

Stranding, Compressed. (Compressed Stranding)

A conductor stranding method in which the outer layer of strands is pressed together so the overall diameter of the finished conductor is less than a concentric stranded conductor but greater than a compact stranded conductor. (CMP-6)

Stranding, Concentric. (Concentric Stranding)

A conductor consisting of a straight central strand surrounded by one or more layers of strands, helically laid in a geometric pattern. (CMP-6)

Strip Light.

A luminaire with multiple lamps arranged in a row. (520) (CMP-15)

Structure.

That which is built or constructed, other than equipment. (CMP-1)

Structure, Relocatable. (Relocatable Structure)

A factory-assembled structure or structures transportable in one or more sections that are built on a permanent chassis and designed to be used as other than a dwelling unit without a permanent foundation. (545) (CMP-7)

> Informational Note: Examples of relocatable structures are those units that are equipped for sleeping purposes only, contractor's and other on-site offices, construction job dormitories, studio dressing rooms, banks, clinics, stores, shower facilities and restrooms, training centers, or for the display or demonstration of merchandise or machines.

Subassembly.

Component parts or a segment of a sign, retrofit kit, or outline lighting system that, when assembled, forms a complete unit or product. (600) (CMP-18)

Substation.

An assemblage of equipment (e.g., switches, interrupting devices, circuit breakers, buses, and transformers) through which electric energy is passed for the purpose of distribution, switching, or modifying its characteristics. (CMP-9)

Supervisory Control and Data Acquisition (SCADA).

An electronic system that provides monitoring and controls for the operation of the critical operations power system. (CMP-13)

> Informational Note: This can include the fire alarm system, security system, control of the HVAC, the start/stop/monitoring of the power supplies and electrical distribution system, annunciation and communications equipment to emergency personnel, facility occupants, and remote operators.

Support Areas.

Areas, other than fixed production offices, intended to support production and where image capture will not take place. Such areas include, but are not limited to, mobile production offices, storage, and workspaces; vehicles and trailers for cast, makeup, hair, lighting, grip, wardrobe, props, catering, and craft services; and portable restrooms. (530) (CMP-15)

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. (CMP-10)

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:

(1) 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

(2) 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

(3) Type 3: Point of utilization SPDs

(4) Type 4: Component SPDs, including discrete components, as well as assemblies. (CMP-10)

Informational Note: See UL 1449, *Standard for Surge Protective Devices* , for further information on SPDs.

Suspended Ceiling Grid.

A system that serves as a support for a finished ceiling surface and other utilization equipment. (393) (CMP-18)

Switch, General-Use. (General-Use Switch)

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. (CMP-9)

Switch, General-Use Snap. (General-Use Snap Switch)

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* . (CMP-9)

Switch, Isolating. (Isolating Switch)

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. (CMP-9)

Switch, Motor-Circuit. (Motor-Circuit Switch)

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. (CMP-11)

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. (CMP-9)

Informational Note: These assemblies can be accessible from the rear or side 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. (CMP-9)

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.

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

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

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 Switch (or Isolating Switch).

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

Interrupter Switch.

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

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

Regulator Bypass Switch.

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

System Isolation Equipment.

A redundantly monitored, remotely operated contactor-isolating system, packaged to provide the disconnection/isolation function, capable of verifiable operation from multiple remote locations by means of lockout switches, each having the capability of being padlocked in the "off" (open) position. (430) (CMP-11)

Tap Conductor.

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. (240) (CMP-10)

Task Illumination.

Provisions for the minimum lighting required to carry out necessary tasks in the areas described in 517.34(A) , including safe access to supplies and equipment and access to exits. [**99:** 3.3.177] (517) (CMP-15)

Technical Power System.

An electrical distribution system where the equipment grounding conductor is isolated from the premises grounded conductor and the premises equipment grounding conductor except at a single grounded termination point within a branch-circuit panelboard, at the originating (main breaker) branch-circuit panelboard or at the premises grounding electrode. (640) (CMP-12)

Temporary Equipment.

Portable wiring and equipment intended for use with events of a transient or temporary nature where all equipment is presumed to be removed at the conclusion of the event. (640) (CMP-12)

Terminal (as applied to batteries).

That part of a cell, container, or battery to which an external connection is made (commonly identified as post, pillar, pole, or terminal post). (CMP-13)

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. (CMP-11)

> 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.

Thermal Resistivity.

The heat transfer capability through a substance by conduction. (CMP-6)

> Informational Note: Thermal resistivity is the reciprocal of thermal conductivity and is designated Rho, which is expressed in the units °C-cm/W.

Thermally Protected (as applied to motors).

A motor or motor-compressor that is provided with a thermal protector. (CMP-11)

Top Shield.

A grounded metal shield covering under-carpet components of the flat conductor cable (Type FCC) system for the purposes of providing protection against physical damage. (324) (CMP-6)

Tower.

A pole or other structure that supports a wind turbine. (694) (CMP-4)

Transfer Switch.

An automatic or nonautomatic device for transferring one or more load conductor connections from one power source to another. (CMP-13)

Transfer Switch, Branch-Circuit Emergency Lighting. (Branch-Circuit Emergency Lighting Transfer Switch)

A device connected on the load side of a branch-circuit overcurrent protective device that transfers only emergency lighting loads from the normal power source to an emergency power source. (700) (CMP-13)

> Informational Note: See ANSI/UL 1008, *Transfer Switch Equipment* , for information covering branch-circuit emergency lighting transfer switches.

Transfer Switch, Bypass Isolation. (Bypass Isolation Transfer Switch)

A manual, nonautomatic, or automatic 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. (CMP-13)

Transfer Switch, Meter-Mounted. (Meter-Mounted Transfer Switch)

A transfer switch connected between the utility meter and the meter base. (CMP-13)

> Informational Note: Meter-mounted transfer switches can plug into the meter base. Transfer switches that incorporate the meter base in the transfer equipment assembly are not considered meter-mounted transfer switches.

Transformer.

Equipment, either single-phase or polyphase, that uses electromagnetic induction to convert current and voltage in a primary circuit into current and voltage in a secondary circuit. (CMP-9)

Transition Assembly.

An assembly to facilitate connection of the flat conductor cable (Type 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. (324) (CMP-6)

Transport Refrigerated Unit (TRU).

A trailer or container, with integrated cooling or heating, or both, used for the purpose of maintaining the desired environment of temperature-sensitive goods or products. (626) (CMP-12)

Transportable.

X-ray equipment that is to be installed in a vehicle or that may be readily disassembled for transport in a vehicle. (660) (CMP-12)

Truck.

A motor vehicle designed for the transportation of goods, services, and equipment. (626) (CMP-12)

Truck Coupler.

A truck flanged surface inlet and mating cord connector. (626) (CMP-12)

Truck Flanged Surface Inlet.

The device(s) on the truck into which the connector(s) is inserted to provide electric energy and other services. This device is part of the truck coupler. For the purposes of this article, the truck flanged surface inlet is considered to be part of the truck and not part of the electrified truck parking space supply equipment. (626) (CMP-12)

Trunk Cable.

A portable extension cable containing six or more branch circuits, a male multipole plug, and a female multipole receptacle. (520) (CMP-15)

Tubing, Electrical Metallic (EMT). (Electrical Metallic Tubing)

An unthreaded thinwall raceway of circular cross section designed for the physical protection and routing of conductors and cables and for use as an equipment grounding conductor when installed utilizing appropriate fittings. (CMP-8)

Tubing, Electrical Nonmetallic (ENT). (Electrical Nonmetallic Tubing)

A nonmetallic, pliable, corrugated raceway of circular cross section with integral or associated couplings, connectors, and fittings for the installation of electrical conductors. It is composed of a material that is resistant to moisture and chemical atmospheres and is flame retardant.

A pliable raceway is a raceway that can be bent by hand with a reasonable force but without other assistance. (CMP-8)

Tubing, Flexible Metallic (FMT). (Flexible Metallic Tubing)

A metal raceway that is circular in cross section, flexible, and liquidtight without a nonmetallic jacket. (CMP-8)

Two-Fer.

An assembly containing one male plug and two female cord connectors used to connect two loads to one branch circuit. (520) (CMP-15)

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. (CMP-14)

> Informational Note: See ANSI/UL 60079-15, *Explosive Atmospheres — Part 15: Equipment Protection by Type of Protection “n”* , for additional information.

Ungrounded.

Not connected to ground or to a conductive body that extends the ground connection. (CMP-5)

Uninterruptible Power Supply (UPS).

A device or system that provides quality and continuity of ac power through the use of a stored-energy device as the backup power source for a period of time when the normal power supply is incapable of performing acceptably. (CMP-13)

Unit Equipment.

A battery-equipped emergency luminaire that illuminates only as part of the emergency illumination system and is not illuminated when the normal supply is available. (CMP-13)

Utilization Equipment.

Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes. (CMP-1)

Valve Actuator Motor (VAM) Assemblies.

A manufactured assembly, used to operate a valve, consisting of an actuator motor and other components such as motor controllers, torque switches, limit switches, and overload protection. (430) (CMP-11)

Informational Note: VAMs typically have short-time duty and high-torque characteristics.

Ventilated.

Provided with a means to permit circulation of air sufficient to remove an excess of heat, fumes, or vapors. (CMP-14)

Vessel.

A container such as a barrel, drum, or tank for holding fluids or other material. (CMP-17)

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. (CMP-14)

Voltage (of a circuit).

The greatest root-mean-square (rms) (effective) difference of potential between any two conductors of the circuit concerned. (CMP-1)

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, High. (High Voltage)

A potential difference of more than 1000 volts, nominal. (CMP-9)

Informational Note: Circuits and equipment rated at potential differences of more than 1000 volts and up to 52 kV are also commonly referred to as medium voltage.

Voltage, Low. (Low Voltage).

An electromotive force rated 24 volts, nominal, or less. (551) (CMP-7)

Voltage, Nominal. (Nominal Voltage)

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). (CMP-1)

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, Nominal (as applied to battery or cell).(Nominal Voltage)

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. (CMP-13)

> Informational Note: The most common nominal cell voltages are 2 volts per cell for the lead-acid batteries, 1.2 volts per cell for alkali batteries, and 3.2 to 3.8 volts per cell for Li-ion batteries. Nominal voltages might vary with different chemistries.

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. (CMP-1)

Watertight.

Constructed so that moisture will not enter the enclosure under specified test conditions. (CMP-1)

Weatherproof.

Constructed or protected so that exposure to the weather will not interfere with successful operation. (CMP-1)

> 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.

Wharf.

A structure at the shoreline that has a platform built along and parallel to a body of water with either an open deck or a superstructure. [**307:** 3.3.28] (555) (CMP-7)

Wind Turbine.

A mechanical device that converts wind energy to electrical energy. (CMP-4)

Wind Turbine Output Circuit. (Turbine Output Circuit)

The circuit conductors between the internal components of a wind turbine (which might include an alternator, integrated rectifier, controller, and/or inverter) and other equipment. (694) (CMP-4)

Wire.

A factory assembly of one or more insulated conductors without an overall covering. (805) (CMP-16)

Wireless Power Transfer (WPT).

The transfer of electrical energy from a power source to an electrical load via magnetic fields by a contactless means between a primary device and a secondary device. (625) (CMP-12)

Wireless Power Transfer Equipment (WPTE).

Equipment installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle without physical electrical contact. (625) (CMP-12)

> Informational Note No. 1: The general form of WPTE consists of two physical packages: a control box and a primary pad.

> Informational Note No. 2: Electric vehicle power export equipment and wireless power transfer equipment are sometimes contained in one set of equipment, sometimes referred to as a bidirectional WPTE.

Wireways, Metal. (Metal Wireways)

Sheet metal troughs with hinged or removable covers for housing and protecting electrical wires and cable and in which conductors are laid in place after the raceway has been installed as a complete system. (CMP-8)

Wireways, Nonmetallic. (Nonmetallic Wireways)

Flame-retardant, nonmetallic troughs with removable covers for housing and protecting electrical wires and cables in which conductors are laid in place after the raceway has been installed as a complete system. (CMP-8)

Work Surface.

A fixed, stationary, or portable surface typically intended for dry use and for tasks other than food preparation, personal lavation, or laundering that presents an incidental risk of spillage of smaller quantities of beverages and other liquids upon outlets mounted directly on or recessed in the surface. (CMP-2)

> Informational Note No. 1: See UL 111, *Outline of Investigation for Multioutlet Assemblies* , and UL 962A, *Furniture Power Distribution Units* , which establish the performance evaluation criteria and construction criteria.
>
> Informational Note No. 2: See 406.5(F) , 406.5(G)(1) , and 406.5(H) for information on receptacles for work surfaces distinguished from receptacles for counters and countertops.

Zone.

A physically identifiable area (such as barriers or separation by distance) within an information technology equipment room, with dedicated power and cooling systems for the information technology equipment or systems. (645) (CMP-12)

Statement of Problem and Substantiation for Public Input

Whether the NEC is improved with a listed definition of “backup power” to support the three times it is already used in Article 100 is likely an issue over which good minds will disagree, but let’s get it explored. The IEEE Orange Book (Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications) was last published in 1995 and a follow up 3000-collection standard does not appear on the horizon. Including this “definition” may support development of reliability goals of state and federal electric and telecommunication security agencies.

Article 685 may capture the possibilities presented by microgrids and renewable sources of power when an installation operates isolated.

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Public Input No. 3157-NFPA 70-2023 [Definition: Battery, Stationary Standby. (Stationary Standb...]

Battery, Stationary Standby. (Stationary Standby Battery)

A battery that spends the majority of the time on continuous float charge or in a high state of charge, in readiness for a discharge event. (CMP-13)

Informational Note: ~~-~~ Portable batteries connected to premises wiring and Uninterruptible Power Supply (UPS) batteries are ~~an example~~ examples that ~~falls under~~ fall under this definition.

Statement of Problem and Substantiation for Public Input

Addition intended to clarify that battery energy storage equipment that may be used as portable or as stationary, when connected to premises wiring shall be considered to be a Stationary Standby Battery.

There are portable batteries equipped with electronics and marketed for home backup intended for installation connected to premises wiring. Installation manuals and specifications describe them to be connected to premises wiring through a transfer switch to a subpanel (some even include the subpanel with the portable battery). A portable battery connected to premises wiring in such a way should no longer be considered portable - once connected to premises wiring it should be considered to be stationary, thus needing to comply with requirements in Article 480.

Example 1: Yeti 6000X and Yeti Home Integration Kit transfer switch. See specification: https://www.goalzero.com/collections/home-energy-storage-kits/products/6-kwh-home-energy-storage-kit#specs

Note product is sold including an "Integration Kit" to wire to permanent premises wiring. Integration kit is meant as permanent installation connected to premises wiring.
Note 'Reviews' section with product installed per manufacturer's instructions for a "portable" battery.

Example 2: Geneforce Solar Rechargeable Indoor BATTERY POWERED INDOOR GENERATORS. See specification sheet which indicates product is listed as "ETL listed to CSA 107.1, UL458 and UL458": https://nebula.wsimg.com/bb940e1922384ec823fa6507280827f6?AccessKeyId=7AC1F6D38E7862F90BD6&disposition=0&alloworigin=1

Note example 2 wiring diagram per manufacturer's instructions: https://www.geneforcepower.com/wiring-diagram-60a.html

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Public Input No. 727-NFPA 70-2023 [Definition: Connector, Intertier. (Intertier Connector)]

Connector, ~~Intertier~~ Inter-Tier . (~~Intertier~~ Inter-Tier Connector)

An electrical conductor used to connect two cells on different tiers of the same rack or different shelves of the same rack. (CMP-13)

Statement of Problem and Substantiation for Public Input

"Intertier" is not found in any American English dictionary (or any dictionary of any variant of English), so it isn't a word in English. In fact, one would probably think "intertie" when they see "intertier" because they thought it was a typo (which it is, though missing a hyphen instead of a letter).

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Public Input No. 1625-NFPA 70-2023 [Definition: Control Device, Emergency Lighting. (Emergency ...]

Control Device, Emergency Lighting. (ELCD), (Emergency Lighting Control Device)

A separate or integral device intended to perform one or more emergency lighting control functions. (700) (CMP-13)

Informational Note: See UL 924, *Emergency Lighting and Power Equipment*, for information covering emergency lighting control devices.

Statement of Problem and Substantiation for Public Input

The acronym ELCD is now commonly used to refer to an Emergency Lighting Control Device. This acronym is also used in the UL924 standard that covers these devices. As such, the acronym should be added to the definition of this device.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1710-NFPA 70-2023 [Section No. 700.24]	Uses acronym ELCD
Public Input No. 172-NFPA 70-2023 [Section No. 700.10(B)]	
Public Input No. 1710-NFPA 70-2023 [Section No. 700.24]	

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Committee: NEC-P13

Public Input No. 1620-NFPA 70-2023 [Definition: Emergency Luminaire, Directly Controlled. (Dire...]

Emergency Luminaire, Directly Controlled. (DCEL) (Directly Controlled Emergency Luminaire)

A luminaire supplied by the facility emergency power system and with a control input for dimming or switching that provides an emergency illumination level upon loss of normal power. (700) (CMP-13)

Informational Note: See ANSI/UL 924, *Emergency Lighting and Power Equipment*, for information covering directly controlled emergency luminaires.

Statement of Problem and Substantiation for Public Input

The acronym DCEL is used more and more frequently to describe a Directly Controlled Emergency Luminiare, and thus should be included in the defintion of this device. The DCEL also appears in at least one PI for the 2026 revision cycle.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1710-NFPA 70-2023 [Section No. 700.24]	Uses the acronym DCEL
Public Input No. 1710-NFPA 70-2023 [Section No. 700.24]	

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Public Input No. 4296-NFPA 70-2023 [Definition: Energy Management System (EMS).]

Energy Management System (EMS).

A system ~~consisting of any of the following: a monitor(s), communications equipment, a controller(s), a timer(s), or other device(s) that monitors and/or controls an electrical load or a power production or storage source~~ which monitors and controls power within an electrical system . (CMP-13)

Statement of Problem and Substantiation for Public Input

This public input is part of a series of changes submitted on behalf of a task group appointed by the NEC Correlating Committee. This task group was appointed to clarify the requirements for energy management systems that include controls to prevent the overload of conductors and equipment. The members of the task group are: Derrick Atkins, Greg Ball, Doug Burket, Mark Cook, Jason Fisher, Matthew Grover, Rebekah Hren, Pete Jackson, Robert Jordan, Robert Osborne, Charles Picard, Laura Stevens, Tim Windey, Timothy Zgonena.

The definition of energy management system is revised for clarity. The existing definition includes both features and device types that may be present, but this has resulted in confusion around the application of EMS requirements. For example, energy metering or communications equipment that is not coupled with controls should not be considered as an energy management system.

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Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]

Energy Management System (EMS).

A system consisting of any of the following: a monitor(s), communications equipment, a controller(s), a timer(s), or other device(s) that monitors and/or controls an electrical load or a power production or storage source. (CMP-13)

Informational Note: A listed power circuit management device or system is a type of EMS that provides additional protective functions to mitigate electrical overload conditions.

Statement of Problem and Substantiation for Public Input

Activities, such as the electrification of the transportation sector and replacement of gas-fired appliance with all electric appliances, coupled with widespread adoption of on-site storage and generation, will place significant new demands on the premises wiring systems covered by the NEC. These activities are complicated by the need to facilitate this shift in energy generation, storage, and use, with an existing (and aging) infrastructure.

An emerging trend is to leverage the technology offered by "Energy Management Systems" to manage these complex electrical systems in a way that prevents overloading of the premises wiring system. These types of systems require functional reliability in order to prevent overloading of the premises wiring, as well as utility owned assets serving the facility. Energy management systems (EMS) historically have not been evaluated for functional reliability to address electrical overload.

While other PI's may address this need for a more robust "Energy Management System", this must co-exist with the realization that there is still a place for the traditional Energy Management devices that are not being relied upon for these functions and should not be mandated to meet functional safety requirements.

Recognizing that these existing products will continue to exist in the marketplace, a new term is needed to differentiate between the historic EMS application of energy optimization for appliance control versus electrical overload and/or grid interconnection applications where safety is paramount. With this in mind, this PI focuses on introducing the term Power Circuit Management (PCM) where functional reliability has been applied.

This PI adds an Informational Note to explain the difference between "PCM' and "EMS". The structure of this note is similar to that of the Informational Note in 705.13, which draws a contrast between Power Control System (PCS) and an Energy Management System (EMS).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	Related due to addition of new PCM definition / term
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	Related due to addition of new PCM definition / term
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	Related due to addition of new PCM definition / term
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	Related due to addition of new PCM definition / term

Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	Related due to addition of new PCM definition / term
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	Related due to addition of new PCM definition / term
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	Related due to addition of new PCM definition / term
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	Related due to addition of new PCM definition / term
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling “q”.]	Related due to addition of new PCM definition / term
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling “q”.]	
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	

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Public Input No. 3863-NFPA 70-2023 [Definition: Energy Storage System (ESS).]

Energy Storage System (ESS).

One or more devices ~~installed as a system~~ , assembled together, capable of storing energy ~~and providing electrical energy into the premises wiring system or an electric power production and distribution network.~~ to supply electrical energy at a future time. . (CMP-13)

Informational Note No. 1: An ESS(s) can include but is not limited to batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). An ESS(s) can include inverters or converters to change voltage levels or to make a change between an ac or a dc system.

~~Informational Note No. 2: These systems differ from a stationary standby battery installation where a battery spends the majority of the time on continuous float charge or in a high state of charge, in readiness for a discharge event.~~

Statement of Problem and Substantiation for Public Input

To make the definition of ESS consistent with NFPA 855 and proposed changes to articles 480 and 706

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3808-NFPA 70-2023 [Article 480]	
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]	
Public Input No. 3859-NFPA 70-2023 [Section No. 706.1]	

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Public Input No. 1200-NFPA 70-2023 [Definition: Generator (Generator Set).]

Generator ~~(Generator Set)~~ .

A machine that converts mechanical energy into electrical energy ~~by means of a prime mover and alternator and/or inverter.~~ . Sources of mechanical energy include, but are not limited to, internal combustion engines, wind turbines, water turbines, gas turbines, or steam turbines. (CMP-13)

Statement of Problem and Substantiation for Public Input

This is a companion PI to a PI for splitting article 445 into three parts. A Generator is simply a device that turns mechanical energy into electrical energy. It is sometimes referred to as a "generator head." Generators are covered by UL 1004-4 and Engine-Generator Assemblies are covered by UL 2200. Some (Most) of Article 445 covers generators. Some covers Engine-Generator Assemblies. Separate definitions, in Article 100, and Separate Parts, in Article 445, are needed to distinguish between the two and guide the user to apply the appropriate section to the appropriate equipment.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 406-NFPA 70-2023 [Article 445]	Split the definition into Generators and Engine-Generator Assemblies
Public Input No. 406-NFPA 70-2023 [Article 445]	
Public Input No. 1201-NFPA 70-2023 [New Definition after Definition: Generator (Generator Set).]	

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Submittal Date: Sun Jun 25 14:42:49 EDT 2023

Committee: NEC-P13

Public Input No. 176-NFPA 70-2023 [Definition: Generator (Generator Set).]

Generator (Generator Set).

A machine that converts mechanical energy into electrical energy by means of a prime mover and alternator ~~and/or inverter~~ . (CMP-13)

Statement of Problem and Substantiation for Public Input

The term inverter does not belong in the definition of generator. Per the definition of inverter, it is a device that converts dc to ac. An inverter does not convert mechanical energy to electrical energy and the term should not be part of the definition of a device that does convert mechanical energy into electrical energy.

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Committee: NEC-P13

Public Input No. 3610-NFPA 70-2023 [Definition: Normal/Emergency Power Source.]

~~**Normal/Emergency Power Source.**~~

~~A power source on the output side of a transfer switch or uninterruptible power supply that is automatically available upon loss of normal power. (700) (CMP-13).~~

Statement of Problem and Substantiation for Public Input

For healthcare, we have eliminated these terms, and we have moved to off-site sources and on-site sources.

Also, i think the sources should be on the input side of the transfer switch.

Also, i think the definition could be better, if you keep it. I think you might separate the definitions and define normal source and alternate source separately.

Thank you.

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Public Input No. 1622-NFPA 70-2023 [Definition: Relay, Automatic Load Control. (Automatic Load ...]

Relay, Automatic Load Control. (ALCR), (Automatic Load Control Relay)

An emergency lighting control device used to set normally dimmed or normally-off switched emergency lighting equipment to full power illumination levels in the event of a loss of the normal supply by bypassing the dimming/switching controls, and to return the emergency lighting equipment to normal status when the device senses the normal supply has been restored. (700) (CMP-13)

Informational Note: See ANSI/UL 924, *Emergency Lighting and Power Equipment*, for the requirements covering automatic load control relays.

Statement of Problem and Substantiation for Public Input

"ALCR" is now a commonly used acronym for Automatic Load Control Relay. As such it should be added to the definition of this device.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 172-NFPA 70-2023 [Section No. 700.10(B)]	

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Public Input No. 4388-NFPA 70-2023 [Definition: Relay, Automatic Load Control. (Automatic Load ...]

Relay, Automatic Load Control. (Automatic Load Control Relay)

An emergency lighting control device used to set normally dimmed or normally-off switched emergency lighting equipment to full power illumination levels in the event of a loss of the normal supply by bypassing the dimming/switching controls, and to return the emergency lighting equipment to normal status when the device senses the normal supply has been restored. (700) (CMP-13)

Informational Note 1 : See ANSI/UL 924, *Emergency Lighting and Power Equipment*, for the requirements covering automatic load control relays.

Reliability. The probability that a system or component will operate properly for a specifiedperiod of time under design operating conditions without failure. Informational

Note: Additional information is available in IEEE 3006.2-2016 RecommendedPractice for Evaluating the Reliability of Existing Industrial and Commercial Power Systems

Statement of Problem and Substantiation for Public Input

This Code will be improved if it recognizes that lack of electrical power is at least as much of a hazard as its presence. The reliability of a power system is its essential characteristic and contributes to the goal of practical safeguarding of persons and property; more so since the need for electrical in-home medical therapies gathers pace.

This proposed definition pairs with the proposed definition of "Availability" and is summarized below:

RELIABILITY

Definition: Refers to the probability that a system, component, or process will perform its intended function without failure for a specified period and under given operating conditions.

Measurement: Reliability is often measured using metrics such as Mean Time Between Failures (MTBF) or Failure Rate. MTBF represents the average time a system operates before experiencing a failure, while Failure Rate is the number of failures per unit of time.

Focus: Reliability focuses on the ability of a system to operate without unexpected or unplanned interruptions or breakdowns.

Example: If a car engine has a high reliability, it means it is less likely to break down or experience failures during normal operation.

AVAILABILITY

Definition: Availability is a measure of the proportion of time that a system, component, or process is operational and ready to perform its intended function when needed.

Measurement: Availability is typically measured as a percentage and can be calculated using the formula: Availability (%) = (MTBF / (MTBF + MTTR)) × 100, where MTTR is the Mean Time To Repair.

Focus: Availability focuses on both the prevention of failures (reliability) and the speed of recovery (repair or maintenance) when failures do occur.

Example: A data center with high availability is one that experiences minimal downtime and can quickly recover from any disruptions.

In summary, reliability is concerned with the likelihood of a system operating without failures, while availability considers the system's uptime, factoring in the time it takes to recover from failures. Both concepts are essential in different aspects of engineering and maintenance, and reliability engineers use these metrics to design, improve, and maintain systems to meet specific performance goals and requirements.

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Public Input No. 1623-NFPA 70-2023 [Definition: Transfer Switch, Branch-Circuit Emergency Light...]

Transfer Switch, Branch-Circuit Emergency Lighting. (BCELTS), (Branch-Circuit Emergency Lighting Transfer Switch)

A device connected on the load side of a branch-circuit overcurrent protective device that transfers only emergency lighting loads from the normal power source to an emergency power source. (700) (CMP-13)

Informational Note: See ANSI/UL 1008, *Transfer Switch Equipment*, for information covering branch-circuit emergency lighting transfer switches.

Statement of Problem and Substantiation for Public Input

The acronym BCELTS is now commonly used to describe a Branch Circuit Emergency Lighting Transfer Switch. This acronym is also used in the UL 1008 standard that covers these devices. As such, it should be added to the definition of this device.

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Public Input No. 1201-NFPA 70-2023 [New Definition after Definition: Generator (Generator Set).]

Generator, Engine-Generator Assembly (Engine-Generator Assembly)

An assembly that includes an electrical generator, an engine that uses gasoline, LP-gas, natural gas, or diesel; and all the other necessary components to produce electricity.

Statement of Problem and Substantiation for Public Input

This is a companion PI to split the definition of Generator into two definitions: Generators and Engine-Generator Assemblies. The title that i have proposed might need to be edited to fit the appropriate style. The substantiation for this change is in PI 1200 and in PI 406. The definition comes from UL. An engine-generator assembly is covered under UL product code FTSR.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 406-NFPA 70-2023 [Article 445]	
Public Input No. 1200-NFPA 70-2023 [Definition: Generator (Generator Set).]	
Public Input No. 406-NFPA 70-2023 [Article 445]	

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Committee: NEC-P13

Public Input No. 4442-NFPA 70-2023 [New Definition after Definition: Generator (Generator Set).]

Generator Terminals

The point of connection for the output conductors on the generator.

Statement of Problem and Substantiation for Public Input

We have experienced many cases of misinterpretation or article 445.13. These changes will provide clarity to the users of this code. The term "generator terminals" is used in article 240.21(G) and 445.13. This code defines a generator as the complete machine; prime mover and alternator/ invertor, not just the device that generates the electricity. With that in mind it is appropriate to define "generator terminals". This definition is needed to clarify that the generator terminals are the connection point of the output conductors for the whole generator set not just the generator. Examples of "generator terminals" can be power distribution blocks, busbars, circuit breakers, etc..

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4418-NFPA 70-2023 [Section No. 445.13]	defines term used in article 445.13
Public Input No. 4418-NFPA 70-2023 [Section No. 445.13]	

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Public Input No. 1621-NFPA 70-2023 [New Definition after Definition: Luminaire.]

Luminaire, Directly Controlled. (DCL)

A luminaire containing a control input for a dimming or switching function. (700) (CMP-13)

Statement of Problem and Substantiation for Public Input

There is ongoing confusion between Directly Controlled Emergency Luminaires that are listed for emergency use, and Directly Controlled Luminaires that are similar in function but are not listed for emergency use. An additional definition of this device is needed to provide clarity.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1710-NFPA 70-2023 [Section No. 700.24]	Uses the term Directly Controlled Luminaire (DCL)
Public Input No. 1710-NFPA 70-2023 [Section No. 700.24]	

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Submittal Date: Thu Jul 27 13:43:18 EDT 2023
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Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling “q”.]

Power Circuit Management (PCM) - A device or system which monitors and controls power within an electrical system to prevent electrical overload of an electrical service, feeder, conductor, or other power distribution equipment. (CMP-13)

-

Informational Note: Power circuit management may control generation devices, loads, circuit controllers, or other equipment, to manage power, and may contain additional protective functions relative to Energy Management Systems (EMS) and/or grid interconnection functions.

Statement of Problem and Substantiation for Public Input

Activities, such as the electrification of the transportation sector and replacement of gas-fired appliance with all electric appliances, coupled with widespread adoption of on-site storage and generation, will place significant new demands on the premises wiring systems covered by the NEC. These activities are complicated by the need to facilitate this shift in energy generation, storage, and use, with an existing (and aging) infrastructure.

An emerging trend is to leverage the technology offered by “Energy Management Systems” to manage these complex electrical systems in a way that prevents overloading of the premises wiring system. These types of systems require functional reliability in order to prevent overloading of the premises wiring, as well as utility owned assets serving the facility. Energy management systems (EMS) historically have not been evaluated for functional reliability to address electrical overload.

While other PI’s may address this need for a more robust “Energy Management System”, this must co-exist with the realization that there is still a place for the traditional Energy Management devices that are not being relied upon for these functions and should not be mandated to meet functional safety requirements.

Recognizing that these existing products will continue to exist in the marketplace, a new term is needed to differentiate between the historic EMS application of energy optimization for appliance control versus electrical overload and/or grid interconnection applications where safety is paramount. With this in mind, this PI focuses on introducing the term Power Circuit Management (PCM) where functional reliability has been applied.

This PI introduces the new term for “Power Circuit Management (PCM)” and includes an Informational Note that describes some of the functions associated with PCM.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	Related due to addition of new PCM definition / term
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	Related due to addition of new PCM definition / term
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	Related due to addition of new PCM definition / term

Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	Related due to addition of new PCM definition / term
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	Related due to addition of new PCM definition / term
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	Related due to addition of new PCM definition / term
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	Related due to addition of new PCM definition / term
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	Related due to addition of new PCM definition / term
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	

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Public Input No. 1337-NFPA 70-2023 [New Definition after Definition: Suspended Ceiling Grid.]

Switch, Bypass Isolation. (Bypass Isolation Switch)

A manual, nonautomatic, or automatic operated device used in conjunction with a transfer switch to provide a means of bypass that directly connects the load conductors to a power source and allows the transfer switch to be isolated or disconnected. (CMP-13)

Statement of Problem and Substantiation for Public Input

This defined term correlates with the exact definition of the same term in NFPA 110. This new defined term adds clarity where the term is used. This PI does not identify this as extracted text because the title of this definition is different than that in NFPA 110 but the body of the definition is the same.

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Public Input No. 406-NFPA 70-2023 [Article 445]

~~**Article 445** Generators~~

Article 445 Electric Generators and Engine Generator Assemblies

Part I. General

445.1 Scope.

This article contains installation and other requirements for electric generators ~~.~~ and engine generator assemblies

445.6 Listing.

~~Stationary generators~~ Generators shall be listed.

Exception: One of a kind or custom manufactured generators shall be permitted to be field labeled.

Informational Note 1 : See UL 2200, *Standard for Stationary Engine Generator Assemblies*, for additional information.

Informational Note 2: See UL 1004-4, *Standard for Electric Generators,* for additional information

445. 9 **Emergency Shutdown of Prime Mover.**

(A) General.

Generators shall have provisions to shut down the prime mover. The means of shutdown shall comply with all of the following:

(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

The provisions to shut down the prime mover 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 .

(B) Remote Emergency Shutdown.

For other than one- and two-family dwelling units, generators with greater than 15 kW rating shall be provided with a remote emergency stop switch to shut down the prime mover. The remote emergency stop switch shall be located outside the equipment room or generator enclosure at a readily accessible location and shall also meet the requirements of 445.19(A) (1) and (A)(2).

The remote emergency stop switch shall be permitted to be mounted on the exterior of the generator enclosure. The remote emergency stop switch shall be labeled Generator Emergency Shutdown, and the label shall meet the requirements of 110.21(B) .

(C) Emergency Shutdown in One- and Two-Family Dwelling Units.

For other than cord-and-plug-connected portable generators, an emergency shutdown device shall be located outside the dwelling unit at a readily accessible location and shall also meet the requirements of 445.19(A) (1) and (A)(2).

An emergency shutdown device mounted on the exterior of the generator enclosure shall be permitted to satisfy the requirements of this section. The shutdown device shall be marked as the Generator Emergency Shutdown, and the label shall meet the requirements of 110.21(B)).

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 .

> Informational Note: See NFPA 37-2021, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines* , for information on the location of generators.

445.11 Marking.

Each generator shall be provided with an accessible nameplate giving the manufacturer's name, the rated frequency, the number of phases if 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.

Nameplates or manufacturer's instructions shall provide the following information for all stationary generators and portable generators rated more than 15 kW:

(1) Alternator subtransient, transient, synchronous, and zero sequence reactances

(2) Generator set power rating category (including but not limited to prime, standby, or continuous)

(3) Alternator temperature rise at rated load and insulation system class

(4) Indication if the generator is protected against overload by inherent design, an overcurrent protective relay, a circuit breaker, or a fuse

(5) Available fault current for inverter-based generators, in lieu of the synchronous, subtransient, and transient reactances

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.

Part II. Electric Generators

445.12 Overcurrent Protection.

(A) Constant-Voltage Generators.

Constant-voltage generators, except ac generator exciters, shall be protected from overload by inherent design, circuit breakers, fuses, protective relays, or other identified overcurrent protective means suitable for the conditions of use.

(B) Two-Wire Generators.

Two-wire, dc generators shall be permitted to have overcurrent protection in one conductor only if the overcurrent device is actuated by the entire current generated other than the current in the shunt field. The overcurrent device shall not open the shunt field.

(C) 65 Volts or Less.

Generators operating at 65 volts or less and driven by individual motors shall be considered as protected by the overcurrent device protecting the motor if these devices will operate when the generators are delivering not more than 150 percent of their full-load rated current.

(D) Balancer Sets.

Two-wire, dc generators used in conjunction with balancer sets to obtain neutral points for 3-wire systems shall be equipped with overcurrent devices that disconnect the 3-wire system in case of excessive unbalancing of voltages or currents.

(E) Three-Wire, Direct-Current Generators.

Three-wire, dc generators, whether compound or shunt wound, shall be equipped with overcurrent devices, one in each armature lead, and connected so as to be actuated by the entire current from the armature. Such overcurrent devices shall consist either of a double-pole, double-coil circuit breaker or of a 4-pole circuit breaker connected in the main and equalizer leads and tripped by two overcurrent devices, one in each armature lead. Such protective devices shall be interlocked so that no one pole can be opened without simultaneously disconnecting both leads of the armature from the system.

Exception to (A) through (E): Where deemed by the authority having jurisdiction that a generator is vital to the operation of an electrical system and the generator should operate to failure to prevent a greater hazard to persons, the overload sensing device(s) shall be permitted to be connected to an annunciator or alarm supervised by authorized personnel instead of interrupting the generator circuit.

445.13 Ampacity of Conductors.

(A) General.

The ampacity of the conductors from the generator output terminals to the first distribution device(s) containing overcurrent protection shall not be less than 115 percent of the nameplate current rating of the generator. It shall be permitted to size the neutral conductors in accordance with 220.61 . Conductors that must carry ground-fault currents shall not be smaller than required by 250.30(A) . Neutral conductors of dc generators that must carry ground-fault currents shall not be smaller than the minimum required size of the largest conductor.

Exception: Where the design and operation of the generator prevent overloading, the ampacity of the conductors shall not be less than 100 percent of the nameplate current rating of the generator.

(B) Overcurrent Protection Provided.

Where the generator set is equipped with a listed overcurrent protective device or 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) .

Tapped conductors shall not be permitted for portable generators rated 15 kW or less where field wiring connection terminals are not accessible.

445.14 Protection of Live Parts.

Live parts of generators operated at more than 50 volts ac or 60 volts dc to ground shall not be exposed to accidental contact where accessible to unqualified persons.

445.15 Guards for Attendants.

Where necessary for the safety of attendants, the requirements of 430.233 shall apply.

445.16 Bushings.

Where field-installed wiring passes through an opening in an enclosure, a conduit box, or a barrier, a bushing shall be used to protect the conductors from the edges of an opening having sharp edges. The bushing shall have smooth, well-rounded surfaces where it may be in contact with the conductors. If used where oils, grease, or other contaminants may be present, the bushing shall be made of a material not deleteriously affected.

445.17 Generator Terminal Housings.

Generator terminal housings shall comply with 430.12 . Where a horsepower rating is required to determine the required minimum size of the generator terminal housing, the full-load current of the generator shall be compared with comparable motors in Table 430.247 through Table 430.250 . The higher horsepower rating of Table 430.247 and Table 430.250 shall be used whenever the generator selection is between two ratings.

Exception: This section shall not apply to generators rated over 600 volts.

Part III. Engine Generator Assemblies

445.18 Disconnecting Means.

(A) Disconnecting Means.

~~Generators other~~

Engine generator assemblies other than cord-and-plug-connected portable

~~generators shall~~

engine generator assemblies shall have one or more disconnecting means. Each disconnecting means shall simultaneously open all associated ungrounded conductors. Each disconnecting means shall be lockable open in accordance with 110.25 .

The disconnecting means shall be permitted to be located within the engine generator

~~behind~~

assembly behind a hinged cover, door, or enclosure panel. Where the generator disconnecting means is located within the engine generator assembly , a field applied label meeting the requirements of 110.21(B) shall be provided indicating the location of the generator disconnecting means.

(B)

~~Generators Installed~~

Engine g enerator assemblies Installed in Parallel.

Where

~~a~~

an engine generator assembly is installed in parallel with other

~~generators~~

engine generator assemblies , the provisions of 445.18(A) shall be capable of isolating the engine generator assembly output terminals from the paralleling system bus. The disconnecting means shall not be required to be located at the engine generator assembly .

445.

~~19 Emergency Shutdown of Prime Mover.~~

~~**(A)** General.~~

~~Generators shall have provisions to shut down the prime mover. The means of shutdown shall comply with all of the following:~~

(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~~

~~The provisions to shut down the prime mover 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 .~~

~~**(B)** Remote Emergency Shutdown.~~

~~For other than one- and two-family dwelling units, generators with greater than 15 kW rating shall be provided with a remote emergency stop switch to shut down the prime mover. The remote emergency stop switch shall be located outside the equipment room or generator enclosure at a readily accessible location and shall also meet the requirements of 445.19(A) (1) and (A)(2).~~

~~The remote emergency stop switch shall be permitted to be mounted on the exterior of the generator enclosure. The remote emergency stop switch shall be labeled Generator Emergency Shutdown, and the label shall meet the requirements of 110.21(B) .~~

~~**(C)** Emergency Shutdown in One- and Two-Family Dwelling Units.~~

~~For other than cord-and-plug-connected portable generators, an emergency shutdown device shall be located outside the dwelling unit at a readily accessible location and shall also meet the requirements of 445.19(A) (1) and (A)(2).~~

~~An emergency shutdown device mounted on the exterior of the generator enclosure shall be permitted to satisfy the requirements of this section. The shutdown device shall be marked as the Generator Emergency Shutdown, and the label shall meet the requirements of 110.21(B)).~~

445~~.~~

20 Ground-Fault Circuit-Interrupter Protection for Receptacles on 15-kW or Smaller Portable Generators.

Receptacle outlets that are a part of a 15-kW or smaller portable generator shall have listed ground-fault circuit-interrupter protection (GFCI) for personnel integral to the generator or receptacle as indicated in either 445.20(A) or (B):

(A) Unbonded (Floating Neutral) Generators.

Unbonded generators with both 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) is interlocked such that it is not available for use when any 125/250-volt receptacle(s) 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.

Informational Note: See 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 GFCI protection for personnel identified for portable use shall be permitted.

Additional Proposed Changes

File Name	Description	Approved
generator_pictures.docx	Pictures of generators and engine generator assemblies	
Article_445_edits.docx	Word file in track changes mode of the proposed changes.	

Statement of Problem and Substantiation for Public Input

The original Article 445 was written for electric generators. In the last few Code cycles, requirements for engine generator sets have been added to the Article. Adding Parts, and changing the title, will make it clear that there are two types of generators that are covered by Article 445. For example, it doesn't make sense to require conductors to be 115% if these conductors are within a listed product. Here is part of the scope statement from UL 1004-4:

1.2 This Standard covers electric generators, also referred to as alternators, which, when coupled with prime movers, such as engines or electric motors, are used to produce electricity. This Standard covers
generators, including those for standby use rated 34,000 volts or less.

1.3 This Standard does not cover stationary or portable generator assemblies, which are respectively covered under the Standard for Stationary Engine Generator Assemblies, UL 2200, and the Standard for
Carbon Monoxide (CO) Emission Rate of Portable Generators, UL 2201.

My proposed organization of 445 is just that, a proposal. I kept the listing requirement in general. The Code Making Panel may decide to move the listing requirement to engine generator assemblies and not require listing for generators themselves. If someone is going to use a generator, within the scope of the Code, they they will have to construct the entire system and all of this will have to be approved anyway.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1200-NFPA 70-2023 [Definition: Generator (Generator Set).]	revise definition so that it only applies to electric senerators
Public Input No. 1201-NFPA 70-2023 [New Definition after Definition: Generator (Generator Set).]	Add definition for engine generator assembly (genset)
Public Input No. 1200-NFPA 70-2023 [Definition: Generator (Generator Set).]	
Public Input No. 1201-NFPA 70-2023 [New Definition after Definition: Generator (Generator Set).]	

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Committee:	NEC-P13

Article 445 Electric Generators and Engine Generator Assemblies

Part I. General

445.1 Scope.

This article contains installation and other requirements for electric generators and engine generator assemblies.

445.6 Listing.

~~Stationary G~~generators shall be listed.

Exception: One of a kind or custom manufactured generators shall be permitted to be field labeled.

Informational Note 1: See UL 2200, *Standard for Stationary Engine Generator Assemblies*, for additional information

Informational Note 2: See UL 1004-4, *Standard for Electric Generators,* for additional information

445.9 Emergency Shutdown of Prime Mover

(A) General.

Generators shall have provisions to shut down the prime mover. The means of shutdown shall comply with all of the following:

- (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

The provisions to shut down the prime mover 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**.

(B) Remote Emergency Shutdown.

Commented [ES1]: There are companion PIs to define Electric Generator and to define Engine Generator Assemblies. The definitions follow the definitions in the respective UL standards.

Commented [ES2]: This section is currently 445.19. My thought is that CMP-13 might want this in the General section. If not, it can be left in part III.

For other than one- and two-family dwelling units, generators with greater than 15 kW rating shall be provided with a remote emergency stop switch to shut down the prime mover. The remote emergency stop switch shall be located outside the equipment room or generator enclosure at a readily accessible location and shall also meet the requirements of **445.19(A)**(1) and (A)(2).

The remote emergency stop switch shall be permitted to be mounted on the exterior of the generator enclosure. The remote emergency stop switch shall be labeled Generator Emergency Shutdown, and the label shall meet the requirements of **110.21(B)**.

(C) Emergency Shutdown in One- and Two-Family Dwelling Units.

For other than cord-and-plug-connected portable generators, an emergency shutdown device shall be located outside the dwelling unit at a readily accessible location and shall also meet the requirements of **445.19(A)**(1) and (A)(2).

An emergency shutdown device mounted on the exterior of the generator enclosure shall be permitted to satisfy the requirements of this section. The shutdown device shall be marked as the Generator Emergency Shutdown, and the label shall meet the requirements of **110.21(B)**).

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**.

Informational Note: See NFPA 37-2021, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, for information on the location of generators.

445.11 Marking.

Each generator shall be provided with an accessible nameplate giving the manufacturer's name, the rated frequency, the number of phases if 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.

Nameplates or manufacturer's instructions shall provide the following information for all stationary generators and portable generators rated more than 15 kW:

- (1) Alternator subtransient, transient, synchronous, and zero sequence reactances
- (2) Generator set power rating category (including but not limited to prime, standby, or continuous)
- (3) Alternator temperature rise at rated load and insulation system class
- (4) Indication if the generator is protected against overload by inherent design, an overcurrent protective relay, a circuit breaker, or a fuse
- (5) Available fault current for inverter-based generators, in lieu of the synchronous, subtransient, and transient reactances

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

Part II Electric Generators

445.12 Overcurrent Protection.

(A) Constant-Voltage Generators.
Constant-voltage generators, except ac generator exciters, shall be protected from overload by inherent design, circuit breakers, fuses, protective relays, or other identified overcurrent protective means suitable for the conditions of use.

(B) Two-Wire Generators.
Two-wire, dc generators shall be permitted to have overcurrent protection in one conductor only if the overcurrent device is actuated by the entire current generated other than the current in the shunt field. The overcurrent device shall not open the shunt field.

(C) 65 Volts or Less.
Generators operating at 65 volts or less and driven by individual motors shall be considered as protected by the overcurrent device protecting the motor if these devices will operate when the generators are delivering not more than 150 percent of their full-load rated current.

(D) Balancer Sets.
Two-wire, dc generators used in conjunction with balancer sets to obtain neutral points for 3-wire systems shall be equipped with overcurrent devices that disconnect the 3-wire system in case of excessive unbalancing of voltages or currents.

(E) Three-Wire, Direct-Current Generators.
Three-wire, dc generators, whether compound or shunt wound, shall be equipped with overcurrent devices, one in each armature lead, and connected so as to be actuated by the entire current from the armature. Such overcurrent devices shall consist either of a double-pole, double-coil circuit breaker or of a 4-pole circuit breaker connected in the main and equalizer leads and tripped by two overcurrent devices, one in each armature lead. Such protective devices shall be interlocked so that no one pole can be opened without simultaneously disconnecting both leads of the armature from the system.

Exception to (A) through (E): Where deemed by the authority having jurisdiction that a generator is vital to the operation of an electrical system and the generator should operate to failure to prevent a greater hazard to persons, the overload sensing device(s) shall be permitted to be connected to an annunciator or alarm supervised by authorized personnel instead of interrupting the generator circuit.

445.13 Ampacity of Conductors.

(A) General.
The ampacity of the conductors from the generator output terminals to the first distribution device(s) containing overcurrent protection shall not be less than 115 percent of the nameplate current rating of the generator. It shall be permitted to size the neutral conductors in accordance with **220.61**. Conductors that must carry ground-fault currents shall not be smaller than required by **250.30(A)**. Neutral conductors of dc generators that must carry ground-fault currents shall not be smaller than the minimum required size of the largest conductor.

Exception: Where the design and operation of the generator prevent overloading, the ampacity of the conductors shall not be less than 100 percent of the nameplate current rating of the generator

(B) Overcurrent Protection Provided.

Where the generator set is equipped with a listed overcurrent protective device or 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)**.

Tapped conductors shall not be permitted for portable generators rated 15 kW or less where field wiring connection terminals are not accessible.

445.14 Protection of Live Parts.

Live parts of generators operated at more than 50 volts ac or 60 volts dc to ground shall not be exposed to accidental contact where accessible to unqualified persons.

445.15 Guards for Attendants.

Where necessary for the safety of attendants, the requirements of **430.233** shall apply.

445.16 Bushings.

Where field-installed wiring passes through an opening in an enclosure, a conduit box, or a barrier, a bushing shall be used to protect the conductors from the edges of an opening having sharp edges. The bushing shall have smooth, well-rounded surfaces where it may be in contact with the conductors. If used where oils, grease, or other contaminants may be present, the bushing shall be made of a material not deleteriously affected.

445.17 Generator Terminal Housings.

Generator terminal housings shall comply with **430.12**. Where a horsepower rating is required to determine the required minimum size of the generator terminal housing, the full-load current of the generator shall be compared with comparable motors in **Table 430.247** through **Table 430.250**. The higher horsepower rating of **Table 430.247** and **Table 430.250** shall be used whenever the generator selection is between two ratings.

Exception: This section shall not apply to generators rated over 600 volts.

Part III. Engine Generator Assemblies

445.18 Disconnecting Means.

(A) Disconnecting Means.

Generators other than cord-and-plug-connected portable generators shall have one or more disconnecting means. Each disconnecting means shall simultaneously open all associated ungrounded conductors. Each disconnecting means shall be lockable open in accordance with **110.25**.

The disconnecting means shall be permitted to be located within the generator behind a hinged cover, door, or enclosure panel. Where the generator disconnecting means is located within the generator, a field applied label meeting the requirements of **110.21(B)** shall be provided indicating the location of the generator disconnecting means.

(B) 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 system bus. The disconnecting means shall not be required to be located at the generator.

445.19 Emergency Shutdown of Prime Mover.

Commented [ES3]: Proposal is to move 445.19, from Part III, to 445.9, Part I

(A) ~~**General.**~~

~~Generators shall have provisions to shut down the prime mover. The means of shutdown shall comply with all of the following:~~

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- ~~(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~~

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~~The provisions to shut down the prime mover 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**.~~

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Field Code Changed

Field Code Changed

~~**(B) Remote Emergency Shutdown.**~~

~~For other than one- and two-family dwelling units, generators with greater than 15 kW rating shall be provided with a remote emergency stop switch to shut down the prime mover. The remote emergency stop switch shall be located outside the equipment room or generator enclosure at a readily accessible location and shall also meet the requirements of **445.19(A)**(1) and (A)(2).~~

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Field Code Changed

~~The remote emergency stop switch shall be permitted to be mounted on the exterior of the generator enclosure. The remote emergency stop switch shall be labeled Generator Emergency Shutdown, and the label shall meet the requirements of **110.21(B)**.~~

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Field Code Changed

~~**(C) Emergency Shutdown in One- and Two-Family Dwelling Units.**~~

~~For other than cord-and-plug-connected portable generators, an emergency shutdown device shall be located outside the dwelling unit at a readily accessible location and shall also meet the requirements of **445.19(A)**(1) and (A)(2).~~

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Field Code Changed

~~An emergency shutdown device mounted on the exterior of the generator enclosure shall be permitted to satisfy the requirements of this section. The shutdown device shall be marked as the Generator Emergency Shutdown, and the label shall meet the requirements of **110.21(B)**).~~ **General.**

Generators shall have provisions to shut down the prime mover. The means of shutdown shall comply with all of the following:

- (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

The provisions to shut down the prime mover 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**.

(B) Remote Emergency Shutdown.

For other than one- and two-family dwelling units, generators with greater than 15 kW rating shall be provided with a remote emergency stop switch to shut down the prime mover. The remote emergency stop switch shall be located outside the equipment room or generator enclosure at a readily accessible location and shall also meet the requirements of **445.19(A)**(1) and (A)(2).

The remote emergency stop switch shall be permitted to be mounted on the exterior of the generator enclosure. The remote emergency stop switch shall be labeled Generator Emergency Shutdown, and the label shall meet the requirements of **110.21(B)**.

(C) Emergency Shutdown in One- and Two-Family Dwelling Units.

For other than cord-and-plug-connected portable generators, an emergency shutdown device shall be located outside the dwelling unit at a readily accessible location and shall also meet the requirements of **445.19(A)**(1) and (A)(2).

An emergency shutdown device mounted on the exterior of the generator enclosure shall be permitted to satisfy the requirements of this section. The shutdown device shall be marked as the Generator Emergency Shutdown, and the label shall meet the requirements of **110.21(B)**).

Field Code Changed
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Field Code Changed

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445.20 Ground-Fault Circuit-Interrupter Protection for Receptacles on 15-kW or Smaller Portable Generators.

Receptacle outlets that are a part of a 15-kW or smaller portable generator shall have listed ground-fault circuit-interrupter protection (GFCI) for personnel integral to the generator or receptacle as indicated in either **445.20(A)** or (B):

(A) Unbonded (Floating Neutral) Generators.
Unbonded generators with both 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) is interlocked such that it is not available for use when any 125/250-volt receptacle(s) 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.

Informational Note: See **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 GFCI protection for personnel identified for portable use shall be permitted

Public Input No. 3749-NFPA 70-2023 [Section No. 445.6]

445.~~6~~ 2 Listing.

Stationary generators shall be listed.

Exception: One of a kind or custom manufactured generators shall be permitted to be field labeled.

Informational Note: See UL 2200, *Standard for Stationary Engine Generator Assemblies*, for additional information.

Statement of Problem and Substantiation for Public Input

The requirement should be relocated for compliance with the NEC Style Manual Section 2.2.1.

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Committee: NEC-P13

Public Input No. 3170-NFPA 70-2023 [Section No. 445.11]

445.11 Marking.

(A) General. Each generator shall be provided with an accessible nameplate giving the manufacturer's name, the rated frequency, the number of phases if 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.

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.

(B) 15-kW or larger Generators. Nameplates or manufacturer's instructions shall provide the following information for all stationary generators and portable generators rated more than 15 kW:

(1) Alternator subtransient, transient, synchronous, and zero sequence reactances

(2) Generator set power rating category (including but not limited to prime, standby, or continuous)

(3) Alternator temperature rise at rated load and insulation system class

(4) Indication if the generator is protected against overload by inherent design, an overcurrent protective relay, a circuit breaker, or a fuse

(5) Available fault current for inverter-based generators, in lieu of the synchronous, subtransient, and transient reactances

~~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 Input

Section 445.11 has multiple requirements dependent on different applications, therefore adding 2 new first level subdivisions to clarify this point for Code users. In accordance with NFPA Style Manual section 3.5.1.2 additional subdivisions shall be used where multiple requirements can be broken into independent requirements.

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Committee: NEC-P13

Public Input No. 4508-NFPA 70-2023 [Section No. 445.11]

445.11 Marking.

(A) Each generator shall be provided with an accessible nameplate giving the following information:

(1) the manufacturer's name

~~,~~

(1)

(2) the rated frequency

~~,~~

(1)

(2) the number of phases if ac

~~,~~

(1)

(2) the rating in kilowatts or kilovolt-amperes

~~,~~

(1)

(2) the power factor

~~,~~

(1)

(2) the normal volts and amperes corresponding to the rating

~~, and~~

(1)

(2) the rated ambient temperature.

(B) Nameplates or manufacturer's instructions shall provide the following information for all stationary generators and portable generators rated more than 15 kW:

(1) Alternator subtransient, transient, synchronous, and zero sequence reactances

(2) Generator set power rating category (including but not limited to prime, standby, or continuous)

(3) Alternator temperature rise at rated load and insulation system class

(4) Indication if the generator is protected against overload by inherent design, an overcurrent protective relay, a circuit breaker, or a fuse

(5) Available fault current for inverter-based generators, in lieu of the synchronous, subtransient, and transient reactances

(C) 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 Input

There are three requirements in this section that should be broken into A, B, and C. Content in the first paragraph is imbedded and should be broken into a list to match the style of the rest of the section. This requirement would be more clear if these changes were made.

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Committee:	NEC-P13

Public Input No. 4418-NFPA 70-2023 [Section No. 445.13]

445.13 Ampacity of Conductors.

(A) ~~General~~ Overcurrent Protection not Provided .

The ampacity of the conductors from the generator ~~output~~ terminals to the first distribution device(s) containing overcurrent protection shall not be less than 115 percent of the nameplate current rating of the generator. It shall be permitted to size the neutral conductors in accordance with 220.61. Conductors that must carry ground-fault currents shall not be smaller than required by 250.30(A). Neutral conductors of dc generators that must carry ground-fault currents shall not be smaller than the minimum required size of the largest conductor.

Exception: Where the design and operation of the generator prevent overloading, the ampacity of the conductors shall not be less than 100 percent of the nameplate current rating of the generator.

(B) Overcurrent Protection Provided.

Where the generator set is equipped with a listed overcurrent protective device or a combination of a current transformer and overcurrent relay, conductors shall be sized in accordance with the ampere rating of the listed overcurrent protective devices(s) and permitted to be tapped from the load side of the protected terminals in accordance with 240.21(B).

Tapped conductors shall not be permitted for portable generators rated 15 kW or less where field wiring connection terminals are not accessible.

Exception: Where the design and operation of the generator prevent overloading, the ampacity of the conductors shall not be less than 100 percent of the nameplate current rating of the generator.

Statement of Problem and Substantiation for Public Input

We have experienced many misinterpretations related to this article of the code. These changes will greatly reduce confusion and misinterpretation by the code user of the requirements in this section.
The change to the title of paragraph (A) is to provide clarification to the intent of the article. Paragraph (A) is providing requirements for the ampacity of conductors when an overcurrent device is not provided.
The word "output" was removed to match the reference in article 240.21(G) to this article. A new definition for "Generator Terminals" has been added for this term to clarify its use here.
The change to paragraph (B) clarifies that conductors connecting the output of the generator are to be sized to the ampere rating of the overcurrent protective device or devices. The exception has been added to paragraph (B) to allow for the overload protection that is built into the generator and is a part of the listing of the generator to be used for sizing of the output conductors. This is needed for generators that are capable of running on multiple fuels that result in different rated generator output currents. The overcurrent protective device (usually a circuit breaker) is sized based on the largest output current of the generator. When the generator is to be operated on the fuel that produces a lesser output current the overload protection of the generator can be used to properly size the output conductors. Note the fuel selection and associated output current is made at installation and not changed after that.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4442-NFPA 70-2023 [New Definition after Definition: Generator (Generator Set).]	Definition for term used in this article

Public Input No. 4442-NFPA 70-2023 [New Definition after Definition: Generator (Generator Set).]

Submitter Information Verification

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Committee:	NEC-P13

Public Input No. 2347-NFPA 70-2023 [Section No. 445.18(A)]

(A) Disconnecting Means.

Generators other than cord-and-plug-connected portable generators shall have one or more disconnecting means. Each disconnecting means shall simultaneously open all associated ungrounded conductors. Each disconnecting means shall be readily accessible from the generator and be lockable open in accordance with 110.25. The disconnecting means shall meet the working space requirements of 110.26(A).

The disconnecting means shall be permitted to be located within the generator behind a hinged cover, door, or enclosure panel. Where the generator disconnecting means is located within the generator, a field applied label meeting the requirements of 110.21(B) shall be provided indicating the location of the generator disconnecting means.

Statement of Problem and Substantiation for Public Input

Adding language to make it clear the disconnecting means for the generator must be readily accessible as required in accordance with 408.4(A). Adding same language of 440.14 to 445.18(A) because it relieves the AHJ from interpreting that the generator disconnecting means must have the required working space in 110.26(A). This increases safety for the safe operation and maintenance of such equipment.

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Committee: NEC-P13

Public Input No. 2539-NFPA 70-2023 [Section No. 445.19(A)]

(A) General.

Generators shall have provisions to shut down the prime mover. The means of shutdown shall comply with all of the following:

(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

The provisions to shut down the prime mover shall be permitted to satisfy the requirements of 445.18(A) where it is ~~capable of being locked in the open position~~ lockable open in accordance with 110.25.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document when a disconnecting means is required to be lockable open elsewhere in the code. The text is revised to comply with the NEC Style Manual. The NEC Style Manual Section 3.2.5 Consistent Application of Terms, 3.2.5.3 Lockable Open. Where a requirement specifies that a disconnecting means be capable of being locked in the open position, the phrase lockable open in accordance with 110.25 shall be used.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

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Committee:	NEC-P13

Public Input No. 3702-NFPA 70-2023 [Section No. 445.19(A)]

(A) General.

Generators shall have provisions to shut down the prime mover. The means of shutdown shall comply with all of the following:

(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

The provisions to shut down the prime mover shall be permitted to satisfy the requirements of 445.18(A) where it is capable of being locked ~~in the open position in~~ to prevent all operations in accordance with 110.25.

Statement of Problem and Substantiation for Public Input

The term ”capable of being locked in the open position” should be changed to “capable of being locked to prevent all operations”. This change is needed to add clarity to the requirement.

The requirement as is makes it sound like the prime mover must utilize some type of a disconnect switch as the shutdown device (when this is obviously not the case).

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Committee: NEC-P13

Public Input No. 1837-NFPA 70-2023 [Section No. 445.19(B)]

(B) Remote Emergency Shutdown.

For other than one- and two-family dwelling units, generators with greater than 15 kW rating shall be provided with a remote emergency stop switch to shut down the prime mover. The remote emergency stop switch shall be located outside the equipment room or generator enclosure at a readily accessible location and shall also meet the requirements of 445.19(A)(1) and (A)(2).

The remote emergency stop switch shall be permitted to be mounted on the exterior of the generator enclosure, <u>if it is readily accessible</u> . The remote emergency stop switch shall be labeled Generator Emergency Shutdown, and the label shall meet the requirements of 110.21(B).

Statement of Problem and Substantiation for Public Input

The second paragraph can cause confusion when applying it to gensets that are not readily accessible. For gensets located on roofs, stands or platforms, or otherwise not readily accessible, allowing the emergency shutdown to be mounted to the genset enclosure increases the time required to shutdown a unit that may be causing a hazard.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1838-NFPA 70-2023 [Section No. 445.19(C)]	
Public Input No. 1838-NFPA 70-2023 [Section No. 445.19(C)]	

Submitter Information Verification

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Submittal Date:	Sun Aug 06 09:25:47 EDT 2023
Committee:	NEC-P13

Public Input No. 4137-NFPA 70-2023 [Section No. 445.19(B)]

(B) Remote Emergency Shutdown.

(1) Other than One- and Two-Family Dwellings. For other than one- and two-family dwelling units, generators with greater than 15 kW rating shall be provided with a remote emergency stop switch to shut down the prime mover.

(2) Location. The remote emergency stop switch shall be located outside the equipment room or generator enclosure at a readily accessible location and shall also meet the requirements of 445.19(A)(1) and (A)(2).~~The remote emergency stop switch shall be permitted to be mounted on the exterior of the generator enclosure.~~

(3) Labeling. The remote emergency stop switch shall be labeled Generator Emergency Shutdown, and the label shall meet the requirements of 110.21(B).

Statement of Problem and Substantiation for Public Input

Breaking up 445.19(B) into a list item format to facilitate understanding for Code users. In accordance with NFPA Style Manual section 3.5.1.2 additional subdivisions shall be used where multiple requirements can be broken into independent requirements.

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Committee:	NEC-P13

Public Input No. 1029-NFPA 70-2023 [Section No. 445.19(C)]

(C) Emergency Shutdown in One- and Two-Family Dwelling Units.

For other than cord-and-plug-connected portable generators, an emergency shutdown ~~device~~ devices on automatic generators rated at 8 KW or larger shall be located outside the dwelling unit at a readily accessible location next to the service entrance conductors entering the dwelling unit and shall also meet the requirements of 445.19(A)(1) and (A)(2).

An emergency shutdown device mounted on the exterior of the generator enclosure shall not be permitted to satisfy the requirements of this section. The additional shutdown device shall also be marked as the Generator Emergency Shutdown, and the label shall meet the requirements of 110.21(B)).

Statement of Problem and Substantiation for Public Input

Have another prime mover shutdown at the meter location on one and two family dwelling will allow first responders to shut off the controls to the generator at this location.
First responders will shut off the disconnect on the outside of the dwelling and may not hear the generator start due to the fire engine noise.
First responders might not see the signage in a hurry, but installing a prime mover shutdown next to the meter disconnect they will see.

Submitter Information Verification

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Public Input No. 1838-NFPA 70-2023 [Section No. 445.19(C)]

(C) Emergency Shutdown in One- and Two-Family Dwelling Units.

For other than cord-and-plug-connected portable generators, an emergency shutdown device shall be located outside the dwelling unit at a readily accessible location and shall also meet the requirements of 445.19(A)(1) and (A)(2).

An emergency shutdown device mounted on the exterior of the generator enclosure shall be permitted to satisfy the requirements of this section, <u>if it is readily accessible</u> . The shutdown device shall be marked as the Generator Emergency Shutdown, and the label shall meet the requirements of 110.21(B)).

Statement of Problem and Substantiation for Public Input

The second paragraph can cause confusion when applying it to gensets that are not readily accessible. For gensets located on roofs, stands or platforms, or otherwise not readily accessible, allowing the emergency shutdown to be mounted to the genset enclosure increases the time required to shutdown a unit that may be causing a hazard.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1837-NFPA 70-2023 [Section No. 445.19(B)]	
Public Input No. 1837-NFPA 70-2023 [Section No. 445.19(B)]	

Submitter Information Verification

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Submittal Date:	Sun Aug 06 09:45:16 EDT 2023
Committee:	NEC-P13

Public Input No. 4138-NFPA 70-2023 [Section No. 445.19(C)]

(C) Emergency Shutdown in One- and Two-Family Dwelling Units.

(1) Location. For other than cord-and-plug-connected portable generators, an emergency shutdown device shall be located outside the dwelling unit at a readily accessible location and shall also meet the requirements of 445.19(A)(1) and (A)(2). ~~An emergency shutdown device mounted on the exterior of the generator enclosure shall be permitted to satisfy the requirements of this section.~~

(2) Labeling. The shutdown device shall be marked as the Generator Emergency Shutdown, and the label shall meet the requirements of 110.21(B)).

Statement of Problem and Substantiation for Public Input

Breaking up 445.19(C) into a list item format to facilitate understanding for Code users. In accordance with NFPA Style Manual section 3.5.1.2 additional subdivisions shall be used where multiple requirements can be broken into independent requirements.

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Committee: NEC-P13

Public Input No. 1245-NFPA 70-2023 [New Section after 445.20]

TITLE OF NEW CONTENT

Type your content here ...

445.21. Cybersecurity

Generators that are connected to a communication network and have the capability to be controlled or permit control of any portion of the premises shall comply with either of the following:

(1) The ability to control the system is limited to a direct connection through a local nonnetworked interface.

(2) The generator is connected through a networked interface complying with both of the following methods:

a. The generator and associated software are identified as being evaluated for cybersecurity.

b. A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to cyber attacks.

The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals.

Documentation of the evaluation, assessment, identification, and certification shall be made available to those authorized to inspect, operate, and maintain the system.

Informational Note No. 1: See ANSI/ISA 62443, Cybersecurity Standards series; UL 2900, Cybersecurity Standards series; and the NIST Framework for Improving Critical Infrastructure Cybersecurity, Version 1.1, for assessment guidelines.

Informational Note No. 2: Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

(1) The ISA Security Compliance Institute (ISCI) conformity assessment program

(2) Certification of compliance by a nationally recognized test laboratory

Statement of Problem and Substantiation for Public Input

Most of the cybersecurity focus has been on IT systems. There has been very little public discussion about cybersecurity for Operational Technology (OT), but cyber attacks on OT, by both domestic and foreign actors, occur on almost a daily basis. Hackers can easily destroy unprotected equipment and shut down entire unprotected facilities. Our adversaries such as Russia, China, North Korea, and Iran, are continuously mounting cyber attacks. They understand their limits and, so far, prohibit catastrophic attacks on our financial/banking system and electrical grid. In the mean time, they attack our infrastructure, such as the southeast gas pipeline. We have the ability, and obligation, to prevent this type of damage to our infrastructure from malicious cyber attacks. This Public Input is based upon 240.6(D) and 708.7 in the 2023 NEC. Pay particular attention to the word "identified" in (2) a. "Identified" as applied to equipment, is defined 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. 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 organization concerned with product evaluation." This Public Input simply requires that a generator either not be connected to the internet, or if it is connected to the internet, that it be identified for cybersecurity and that an assessment is provided.

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Public Input No. 629-NFPA 70-2023 [New Section after 455.1]

455.2 Reconditioned Equipment

Phase Converters shall not be reconditioned

Statement of Problem and Substantiation for Public Input

These items are not permitted to be reconditioned per the NEMA Technical Position on Reconditioned Equipment (NEMA CS 100-2020, Appendix B.1)

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 634-NFPA 70-2023 [New Section after 692.1]	

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Committee: NEC-P13

Public Input No. 3753-NFPA 70-2023 [Section No. 455.3]

~~**455.3** Other Articles.~~

~~Phase converters shall comply with this article and with the applicable provisions of other articles of this *Code* .~~

Statement of Problem and Substantiation for Public Input

The section should be removed as it is redundant and the other parts of the NEC are already applicable and do not need to be restated. The requirement should also be removed for compliance with the NEC Style Manual Section 2.2.1.

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Committee: NEC-P13

Public Input No. 1315-NFPA 70-2023 [Section No. 455.8(C)(2)]

(2) Horsepower Rated Disconnect.

The disconnecting means shall be a switch with a horsepower rating. The equivalent locked rotor current of the horsepower rating of the switch shall not be less than 200 percent of the sum of the following:

(1) Nonmotor loads

(2) The 3-phase, locked-rotor current of the largest motor as determined from Table 430.251(B) <u>or Table 430.251(C)</u>

(3) The full-load current of all other 3-phase motors operating at the same time

Statement of Problem and Substantiation for Public Input

This Public Input is a companion to the NEMA Public Input proposing to add new Table 430.251(C).

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Submittal Date: Fri Jul 07 17:43:20 EDT 2023

Committee: NEC-P13

Public Input No. 3808-NFPA 70-2023 [Article 480]

Article 480 Stationary ~~Standby~~ Batteries

480.1 Scope.

This article applies to all installations of stationary standby batteries having a capacity greater than 3.6 MJ (1 kWh).

Informational Note No. 1: See Article 706 for installations that do not meet the definition of stationary standby batteries.

Informational Note No. 2: The following standards are frequently referenced for the installation of stationary batteries:

(1) IEEE 484, *Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications*

(2) IEEE 485, *Recommended Practice for Sizing Vented Lead-Acid Storage Batteries for Stationary Applications*

(3) IEEE 1145, *Recommended Practice for Installation and Maintenance of Nickel-Cadmium Batteries for Photovoltaic (PV) Systems*

(4) IEEE 1187, *IEEE Recommended Practice for Installation Design, and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications*

(5) IEEE 1375, *IEEE Guide for the Protection of Stationary Battery Systems*

(6) IEEE 1578, *Recommended Practice for Stationary Battery Electrolyte Spill Containment and Management*

(7) IEEE 1635/ASHRAE 21, *Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications*

(8) UL 1973, *Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail (LER) Applications*

(9) UL Subject 2436, *Outline of Investigation for Spill Containment for Stationary Lead Acid Battery Systems*

(10) UL 1989, *Standard for Standby Batteries*

(11) UL Subject 1974, *Standard for Evaluation of Repurposed Batteries*

(12) NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems*

480.3 Equipment.

Storage batteries and battery management equipment shall be listed. This requirement shall not apply to lead-acid batteries.

480.4 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's installation and instruction manual.

(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.

(D) Accessibility.

The terminals of all cells or multicell units shall be readily accessible for readings, inspections, and cleaning where required by the equipment design. One side of transparent battery containers shall be readily accessible for inspection of the internal components.

480.5 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 480.6.

480.6 Overcurrent Protection for Prime Movers.

Overcurrent protection shall not be required for conductors from a battery with a 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.

480.7 DC Disconnect Methods.

(A) Disconnecting Means.

A disconnecting means shall be provided for all ungrounded conductors derived from a stationary standby battery with a voltage over 60 volts dc. A disconnecting means shall be readily accessible and located within sight of the stationary standby battery.

Informational Note: See 240.21(H) for information on the location of the overcurrent device for battery conductors.

(B) Emergency Disconnect.

For one-family and two-family dwellings, a disconnecting means or its remote control for a stationary standby battery shall be located at a readily accessible location outside the building for emergency use. The disconnect shall be labeled as follows:

EMERGENCY DISCONNECT

(C) Disconnection of Series Battery Circuits.

Battery circuits exceeding 240 volts dc nominal between conductors or to ground and subject to field servicing shall have provisions to disconnect the series-connected strings into segments not exceeding 240 volts dc nominal for maintenance by qualified persons. Non-load-break bolted or plug-in disconnects shall be permitted.

(D) Remote Actuation.

Where a disconnecting means, located in accordance with 480.7(A), is provided with remote controls to activate the disconnecting means and the controls for the disconnecting means are not located within sight of the stationary standby battery, 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.

(E) Busway.

Where a dc busway system is installed, the disconnecting means shall be permitted to be incorporated into the busway.

(F) 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) Available fault current derived from the stationary standby battery

Informational Note No. 1: Battery equipment suppliers can provide information about available fault current on specific battery models.

(3) An arc flash label in accordance with acceptable industry practice

Informational Note No. 2: See NFPA *70E*-2021, *Standard for Electrical Safety in the Workplace*, for assistance in determining the severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

(4) Date the calculation was performed

Exception: List items (2), (3), and (4) shall not apply to one- and two-family dwellings.

(G) Identification of Power Sources.

Stationary standby batteries shall be indicated by 480.7(G)(1) and (G)(2).

(1) Facilities with Utility Services and Stationary Standby Batteries.

Plaques or directories shall be installed in accordance with 705.10.

Exception: This requirement does not apply where a disconnect in 480.7(A) is not required.

(2) Facilities with Stand-Alone Systems.

A permanent plaque or directory shall be installed in accordance with 710.10.

480.8 Insulation of Batteries.

Batteries constructed of an electrically conductive container shall have insulating support if a voltage is present between the container and ground.

480.9 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.

480.10 Battery Locations.

Battery locations shall conform to 480.10(A) through (G).

(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 1-2021, *Fire Code*, Chapter 52, for ventilation considerations for specific battery chemistries.

> Informational Note No. 2: Some battery technologies do not require ventilation.

> Informational Note No. 3: See IEEE Std 1635-2012/ASHRAE Guideline 21-2012, *Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications*, for additional information on the ventilation of stationary battery systems.

(B) Live Parts.

Guarding of live parts shall comply with 110.27.

(C) Spaces About Stationary Standby Batteries.

Spaces about stationary standby batteries shall comply with 110.26 and 110.34. 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: See IEEE 1187-2013, *IEEE Recommended Practice for Installation Design and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications*, for guidance for top clearance of valve-regulated lead-acid batteries, which are commonly used in battery cabinets.

(E) Egress.

Personnel doors intended for entrance to, and egress from, rooms designated as battery rooms shall open at least 90 degrees in the direction of egress and shall be equipped with listed panic or listed fire exit 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 stationary standby batteries. 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 result in the following:

(1) Expose personnel to energized battery components while performing maintenance on the luminaires in the battery space

(2) Create a hazard to the battery upon failure of the luminaire

480.11 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.

480.12 Battery Interconnections.

Flexible cables, as identified in Table 400.4, 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 for the environmental conditions. Flexible, fine-stranded cables shall only be used with terminals, lugs, devices, or connectors in accordance with 110.14.

480.13 Ground-Fault Detection.

Battery circuits exceeding 100 volts between the conductors or to ground shall be permitted to operate with ungrounded conductors, provided a ground-fault detector and indicator is installed to monitor for ground faults.

Statement of Problem and Substantiation for Public Input

This article should include stationary batteries used in standby energy storage applications as well as newer cyclical energy storage applications.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]	
Public Input No. 3859-NFPA 70-2023 [Section No. 706.1]	
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]	
Public Input No. 3831-NFPA 70-2023 [Section No. 480.3]	
Public Input No. 3840-NFPA 70-2023 [Section No. 480.7(A)]	
Public Input No. 3844-NFPA 70-2023 [Section No. 480.7(D)]	
Public Input No. 3846-NFPA 70-2023 [Section No. 480.7(F)]	
Public Input No. 3848-NFPA 70-2023 [Section No. 480.7(G) [Excluding any Sub-Sections]]	
Public Input No. 3849-NFPA 70-2023 [Section No. 480.7(G)(1)]	
Public Input No. 3853-NFPA 70-2023 [Section No. 480.10(C)]	
Public Input No. 3859-NFPA 70-2023 [Section No. 706.1]	
Public Input No. 3863-NFPA 70-2023 [Definition: Energy Storage System (ESS).]	

Submitter Information Verification

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Submittal Date:	Tue Sep 05 17:26:16 EDT 2023
Committee:	NEC-P13

Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]

480.1 Scope.

This article applies to all installations of stationary ~~standby~~ batteries having a capacity greater than 3.6 MJ (1 kWh).

Informational Note No. 1: See Article 706 for ~~installations that do not meet the definition of stationary standby~~ requirements for components of an energy storage system other than batteries.

Informational Note No. 2: The following standards are frequently referenced for the installation of stationary batteries:

Informational Note No. 3: For batteries rated in ampere hours, kWh is equal to the nominal rated voltage times ampere-hour rating divided by 1000 .

(1) IEEE 484, *Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications*

(2) IEEE 485, *Recommended Practice for Sizing Vented Lead-Acid Storage Batteries for Stationary Applications*

(3) IEEE 1145, *Recommended Practice for Installation and Maintenance of Nickel-Cadmium Batteries for Photovoltaic (PV) Systems*

(4) IEEE 1187, *IEEE Recommended Practice for Installation Design, and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications*

(5) IEEE 1375, *IEEE Guide for the Protection of Stationary Battery Systems*

(6) IEEE 1578, *Recommended Practice for Stationary Battery Electrolyte Spill Containment and Management*

(7) IEEE 1635/ASHRAE 21, *Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications*

(8) UL 1973, *Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail (LER) Applications*

(9) UL Subject 2436, *Outline of Investigation for Spill Containment for Stationary Lead Acid Battery Systems*

(10) UL 1989, *Standard for Standby Batteries*

(11) UL Subject 1974, *Standard for Evaluation of Repurposed Batteries*

(12) NFPA 855~~-2020~~ , *Standard for the Installation of Stationary Energy Storage Systems*

(13) *IEEE 1184 Guide for Batteries for Uninterrutible Power Supply Systems*

(14) *International Fire Code (IFC)*

(15) *NFPA 1, Fire Code*

Statement of Problem and Substantiation for Public Input

This article should include batteries used in standby energy storage applications as well as newer cyclical energy storage applications.

There has been confusion of whether article 480 or 706 should apply to a particular energy storage system. This change, with the associated change, makes it clear that article 480 will apply to all batteries and article 706 will cover other energy storage components that are part of the energy storage system.

Informational note 3 was added to be consistent with article 706

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3808-NFPA 70-2023 [Article 480]	Title and scope have a mandatory relationship
Public Input No. 3859-NFPA 70-2023 [Section No. 706.1]	
Public Input No. 3808-NFPA 70-2023 [Article 480]	
Public Input No. 3831-NFPA 70-2023 [Section No. 480.3]	
Public Input No. 3840-NFPA 70-2023 [Section No. 480.7(A)]	
Public Input No. 3844-NFPA 70-2023 [Section No. 480.7(D)]	
Public Input No. 3846-NFPA 70-2023 [Section No. 480.7(F)]	
Public Input No. 3848-NFPA 70-2023 [Section No. 480.7(G) [Excluding any Sub-Sections]]	
Public Input No. 3849-NFPA 70-2023 [Section No. 480.7(G)(1)]	
Public Input No. 3853-NFPA 70-2023 [Section No. 480.10(C)]	
Public Input No. 3859-NFPA 70-2023 [Section No. 706.1]	
Public Input No. 3863-NFPA 70-2023 [Definition: Energy Storage System (ESS).]	

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Public Input No. 3780-NFPA 70-2023 [Section No. 480.3]

480.3 ~~Equipment.~~ 2 Listing Requirements

Storage batteries and battery management equipment shall be listed. This requirement shall not apply to lead-acid batteries.

Statement of Problem and Substantiation for Public Input

The requirement is revised for compliance with the NEC Style Manual Section 2.2.1.

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Public Input No. 3831-NFPA 70-2023 [Section No. 480.3]

480.3 Equipment.

~~Storage batteries and battery management equipment shall~~ Batteries shall be listed. This requirement shall not apply to lead-acid and nickel-cadmium batteries .

Statement of Problem and Substantiation for Public Input

Goal is to make Article 480 a reference point for electrical safety requirements for batteries only. Fire and explosion safety requirements will be in applicable fire codes. Nickel-cadmium is referenced as an equivalent safety standing to lead-acid as both are long-standing aqueous battery technologies.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3808-NFPA 70-2023 [Article 480]	
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]	

Submitter Information Verification

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Committee:	NEC-P13

Public Input No. 4319-NFPA 70-2023 [Section No. 480.3]

480.

~~3 Equipment~~

2 Listing Requirements .

Storage batteries and battery management equipment shall be listed. This requirement shall not apply to lead-acid batteries.

Statement of Problem and Substantiation for Public Input

Section 480.3 was moved to 408.2 and renamed "Listing Requirements" to comply with NEC style manual section 2.4.1. The language that allows lead-acid batteries to not be listed is an exception so it has been separated from the main requirement and specified as an exception.

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Committee: NEC-P13

Public Input No. 3835-NFPA 70-2023 [Section No. 480.4(A)]

(A) Corrosion Prevention ~~.~~

~~Where mating dissimilar metals, antioxidant material suitable for the battery connection shall be used where recommended by the battery manufacturer's installation and instruction manual~~

for Batteries with Acidic or Caustic Electrolyte .

Connections to and within a battery shall be assembled using an approved corrosion inhibitor in accordance with the battery manufacturer’s instructions as outlined in the installation and operation documentation .

Statement of Problem and Substantiation for Public Input

This section was intended for legacy lead-acid and nickel-cadmium batteries. The wording has been updated to reflect this with some enhancements.

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Public Input No. 3838-NFPA 70-2023 [Section No. 480.4(B)]

(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 No. 1 : For ampacities of conductors for loads shorter than three hours (non-continuous), refer to guidance in IEEE 1184-2022, Annex L.

Informational Note No. 2: 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.

Statement of Problem and Substantiation for Public Input

For systems designed for short time loads, sizing cables for continuous loads is not pragmatic. This give guidance to the user to safely size cables based on actual run times.

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Submittal Date:	Tue Sep 05 18:24:16 EDT 2023
Committee:	NEC-P13

Public Input No. 3840-NFPA 70-2023 [Section No. 480.7(A)]

(A) Disconnecting Means.

A disconnecting means shall be provided for all ungrounded conductors derived from a stationary ~~standby~~ battery with a voltage over 60 volts dc. A disconnecting means shall be readily accessible and located within sight of the stationary ~~standby~~ battery.

Informational Note: See 240.21(H) for information on the location of the overcurrent device for battery conductors.

Statement of Problem and Substantiation for Public Input

This article should include batteries used in standby energy storage applications as well as newer cyclical energy storage applications.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3808-NFPA 70-2023 [Article 480]	
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]	
Public Input No. 3844-NFPA 70-2023 [Section No. 480.7(D)]	
Public Input No. 3846-NFPA 70-2023 [Section No. 480.7(F)]	
Public Input No. 3848-NFPA 70-2023 [Section No. 480.7(G) [Excluding any Sub-Sections]]	
Public Input No. 3849-NFPA 70-2023 [Section No. 480.7(G)(1)]	
Public Input No. 3853-NFPA 70-2023 [Section No. 480.10(C)]	

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Submittal Date: Tue Sep 05 18:31:16 EDT 2023

Committee: NEC-P13

Public Input No. 3841-NFPA 70-2023 [Section No. 480.7(C)]

(C) Disconnection of Series Battery Circuits.

Battery circuits exceeding 240 volts dc nominal between conductors or to ground and subject to field servicing shall have provisions to disconnect the series-connected strings into segments not exceeding 240 volts dc nominal for maintenance by qualified persons. ~~Non-load-break bolted or plug-in disconnects shall be permitted.~~

Informational Note: One common method of accomplishing this is to use a 3-pole dc-rated breaker for the battery string disconnect using the center pole as a mid-string disconnect. This will reduce the arc flash incident energy if the minimum instantaneous trip setting or rating of the breaker is less than the battery short-circuit current. This will also reduce the shock risk.

Statement of Problem and Substantiation for Public Input

The use of non-load break bolted or plug-in disconnects cause additional hazards when they are disconnected. Also, they may not provide consistent connectivity under high loads. The informational notes provides the best practice to reduce shock and arc flash risk and increase overall safety.

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Committee:	NEC-P13

Public Input No. 2540-NFPA 70-2023 [Section No. 480.7(D)]

(D) Remote Actuation.

Where a disconnecting means, located in accordance with 480.7(A), is provided with remote controls to activate the disconnecting means and the controls for the disconnecting means are not located within sight of the stationary standby battery, the disconnecting means shall be ~~capable of being locked in the open position,~~ lockable open 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 Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document when a disconnecting means is required to be lockable open elsewhere in the code. The text is revised to comply with the NEC Style Manual. The NEC Style Manual Section 3.2.5 Consistent Application of Terms, 3.2.5.3 Lockable Open. Where a requirement specifies that a disconnecting means be capable of being locked in the open position, the phrase lockable open in accordance with 110.25 shall be used.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Submittal Date: Sun Aug 20 05:47:06 EDT 2023
Committee: NEC-P13

Public Input No. 3844-NFPA 70-2023 [Section No. 480.7(D)]

(D) Remote Actuation.

Where a disconnecting means, located in accordance with 480.7(A), is provided with remote controls to activate the disconnecting means and the controls for the disconnecting means are not located within sight of the stationary ~~standby~~ battery, 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 Input

This article should include batteries used in standby energy storage applications as well as newer cyclical energy storage applications.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3808-NFPA 70-2023 [Article 480]	
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]	
Public Input No. 3840-NFPA 70-2023 [Section No. 480.7(A)]	

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Submittal Date: Tue Sep 05 18:40:19 EDT 2023
Committee: NEC-P13

Public Input No. 3845-NFPA 70-2023 [Section No. 480.7(E)]

(E) Busway.

Where a dc busway system is installed, the disconnecting means shall be permitted to be incorporated ~~into~~ as part of the busway system .

Statement of Problem and Substantiation for Public Input

'Into' makes it sound like the disconnect is in-line with the busway, but rather it is actually attached to the busway.

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Committee:	NEC-P13

Public Input No. 3846-NFPA 70-2023 [Section No. 480.7(F)]

(F) 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) Available fault current derived from the stationary ~~standby~~ battery

Informational Note No. 1: Battery equipment suppliers can provide information about available fault current on specific battery models.

(3) An arc flash label in accordance with acceptable industry practice

Informational Note No. 2: See NFPA *70E*-2021, *Standard for Electrical Safety in the Workplace*, for assistance in determining the severity of potential exposure, planning safe work practices, arc flash labeling, and selecting personal protective equipment.

(4) Date the calculation was performed

Exception: List items (2), (3), and (4) shall not apply to ~~one- and two-family dwellings~~ voltages below 150 Vdc .

Statement of Problem and Substantiation for Public Input

This article should include batteries used in standby energy storage applications as well as newer cyclical energy storage applications.

Arc flash is not a viable option for 60Vdc battery strings whether installed indoors or outdoors. This revision will negate the need to specify an exclusion for 1- or 2-family dwellings.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3808-NFPA 70-2023 [Article 480]	
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]	
Public Input No. 3840-NFPA 70-2023 [Section No. 480.7(A)]	

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Committee:	NEC-P13

Public Input No. 3849-NFPA 70-2023 [Section No. 480.7(G)(1)]

(1) Facilities with Utility Services and Stationary ~~Standby~~ Batteries.

Plaques or directories shall be installed in accordance with 705.10.

Exception: This requirement does not apply where a disconnect in 480.7(A) is not required.

Statement of Problem and Substantiation for Public Input

This article should include batteries used in standby energy storage applications as well as newer cyclical energy storage applications.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3808-NFPA 70-2023 [Article 480]	
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]	
Public Input No. 3840-NFPA 70-2023 [Section No. 480.7(A)]	

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Public Input No. 3848-NFPA 70-2023 [Section No. 480.7(G) [Excluding any Sub-Sections]]

Stationary ~~standby~~ batteries shall be indicated by 480.7(G)(1) and (G)(2).

Statement of Problem and Substantiation for Public Input

This article should include batteries used in standby energy storage applications as well as newer cyclical energy storage applications.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3808-NFPA 70-2023 [Article 480]	
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]	
Public Input No. 3840-NFPA 70-2023 [Section No. 480.7(A)]	

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Committee:	NEC-P13

Public Input No. 3850-NFPA 70-2023 [Section No. 480.8]

480.8 ~~Insulation of Batteries.~~

~~Batteries constructed of an electrically conductive container shall have insulating support if a voltage is present between the container and ground~~

Grounding of Battery Stands and Conductive Cases.

For battery systems greater than 100 Vdc, it is required to ground conductive battery stands and bond any conductive cases in accordance with Article 250 .

Statement of Problem and Substantiation for Public Input

This section is obsolete and is not a grounding concern any longer. This deals with an ancient requirement . . . . No longer applies.

Grounding of battery stands and conductive cases is important and words were added to address this issue.

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Submittal Date:	Tue Sep 05 18:55:12 EDT 2023
Committee:	NEC-P13

Public Input No. 3851-NFPA 70-2023 [Section No. 480.10(A)]

(A) Ventilation.

~~Provisions appropriate~~ Refer 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~~ applicable fire codes for battery ventilation requirements .

Informational Note No. 1: ~~See~~ Model fire codes include NFPA 1-2021, ~~*Fire Code* ,~~ (Chapter 52, ~~for ventilation considerations for specific battery chemistries~~ which mainly refers to the battery requirements for NFPA 855), and the IFC- 2024 (Section 1207) .

Informational Note No. 2: Some battery technologies do not require ventilation.

Informational Note No. 3: See IEEE Std 1635-2012/ASHRAE Guideline 21-2012, *Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications*, for additional information on the ventilation of stationary battery systems.

Statement of Problem and Substantiation for Public Input

This is not an electrical issue and is covered by appropriate fire and building codes.

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Submittal Date: Tue Sep 05 19:00:47 EDT 2023
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Public Input No. 3853-NFPA 70-2023 [Section No. 480.10(C)]

(C) Spaces About Stationary ~~Standby~~ Batteries.

Spaces about stationary ~~standby~~ batteries shall comply with 110.26 and 110.34. 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 1 : Additional space is often needed to accommodate battery hoisting equipment, tray removal, or spill containment.

Informational Note 2: This section is addressing worker safety concerns. For fire and explosion concerns, see fire codes, e.g., NFPA 1, IFC, etc..

Statement of Problem and Substantiation for Public Input

This article should include batteries used in standby energy storage applications as well as newer cyclical energy storage applications.

There are other spacing concerns when it comes to fire and explosion safety but since they are not electrical safety issues, we refer to the fire codes.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3808-NFPA 70-2023 [Article 480]	
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]	
Public Input No. 3840-NFPA 70-2023 [Section No. 480.7(A)]	

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Committee:	NEC-P13

Public Input No. 3855-NFPA 70-2023 [Section No. 480.10(F)]

~~**(F)** Piping in Battery Rooms.~~

~~Gas piping shall not be permitted in dedicated battery rooms.~~

Statement of Problem and Substantiation for Public Input

Does not apply to electrical safety.

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Submittal Date:	Tue Sep 05 19:08:19 EDT 2023
Committee:	NEC-P13

Public Input No. 3856-NFPA 70-2023 [Section No. 480.11]

~~**480.11** 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 Input

These are technically fire and fire/explosion control issues, not electrical issues and are covered in the fire codes.

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Committee:	NEC-P13

Public Input No. 3857-NFPA 70-2023 [Section No. 480.12]

480.12 Battery Interconnections.

Flexible cables, ~~as identified in Table 400.4 , 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 for the environmental <u>and electrical safety</u> conditions. Flexible, fine-stranded cables shall only be used with terminals, lugs, devices, or connectors in accordance with 110.14.

Statement of Problem and Substantiation for Public Input

Table 404.4 is not applicable, other parts of the code cover requirements of flexible cables. This should apply whether the battery resides in an enclosure or in open air.

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Committee:	NEC-P13

Public Input No. 3858-NFPA 70-2023 [Section No. 480.13]

480.13 Ground-Fault Detection.

Battery circuits exceeding 100 volts between the conductors or to ground shall be permitted to operate with ungrounded conductors, provided a ground-fault detector and indicator is installed to monitor for ground faults. Ungrounded circuits 100 volts or below are permitted without ground-fault detectors or indicators.

Statement of Problem and Substantiation for Public Input

There is no shock hazard on battery voltages 100 volts or less (see NFPA 70E article 320).

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Submittal Date: Tue Sep 05 19:15:39 EDT 2023

Committee: NEC-P13

Public Input No. 1349-NFPA 70-2023 [New Article after 695]

Add New Article Below Article 695 - Article 696 Hamster Wheel Turbine Generator Farms

Add New Article Below Article 695 - Article 696 Hamster Wheel Turbine Generator Farms

Article 696 Hamster Wheel Turbine Generator Farms

Part I. General

696.1 Scope: This article applies to Organic and Non-Organic Hamster Wheel Pico-turbine Generator "Farms" & Power Plants, and any associated biomass facility intended to generate electricity during the disposal of hamsters that have passed away while spinning a turbine.

696.7 Construction and Maintenance: The construction and maintenance, associated wiring, and interconnections shall be performed only by qualified persons.

Informational Note: See Article 100 for the definition of qualified person.

(A) Hamster Wheel Turbine Generator Farms shall be permitted only where in a dedicated facility intended for the purpose.

(B) Equipment: Turbine systems and all associated equipment shall comply with one of the following:

(1) Be listed

(2) Be evaluated for the application and have a field label applied

(C) Anti-motor Protection: Each pico-turbine shall be equipped with a reverse power relay to prevent injury to a hamster in the event it for any reason ceases to spin the wheel while the turbine remains connected to a power source.

(D) Maximum Voltage: The individual operating voltage at each pico-turbine shall be sufficiently low such that a fault would be unable to pose a shock hazard to any hamster working in its designated area. Areas where the hamster is not permitted to occupy shall be permitted to have voltages in excess of this level.

Informational Note: See People for Ethical Treatment of Animals (PETA) regarding lethal shock levels for hamsters.

(E) Loss of Source Protection: The output of Hamster Wheel Turbine Generator Farms shall be automatically disconnected from all ungrounded conductors of the utility when one or more of the phases of the utility source to which it is connected opens. The equipment for detecting such loss of source condition shall be located within the primary switchgear location on the facility premises and not in each individual pico-turbine.

(F) On site biomass incinerator generation facilities: If an on site biomass incinerator is also used at the facility, it shall be in a separate building or separated from the hamster pico-turbine building via an 8 hour firewall.

Statement of Problem and Substantiation for Public Input

As has been used as substantiation for previous proposals that the NFPA has accepted, this proposed article will start the conversation on the possible energy sources that may exist but for which we currently have no regulation for. The subject of how many hypotheticals the NEC should regulate is something that needs to be clarified in light of the actions taken in recent years.

It is important to remember that the only thing standing between this system being a realistic or not is a government subsidy funding bill.

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Committee:	NEC-P13

Public Input No. 2818-NFPA 70-2023 [New Section after 695.1]

695.2 Listing Requirements.

Diesel engine fire pump controllers, electric fire pump controllers, electric motors, fire pump power transfer switches, foam pump controllers, and limited service controllers shall be listed for fire pump service. [20: 9.5.1.1, 10.1.2.1, 12.1.3.1]

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document when general listing requirements are covered within an article. The NEC Style Manual Section 2.2.1 Parallel Numbering Required, states that technical committees shall use the following section numbers for the same purposes within articles. The listing requirements are to be located in the .2 section.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2819-NFPA 70-2023 [Section No. 695.10]	Deleted and relocated to the .2 section.
Public Input No. 2819-NFPA 70-2023 [Section No. 695.10]	

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Submittal Date: Fri Aug 25 14:01:30 EDT 2023
Committee: NEC-P13

Public Input No. 3325-NFPA 70-2023 [Section No. 695.1(B)]

(B) Not Covered.

This article does not cover the following:

(1) The performance, maintenance, and acceptance testing of the fire pump system and the internal wiring of the components of the system

(2) The installation of pressure maintenance (jockey or makeup) pumps

Informational Note No. 1: ~~See Article~~ See 430.6 for the installation of pressure maintenance (jockey or makeup) pumps supplied by the fire pump circuit or another source.

(3) Transfer equipment upstream of the fire pump transfer switch(es)

Informational Note No. 2: See NFPA 20-2019, *Standard for the Installation of Stationary Pumps for Fire Protection*, for further information.

(4) Water pumps installed in one- and two-family dwellings and used for fire suppression

Informational Note No. 3: See NFPA 13D-2019, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, for further information.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the NEC(r) Style Manual prohibits referencing an entire article with the exception of Article 100 or where required for context. It is suggested here that pointing the user to 400.6 will satisfy the needed reference here as that clause describes the proper rules/procedures to size the various components to supply the motors.

Submitter Information Verification

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Submittal Date: Fri Sep 01 09:20:43 EDT 2023

Committee: NEC-P13

Public Input No. 2615-NFPA 70-2023 [Section No. 695.2]

695. ~~2~~ 3 Reconditioned Equipment.

Reconditioned fire pump controllers and transfer switches shall not ~~be permitted~~ be installed .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to comply with the NEC Style Manual Section 2.2.1 regarding reconditioned equipment.

2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning requirements, the subdivisions shall not be included in the article.

Required Parallel Numbering Format

XXX.1 Scope.

XXX.2 Listing Requirements.

XXX.3 Reconditioned Equipment.

XXX.3(A) Permitted to be Installed.

XXX.3(B) Not Permitted to be Installed.

The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

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Committee:	NEC-P13

Public Input No. 1067-NFPA 70-2023 [Section No. 695.3(A) [Excluding any Sub-Sections]]

Where reliable, and where capable of carrying indefinitely the sum of the locked-rotor current of the fire pump motor(s) and the pressure maintenance pump motor(s) and the full-load current of the associated fire pump accessory equipment when connected to this power supply, the power source for an electric motor driven fire pump shall be one or more of the following.

<u>Exception: Redundant fire pump systems required for high-rise buildings shall be permitted to be sized to the locked-rotor current of a single system where documentation is provided to the authority having jurisdiction demonstrating the prevention of simultaneous operation .</u>

Statement of Problem and Substantiation for Public Input

Some building codes require redundant fire pump systems required for high-rise buildings. These systems are typically interlocked. Once system will never run with the other system. However, there is no path to calculate for these system parameters in the Code currently. It ends up creating an unnecessary high cost for construction in the sizing of the system. Also, the local utility may be unable to supply adequate power.

Submitter Information Verification

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Submittal Date: Wed Jun 14 07:43:16 EDT 2023

Committee: NEC-P13

Public Input No. 971-NFPA 70-2023 [Section No. 695.5(A)]

(A) Size.

Where a transformer supplies an electric motor driven fire pump, it shall be rated at a minimum of ~~125 percent of the sum of the fire pump motor(s) and pressure maintenance pump(s) motor loads, and 100 percent of the~~ that specified in 430.21 plus 100 percent of the associated fire pump accessory equipment supplied by the transformer.

Statement of Problem and Substantiation for Public Input

Article 430, via 430.22(E), already implies that it treats every motor, unless falling under 430.22(E), as a continuous load. So, the 125% adjustment factor should not be required for motors that have the same or lower power rating than the highest-rated motor for fire pump system(s). Also, the replacement of "and" with "plus" specifies that the load requirements have to be met in combination, rather than separately.

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Submittal Date:	Wed Jun 07 15:12:15 EDT 2023
Committee:	NEC-P13

Public Input No. 972-NFPA 70-2023 [Section No. 695.5(C)(1)]

(1) Size.

Transformers shall be rated at a minimum of ~~125 percent of the sum of the fire pump motor(s) and pressure maintenance pump(s) motor loads, and 100 percent~~ that specified in 430.21 for the motor loads plus 100 percent of the remaining load supplied by the transformer.

Statement of Problem and Substantiation for Public Input

Article 430, via 430.22(E), already implies that it treats every motor, unless falling under 430.22(E), as a continuous load. So, the 125% adjustment factor should not be required for motors that have the same or lower power rating than the highest-rated motor for fire pump system(s). Also, the replacement of "and" with "plus" specifies that the load requirements have to be met in combination, rather than separately.

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Committee:	NEC-P13

Public Input No. 1676-NFPA 70-2023 [New Section after 695.6(A)(1)]

TITLE OF NEW CONTENT

Grounded conductors shall comply with section 250.24 (D).

Statement of Problem and Substantiation for Public Input

Presently section 695.6 (A) (1) of NEC 2023 refers to section 250.24 (C) for grounded conductors to be brought to the service equipment. Correct section needs to be 250.24 (D). Also, presently NEC 2023 section 695.6 (A) (1) shows it as Informational Note which is for information only and is not enforceable. As such the proposed change would make it part of the code and mandatory as required in section 250.24 (D). This will also resolve recurring issues faced at the time of plan review and inspections and will avoid costly delays and change orders.

Submitter Information Verification

Submitter Full Name: Mohinder Sood

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Submittal Date: Fri Jul 28 13:52:50 EDT 2023

Committee: NEC-P13

Public Input No. 2934-NFPA 70-2023 [Section No. 695.6(A)(1)]

(1) Services and On-Site Power Production Facilities.

Service conductors and conductors supplied by on-site power production facilities shall be physically routed outside a building(s) and shall be installed as service-entrance conductors in accordance with 230.6, 230.9, and Article 230, Parts III and IV ~~of Article 230~~ . Where supply conductors cannot be physically routed outside of buildings, the conductors shall be permitted to be routed through the building(s) where installed in accordance with 230.6(1) or (2).

Exception: The supply conductors within the fire pump room shall not be required to meet 230.6(1) or (2).

Informational Note: See 250.24(C) for routing the grounded conductor to the service equipment.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name: David Williams
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Submittal Date: Mon Aug 28 12:23:27 EDT 2023
Committee: NEC-P13

Public Input No. 3381-NFPA 70-2023 [Section No. 695.6(A)(1)]

(1) Services and On-Site Power Production Facilities.

Service conductors and conductors supplied by on-site power production facilities shall be physically routed outside a building(s) and shall be installed as service-entrance conductors in accordance with 230.6, 230.9, and Parts III and IV of Article 230. Where supply conductors cannot be physically routed outside of buildings, the conductors shall be permitted to be routed through the building(s) where installed in accordance with 230.6(1) or (2).

~~*Exception: The supply conductors within the fire pump room shall not be required to meet 230.6(1) or (2).*~~

Informational Note: See 250.24(C) for routing the grounded conductor to the service equipment.

Statement of Problem and Substantiation for Public Input

There is no requirement that a fire pump room meet 230.2(3) and 450.42. We in the North Texas area have run across a number of installations that have allowed these service conductors inside of a building flush against a sheetrock and metal framed wall that backs up to occupiable interior space. We are aware the room will have an adequate fire protection rating per NFPA 20 4.14.1.1 and 4.14.1.1.2 as well as 913.2.1 in the IBC. There is however no requirement that they maintain any protection from concussive forces that service conductors may generate under fault conditions.

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Submittal Date: Fri Sep 01 16:36:04 EDT 2023

Committee: NEC-P13

Public Input No. 3688-NFPA 70-2023 [Section No. 695.6(A)(2)]

(2) 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:

(1) *Independent Routing.* The conductors shall be kept entirely independent of all other wiring.

(2) *Associated Fire Pump Loads.* The conductors shall supply only loads that are directly associated with the fire pump system.

(3) *Protection from Potential Damage.* The conductors shall be protected from potential damage by fire, structural failure, or operational accident.

(4) *Inside of a Building.* Where routed through a building, the conductors shall be protected from fire for 2 hours using one of the following methods:

a. The cable or raceway is encased in a minimum ~~50 mm (2 in.~~ 127 mm (5 inches) of concrete and 200 ° C (392 ° F) rated conductors are used [limited to the ampacity of 194°F (90°C)] within properly rated conduit .

b. The cable or raceway is part of a listed fire-resistive cable system.

Informational Note No. 1: See UL 2196, *Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*, for one method of defining a fire-resistive cable system.

Informational Note No. 2: See UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) for identifying the system and its installation limitations to maintain a minimum 2-hour fire-resistive rating.

Informational Note No. 3: The listing organization provides information for fire-resistive cable systems on proper installation requirements to maintain the fire rating.

c. The cable or raceway is protected by a listed electrical circuit protective system.

Informational Note No. 4: See UL 1724, *Fire Tests for Electrical Circuit Protective Systems*, for one method of defining an electrical circuit protective system.

Informational Note No. 5: See UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) for identifying the system and its installation limitations to maintain a minimum 2-hour fire-resistive rating.

Informational Note No. 6: The listing organization provides information for electrical circuit protective systems on proper installation requirements to maintain the fire rating.

Exception to 695.6(A)(2)(4): 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.

Statement of Problem and Substantiation for Public Input

The NFPA Research Foundation published a report titled ‘Fire Resistance of Concrete for Electrical Conductors’ in December 2018 to provide insight to the National Electrical Code regarding concrete encasement meant to protect electrical conductors from the effects of fire.

Simply allowing concrete encasement for 2-hour fire protection as its currently written does not appear to hold the same level of scrutiny as those required for the remaining protection options as explained below:

1) The criteria to select concrete for thermal protection are either:
a. End-point heat transmission acceptance criterion of ASTM E119 limiting the temperature rise of the non-exposed concrete surface to an average of 250 F considering all measuring points or a maximum of 325 F at any single point.
b. End-point integrity acceptance criterion of ASTM E119 that prohibits the passage of flame or gases hot enough to ignite cotton waste within the selected test period.

2) Assuming that the NEC permits concrete encasement to provide 2-hour fire protection based on the end-point heat transmission acceptance criterion of item 1) a. above, as temperature of the unexposed surface could be used to relate to the ambient temperature that the conductors will be exposed to:
a. 250 °F (121.1 °C) average and 325 °F single point (162.8 °C) are higher than the rating of many conductor types listed in the NEC, and these are just the rise in temperature above the initial ambient temperature. NFPA 70 Article 310.14 (3) states that “No conductor shall be used in such a manner that its operating temperature exceeds that designated for the type of insulated conductor involved.”
b. Besides the high ambient temperature inside concrete encasement in the event of a fire, the conductors will also heat up from the internal heat generated by resistance during power transmission and they will not be able to dissipate this heat into the surrounding ambient. In a fire event, the temperature of the conductors could become higher than the temperatures found in the concrete encased environment, due to the sum of these effects.
c. Most NEC conductor types would be outside their rated temperature if used in these conditions, thus infringing NFPA 70 Article 310.14 (3).

3) Concrete thickness required to provide 2-hour protection based on end-point heat transmission is up to 5” depending on the type of aggregate used. The ‘Fire Resistance of Concrete for Electrical Conductors’ cites several sources of information where this data can be found. Of notice is ACI 216.1-07 entitled ‘Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies’ by the American Concrete Institute, where tables and graphs clearly demonstrate how concrete thicknesses vary from 3.6 inches to 5 inches to provide 2-hours of protection where the temperature rise. Using only 2 inches of concrete would cause an increase of 250 °F above the initial temperature in less than 1-hour for most concrete types, based on figure 2.3 of the ACU document mentioned above. The only 2-inches thick concrete type that is able to limit the temperature rise of 250 °F above ambient for 1-hour is insulating concrete, and again, only for 1-hour. In light of the presented concerns, it is evident that relying on 2 inches of concrete or even increasing to 5 inches, may not adequately ensure the thermal protection required to safeguard conductors during a 2-hour fire. Such an approach risks exposing conductors to temperatures far beyond their ratings and contravenes NEC safety standards.

Another proposal has been made to modify Article 230.6, where service conductors encased in 2-inches thick concrete are considered to be outside of the building. The proposed modification will clarify that that 2-inches of concrete grants mechanical protection only; fire-resistance is unrelated to this mechanical only consideration as seen in the arguments presented here that 2-inches of concrete may not provide adequate thermal protection to maintain the conductors’ insulation temperature within their rated range.

Therefore, it is important that concrete encasement be reevaluated as an option for providing 2-hour fire protection for conductors. This proposal underscores the need for a more comprehensive and safety-conscious approach to address this critical issue within the electrical code.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3697-NFPA 70-2023 [Section No. 695.14(F)]	

Public Input No. 3707-NFPA 70-2023 [Section No. 700.10(D)(2)]
Public Input No. 3716-NFPA 70-2023 [Section No. 708.10(C)(2)]

Submitter Information Verification

Submitter Full Name:	Alex Marciano
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Submittal Date:	Tue Sep 05 14:02:38 EDT 2023
Committee:	NEC-P13

Public Input No. 973-NFPA 70-2023 [Section No. 695.6(B)]

(B) Conductor Size.

(1) Fire Pump Motors and Other Equipment.

Conductors supplying a fire pump motor(s), pressure maintenance pumps, and associated fire pump accessory equipment shall have an ampacity of not less than the sum of the following:

(1) 125 percent of the sum of ~~the fire pump motor(s) and pressure maintenance motor(s) full-load current(s)~~ the largest motor plus 100% of the sum of all other motors , as determined by 430.~~6(A)~~ 21

(2) 100 percent of the associated fire pump accessory equipment full-load current(s)

(2) Fire Pump Motors Only.

Conductors supplying ~~only a fire~~ only fire pump motor(s) shall have a minimum ampacity in accordance with 430.~~22~~ 21 and shall comply with the voltage drop requirements in 695.7.

Statement of Problem and Substantiation for Public Input

Article 430, via 430.22(E), already implies that it treats every motor, unless falling under 430.22(E), as a continuous load. So, the 125% adjustment factor should not be required for motors that have the same or lower power rating than the highest-rated motor for fire pump system(s). Also, in (B), there may be more than one fire pump.

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Committee:	NEC-P13

Public Input No. 570-NFPA 70-2023 [Section No. 695.6(F)]

~~**(F)** Mechanical Protection.~~

~~All wiring from engine controllers and batteries shall be protected against physical damage and shall be installed in accordance with the controller and engine manufacturer's instructions.~~

Statement of Problem and Substantiation for Public Input

This is required by 110.3 and 110.27. See 90.3 and 4.1.1 of the Style Manual.

Submitter Information Verification

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Committee:	NEC-P13

Public Input No. 2819-NFPA 70-2023 [Section No. 695.10]

~~**695.10** Listed Equipment.~~

~~Diesel engine fire pump controllers, electric fire pump controllers, electric motors, fire pump power transfer switches, foam pump controllers, and limited service controllers shall be listed for fire pump service. [**20:** 9.5.1.1, 10.1.2.1, 12.1.3.1]~~

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document when general listing requirements are covered within an article. The NEC Style Manual Section 2.2.1 Parallel Numbering Required, states that technical committees shall use the following section numbers for the same purposes within articles. The listing requirements are to be located in the .2 section.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2818-NFPA 70-2023 [New Section after 695.1]	Deleted and relocated to the .2 section.
Public Input No. 2818-NFPA 70-2023 [New Section after 695.1]	

Submitter Information Verification

Submitter Full Name: Dean Hunter

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Submittal Date: Fri Aug 25 14:04:46 EDT 2023

Committee: NEC-P13

Public Input No. 569-NFPA 70-2023 [Section No. 695.12(C)]

(C)~~–~~ **Stationary** Storage Batteries.

~~Storage~~ Stationary 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.

Statement of Problem and Substantiation for Public Input

This PI correlates the section with 480.1 and the definitions of Article 100.

Submitter Information Verification

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Committee:	NEC-P13

Public Input No. 3697-NFPA 70-2023 [Section No. 695.14(F)]

(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. The integrity of the generator remote start circuit shall be monitored for broken, disconnected, or shorted wires. Loss of integrity shall start the generator(s).

Informational Note: See NFPA 20-2019, *Standard for the Installation of Stationary Pumps for Fire Protection*, 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. Where routed through a building, the conductors shall be protected from fire for 2 hours using one of the following methods:

(1) The cable or raceway is encased in a minimum ~~50 mm (2 in.~~ 127 mm (5 inches) of concrete and 200 ° C (392 °F) rated conductors are used [limited to the ampacity of 194°F (90°C)] within properly rated conduit .

(2) The cable or raceway is part of a listed fire-resistive cable system.

Informational Note No. 1: See UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*, for testing requirements 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.

(3) The cable or raceway is protected by a listed electrical circuit protective system.

Informational Note No. 3: See UL 1724, *Fire Tests for Electrical Circuit Protection Systems*, for testing requirements for circuit protective systems.

Informational Note No. 4: Electrical circuit protective systems could include, but are not limited to, thermal barriers or a protective shaft.

Informational Note No. 5: 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 Input

The NFPA Research Foundation published a report titled 'Fire Resistance of Concrete for Electrical Conductors' in December 2018 to provide insight to the National Electrical Code regarding concrete encasement meant to protect electrical conductors from the effects of fire.

Simply allowing concrete encasement for 2-hour fire protection as its currently written does not appear to hold the same level of scrutiny as those required for the remaining protection options as explained below:

1) The criteria to select concrete for thermal protection are either:
a. End-point heat transmission acceptance criterion of ASTM E119 limiting the temperature rise of the non-exposed concrete surface to an average of 250 F considering all measuring points or a maximum of 325 F at any single point.
b. End-point integrity acceptance criterion of ASTM E119 that prohibits the passage of flame or gases hot enough to ignite cotton waste within the selected test period.

2) Assuming that the NEC permits concrete encasement to provide 2-hour fire protection based on the end-point heat transmission acceptance criterion of item 1) a. above, as temperature of the unexposed surface could be used to relate to the ambient temperature that the conductors will be exposed to:

a. 250 °F (121.1 °C) average and 325 °F single point (162.8 °C) are higher than the rating of many conductor types listed in the NEC, and these are just the rise in temperature above the initial ambient temperature. NFPA 70 Article 310.14 (3) states that "No conductor shall be used in such a manner that its operating temperature exceeds that designated for the type of insulated conductor involved."

b. Besides the high ambient temperature inside concrete encasement in the event of a fire, the conductors will also heat up from the internal heat generated by resistance during power transmission and they will not be able to dissipate this heat into the surrounding ambient. In a fire event, the temperature of the conductors could become higher than the temperatures found in the concrete encased environment, due to the sum of these effects.

c. Most NEC conductor types would be outside their rated temperature if used in these conditions, thus infringing NFPA 70 Article 310.14 (3).

3) Concrete thickness required to provide 2-hour protection based on end-point heat transmission is up to 5" depending on the type of aggregate used. The 'Fire Resistance of Concrete for Electrical Conductors' cites several sources of information where this data can be found. Of notice is ACI 216.1-07 entitled 'Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies' by the American Concrete Institute, where tables and graphs clearly demonstrate how concrete thicknesses vary from 3.6 inches to 5 inches to provide 2-hours of protection where the temperature rise. Using only 2 inches of concrete would cause an increase of 250 °F above the initial temperature in less than 1-hour for most concrete types, based on figure 2.3 of the ACU document mentioned above. The only 2-inches thick concrete type that is able to limit the temperature rise of 250 °F above ambient for 1-hour is insulating concrete, and again, only for 1-hour.

In light of the presented concerns, it is evident that relying on 2 inches of concrete or even increasing to 5 inches, may not adequately ensure the thermal protection required to safeguard conductors during a 2-hour fire. Such an approach risks exposing conductors to temperatures far beyond their ratings and contravenes NEC safety standards.

Another proposal has been made to modify Article 230.6, where service conductors encased in 2-inches thick concrete are considered to be outside of the building. The proposed modification will clarify that that 2-inches of concrete grants mechanical protection only; fire-resistance is unrelated to this mechanical only consideration as seen in the arguments presented here that 2-inches of concrete may not provide adequate thermal protection to maintain the conductors' insulation temperature within their rated range.

Therefore, it is important that concrete encasement be reevaluated as an option for providing 2-hour fire protection for conductors. This proposal underscores the need for a more comprehensive and safety-conscious approach to address this critical issue within the electrical code.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3688-NFPA 70-2023 [Section No. 695.6(A)(2)]	Same topic

Submitter Information Verification

Submitter Full Name: Alex Marciano
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Submittal Date:	Tue Sep 05 14:19:30 EDT 2023
Committee:	NEC-P13

Public Input No. 1251-NFPA 70-2023 [New Section after 695.15]

TITLE OF NEW CONTENT

Type your content here ...

695.16. Cybersecurity

Fire Pumps that are connected to a communication network and have the capability to be controlled or permit control of any portion of the premises shall comply with either of the following:

(1) The ability to control the system is limited to a direct connection through a local nonnetworked interface.

(2) The Fire Pump is connected through a networked interface complying with both of the following methods:

a. The Fire Pump and associated software are identified as being evaluated for cybersecurity.

b. A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to cyber attacks.

The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals.

Documentation of the evaluation, assessment, identification, and certification shall be made available to those authorized to inspect, operate, and maintain the system.

Informational Note No. 1: See ANSI/ISA 62443, Cybersecurity Standards series; UL 2900, Cybersecurity Standards series; and the NIST Framework for Improving Critical Infrastructure Cybersecurity, Version 1.1, for assessment guidelines.

Informational Note No. 2: Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

(1) The ISA Security Compliance Institute (ISCI) conformity assessment program

(2) Certification of compliance by a nationally recognized test laboratory

Statement of Problem and Substantiation for Public Input

Most of the cybersecurity focus has been on IT systems. There has been very little public discussion about cybersecurity for Operational Technology (OT), but cyber attacks on OT, by both domestic and foreign actors, occur on almost a daily basis. Hackers can easily destroy unprotected equipment and shut down entire unprotected facilities. Our adversaries such as Russia, China, North Korea, and Iran, are continuously mounting cyber attacks. They understand their limits and, so far, prohibit catastrophic attacks on our financial/banking system and electrical grid. In the mean time, they attack our infrastructure, such as the southeast gas pipeline. We have the ability, and obligation, to prevent this type of damage to our infrastructure from malicious cyber attacks. This Public Input is based upon 240.6(D) and 708.7 in the 2023 NEC. Pay particular attention to the word "identified" in (2) a. "Identified" as applied to equipment, is defined 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. 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 organization concerned with product evaluation." This Public Input simply requires that a Fire Pump either not be connected to the internet, or if it is connected to the internet, that it be identified for cybersecurity and that an assessment is provided.

Submitter Information Verification

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Submittal Date:	Fri Jun 30 14:41:07 EDT 2023
Committee:	NEC-P13

Public Input No. 1521-NFPA 70-2023 [New Section after 695.15]

695.20 Locked Rotor Currents

Locked-rotor current values for listed fire pump motors shall be permitted to be selected as applicable from Table 695.20(a), Table 695.20(b) or Table 695.20(c).

Table 695.20(a) Horsepower and Locked Rotor Current Motor Designation for Three-Phase NEMA Motors

Rated Horsepower	Locked Rotor Current Three-Phase 230 V at 60 Hertz (A)*	Motor Desi (*NFPA 70* , Lo Indicating Code I and Inclu
1	30	N
1½	40	M
2	50	L
3	64	K
5	92	J
7½	127	H
10	162	H
15	232	G
20	290	G
25	365	G
30	435	G
40	580	G
50	725	G
60	870	G
75	1085	G
100	1450	G
125	1815	G
150	2170	G
200	2900	G
250	3650	G
300	4400	G
350	5100	G
400	5800	G
450	6500	G
500	7250	G

*Locked rotor current values are maximums.

Table 695.20(b) Horsepower and Locked Rotor Current Motor Designation for Single-Phase NEMA Design Motors

Rated Horsepower	Locked Rotor Current Single-Phase 115 V at 60 Hertz (A)*		Locked Rotor Current 230 V at 60 Hertz
	Design N	Design L	Design N

Table 695.20(a) Horsepower and Locked Rotor Current Motor Designation for Three-Phase NEMA Motors

Rated Horsepower	Locked Rotor Current Three-Phase 230 V at 60 Hertz (A)*		Motor Desi (*NFPA 70* , Lo Indicating Code I and Inclu
	Locked Rotor Current Single-Phase 115 V at 60 Hertz (A)*		Locked Rotor Current 230 V at 60 Hertz
Rated Horsepower	Design N	Design L	Design N
1/6	20	—	12
1/4	26	—	15
1/3	31	—	18
1/2	45	45	25
3/4	61	61	35
1	80	80	45
1½	—		—
2	—		—
3	—		—
5	—		—
7½	—		—
10	—		—

*Locked rotor current values are maximums.

Table 695.20 (c) Horsepower and Locked Rotor Current Motor Designation for Three-Phase, 380 V, 50 Hertz, NEMA Design B Motors

Rated Horsepower	Locked Rotor Current Three-Phase 380 V at 50 Hertz (A)*	Motor Designation (*NFPA 70* , Lock Indicating Code Letter) "F" to and I
1	20	P
1½	27	N
2	34	M
3	43	L
5	61	K
7½	84	J
10	107	H
15	154	H
20	194	H
25	243	H
30	289	H
40	387	H

Rated Horsepower	Locked Rotor Current Three-Phase 380 V at 50 Hertz (A)*	Motor Designation (*NFPA 70* , Locl Indicating Code Letter) "F" to and I
50	482	H
60	578	H
75	722	H
100	965	H
125	1207	H
150	1441	H
200	1927	H
250	2534	H
300	3026	H
350	3542	H
400	4046	H
450	4539	H
500	5069	H

Statement of Problem and Substantiation for Public Input

Article 695 provides requirements that demand the determination of the locked rotor current of fire pumps but does not provide clarity in regards to where to find this information. This change will provide the guidance necessary to determine the locked-rotor currents of this equipment.

NFPA 20 Section 9.5, indicates for listed fire pump motors the Code letters and corresponding locked rotor currents. The new tables in 695 proposed here are extracted from NFPA 20 and provide clarity for how to determine the locked rotor amps of these fire pump motors

Submitter Information Verification

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Affiliation: self
Street Address:
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Submittal Date: Sun Jul 23 19:02:38 EDT 2023
Committee: NEC-P13

Public Input No. 2551-NFPA 70-2023 [Section No. 695.15]

695.15 Surge Protection.

A listed surge protective device (SPD) shall be ~~installed in or on the~~ installed on the supply-side of a fire pump controller.

Informational Note: See UL 1449-2021, *Standard for Surge Protective Devices*, for proper application of SPD types.

~~*Exception: Surge-protective devices shall not be required in or on a fire pump controller for diesel fire pumps.*~~

Statement of Problem and Substantiation for Public Input

This public input deletes the exception as transient overvoltages and surge currents can have a detrimental impact on fire pump controllers where the fire pump is electric driven or diesel driven. The safety and reliability of all fire pump controllers and fire pumps is essential for the life and property safety during a fire event. As cited in the Fire Protection Research Foundation (FPRF) report Data Assessment for Electrical Surge Protective Devices, a survey of facility managers conducted by the National Electrical Manufacturers Association (NEMA) for the years 2013 and 2014 documented that 12 percent of the respondents indicated they had experienced surge damage to fire pump associated equipment. To avoid a conflict the related UL product safety standards and other related NFPA standards, the location of the SPD “in or on” the fire pump controller is changed to “on the supply-side” to correct this conflict.

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Public Input No. 2396-NFPA 70-2023 [Article 700]

Article 700 Emergency Standby Systems

Part I. General

700.1 Scope.

This article applies to the electrical safety of the installation, operation, and maintenance of emergency systems consisting of circuits and equipment intended to supply, distribute, and control electricity for illumination, power, or both, to required facilities when the normal electrical supply or system is interrupted.

> Informational Note No. 1: Emergency systems are generally installed in places of assembly where artificial illumination is required for safe exiting and for panic control in buildings subject to occupancy by large numbers of persons, such as hotels, theaters, sports arenas, health care facilities, and similar institutions. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, fire detection and alarm systems, elevators, fire pumps, public safety communications systems, industrial processes where current interruption would produce serious life safety or health hazards, and similar functions.

> Informational Note No. 2: See Article 517, Health Care Facilities, for further information regarding wiring and installation of emergency systems in health care facilities.

> Informational Note No. 3: See NFPA 99-2018, *Health Care Facilities Code*, for further information regarding performance and maintenance of emergency systems in health care facilities.

> Informational Note No. 4: See NFPA *101*-2018, *Life Safety Code*, for specification of locations where emergency lighting is considered essential to life safety.

> Informational Note No. 5: See NFPA 110-2019, *Standard for Emergency and Standby Power Systems*, and NFPA 111-2019, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, for further information regarding performance of emergency and standby power systems. Emergency systems are considered Level 1 systems when applying NFPA 110.

700.2 Reconditioned Equipment.

Reconditioned transfer switches shall not be permitted.

700.3 Tests and Maintenance.

(A) Commissioning Witness Test.

The authority having jurisdiction shall conduct or witness the commissioning of the complete system upon installation and periodically afterward.

> Informational Note: See NECA 90, *Standard for Commissioning Building Electrical Systems*.

(B) Tested Periodically.

Systems shall be tested periodically on a schedule approved by 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.

(E) Testing Under Load.

Means for testing all emergency lighting and power systems during maximum anticipated load conditions shall be provided.

> Informational Note: See NFPA 110-2019, *Standard for Emergency and Standby Power Systems*, for information on testing and maintenance of emergency power supply systems (EPSSs).

(F) 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 will be disabled for maintenance or repair, the emergency system shall include permanent switching means to connect a portable or temporary alternate source of power that shall be available for the duration of the maintenance or repair. The permanent switching means to connect a portable or temporary alternate source of power shall comply with the following:

(1) Connection to the portable or temporary alternate source of power shall not require modification of the permanent system wiring.

(2) Transfer of power between the normal power source and the emergency power source shall be in accordance with 700.12.

(3) The connection point for the portable or temporary alternate source shall be marked with the phase rotation and system bonding requirements.

(4) The switching means, including the interlocks, shall be listed and provided with mechanical or mechanical and electrical interlocking to prevent inadvertent interconnection of power sources.

(5) The switching means shall include a contact point that shall annunciate at a location remote from the generator or at another facility monitoring system to indicate that the permanent emergency source is disconnected from the emergency system.

(6) The permanent connection point for the temporary generator shall be located outdoors and shall not have cables from the connection point to the temporary generator routed through exterior windows, doors, or similar openings.

(7) A permanent label shall be field applied at the permanent connection point to identify the system voltage, maximum amperage, short-circuit current rating of the load side of equipment supplied, and ungrounded conductor identification in accordance with 210.5.

It shall be permissible to use manual switching to switch from the permanent source of power to the portable or temporary alternate source of power and to use the switching means for connection of a load bank.

Informational Note: See Informational Note Figure 700.3(F) for one example of many possible methods to achieve the requirements of 700.3(F).

Figure Informational Note Figure 700.3(F)

Exception: The permanent switching means to connect a portable or temporary alternate source of power for the duration of the maintenance or repair shall not be required where any 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 protection 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.

700.4 Capacity and Rating.

(A) Capacity.

An emergency system shall have adequate capacity in accordance with Parts I through IV of Article 220 or by another approved method. The system capacity shall be sufficient for the rapid load changes and transient power and energy requirements associated with any expected loads.

(B) Selective Load Management.

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 load management (that includes automatic selective load pickup and load shedding) is provided as needed to ensure adequate power to the following in order of priority:

(1) Emergency circuits

(2) Legally required standby circuits

(3) Optional standby circuits

(C) Parallel Operation.

Parallel operation of the emergency source(s) shall consist of the sources specified in 700.4(C)(1) and (C)(2).

(1) Normal Source.

The emergency source shall be permitted to operate in parallel with the normal source in compliance with Part I or Part II of Article 705 where the capacity required to supply the emergency load is maintained at all times. Any operating condition that results in less than the required emergency source capacity shall initiate a system malfunction signal in accordance with 700.6(A).

Parallel operation shall be permitted for satisfying the test requirements of 700.3(B), provided all other conditions of 700.3 are met.

Informational Note: Peak load shaving is one application for parallel source operation.

(2) Emergency Source.

Emergency sources shall be permitted to operate in parallel where the necessary equipment to establish and maintain a synchronous condition is provided.

700.5 Transfer Equipment.

(A) General.

Transfer equipment shall be automatic, listed, and marked for emergency use. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and emergency 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. Meter-mounted transfer switches shall not be permitted for emergency system use.

(B) Bypass Isolation Transfer Switches.

Means shall be permitted to bypass and isolate the transfer equipment. Where bypass isolation transfer switches are used, inadvertent parallel operation shall be prevented.

(C) Automatic Transfer Switches.

Automatic transfer switches shall be electrically operated and mechanically held.

(D) Redundant Transfer Equipment.

If emergency loads are supplied by a single feeder, the emergency power system shall include redundant transfer equipment or a bypass isolation transfer switch to facilitate maintenance as required in 700.3(C) without jeopardizing continuity of power. If the redundant transfer equipment or bypass isolation transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair.

Exception: The requirement for redundancy with the transfer equipment shall not apply where any of the following conditions exist:

(1) All processes that rely on the emergency system source are capable of being disabled during maintenance or repair activities without jeopardizing the safety to human life.

(2) The building or structure is unoccupied and fire protection systems are fully functional and do not require an alternate power source.

(3) Other temporary means shall be permitted to be substituted for the emergency system.

(4) A written emergency plan that includes mitigation actions and responsibilities for qualified persons to address the recognized site hazards for the duration of the maintenance or repair activities shall be developed and implemented. The emergency plan shall be made available to the authority having jurisdiction.

(E) Use.

Transfer equipment shall supply only emergency loads.

Informational Note: Transfer equipment that supplies emergency loads provides separation of this load type from any others and is independent of any equipment used to combine or parallel sources.

(F) 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.

700.6 Signals.

Audible, visual, and facility or network remote annunciation devices shall be provided, where applicable, for the purpose described in 700.6(A) through (D).

(A) Malfunction.

Malfunction signals indicate a malfunction of the emergency source.

(B) Carrying Load.

Load carrying signals indicate that the emergency source is carrying load.

(C) Storage Battery Charging Malfunction.

Storage battery charging malfunction signals indicate a charging malfunction on a battery required for source readiness, including starting the prime mover, is not functioning.

(D) Ground Fault.

Ground-fault signals indicate a ground fault in solidly grounded wye emergency 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 emergency 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 the 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 and the system bonding jumper shall be permitted to be at an alternative location.

700.7 Signs.

(A) Emergency Sources.

A sign shall be placed at the service-entrance equipment, indicating type and location of each on-site emergency power source.

Exception: A sign shall not be required for individual unit equipment as specified in 700.12(H).

(B) Grounding.

Where removal of a grounding or bonding connection in normal power source equipment interrupts the grounding electrode conductor connection to the alternate power source(s) grounded conductor, a warning sign shall be installed at the normal power source equipment stating:

WARNING

SHOCK HAZARD EXISTS IF GROUNDING

ELECTRODE CONDUCTOR OR BONDING JUMPER

CONNECTION IN THIS EQUIPMENT IS REMOVED

WHILE ALTERNATE SOURCE(S) IS ENERGIZED.

The warning sign(s) or label(s) shall comply with 110.21(B).

700.8 Surge Protection.

A listed SPD shall be installed in or on all emergency system switchgear, switchboards, and panelboards.

Part II. Circuit Wiring

700.10 Wiring, Emergency System.

(A) Identification.

Emergency circuits shall be permanently marked so they will be readily identified as a component of an emergency circuit or system by the following methods:

(1) All boxes and enclosures (including transfer switches, generators, and power panels) for emergency circuits shall be permanently marked as a component of an emergency circuit or system.

(2) Where boxes or enclosures are not encountered, exposed cable or raceway systems shall be permanently marked to be identified as a component of an emergency circuit or system, at intervals not to exceed 7.6 m (25 ft).

Receptacles supplied from the emergency system shall have a distinctive color or marking on the receptacle cover plates or the receptacles.

(B) Wiring.

Wiring from an emergency source or emergency source distribution overcurrent protection to emergency loads shall be kept entirely independent of all other wiring and equipment unless otherwise permitted in the following:

(1) Wiring from the normal power source located in transfer equipment enclosures

(2) Wiring supplied from two sources in exit or emergency luminaires

(3) Wiring from two sources in a listed load control relay supplying exit or emergency luminaires, or in a common junction box, attached to exit or emergency luminaires

(4) Wiring within a common junction box attached to unit equipment, containing only the branch circuit supplying the unit equipment and the emergency circuit supplied by the unit equipment

(5) Wiring within a traveling cable to an elevator

(6) Wiring from an emergency source to supply emergency and other (nonemergency) loads in accordance with the following:

- (7) Separate vertical switchgear sections or separate vertical switchboard sections, with or without a common bus, or individual disconnects mounted in separate enclosures shall be used to separate emergency loads from all other loads.
- (8) The common bus of separate sections of the switchgear, separate sections of the switchboard, or the individual enclosures shall be either of the following:
  - (9) Supplied by single or multiple feeders without overcurrent protection at the source
  - (10) Supplied by single or multiple feeders with overcurrent protection, provided that the overcurrent protection that is common to an emergency system and any nonemergency system(s) is selectively coordinated with the next downstream overcurrent protective device in the nonemergency system(s)

Informational Note: See Informational Note Figure 700.10(B)(1) and Informational Note Figure 700.10(B)(2) for further information.

Figure Informational Note Figure 700.10(B)(1) Single or Multiple Feeders Without Overcurrent Protection.

Figure Informational Note Figure 700.10(B)(2) Single or Multiple Feeders with Overcurrent Protection.

(11) Emergency circuits shall not originate from the same vertical switchgear section, vertical switchboard section, panelboard enclosure, or individual disconnect enclosure as other circuits.

(12) It shall be permissible to use single or multiple feeders to supply distribution equipment between an emergency source and the point where the emergency loads are separated from all other loads.

(13) At the emergency power source, such as a generator, multiple integral overcurrent protective devices shall each be permitted to supply a designated emergency or a designated nonemergency load, provided that there is complete separation between emergency and nonemergency loads beginning immediately after the overcurrent protective device line-side connections.

Wiring of two or more emergency circuits supplied from the same source shall be permitted in the same raceway, cable, box, or cabinet.

(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.

(D) Fire Protection.

(1) Occupancies.

Emergency systems shall meet the additional requirements in 700.10(D)(2) through (D)(4) in the following occupancies:

(1) Assembly occupancies for not less than 1000 persons

(2) Buildings above 23 m (75 ft) in height

(3) Educational occupancies with more than 300 occupants

(2) Feeder-Circuit Wiring.

Feeder-circuit wiring shall meet one of the following conditions:

(1) The cable or raceway is installed in spaces or areas that are fully protected by an approved automatic fire protection 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: See UL 1724, *Fire Tests for Electrical Circuit Protection Systems,* for one method of defining an electrical circuit protective system. The UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain a minimum 2-hour fire-resistive rating and is available from the certification body.

(3) The cable or raceway is a listed fire-resistive cable system with a minimum 2-hour fire rating.

Informational Note No. 2: See UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*, for one method of defining a fire-resistive cable system.

(4) The cable or raceway is protected by a listed fire-rated assembly that has a minimum fire rating of 2 hours and contains only emergency circuits.

(5) The cable or raceway is encased in a minimum of 50 mm (2 in.) of concrete.

(3) Feeder-Circuit Equipment.

Equipment for feeder circuits (including transfer switches, transformers, and panelboards) shall be located either in spaces fully protected by an approved automatic fire protection system or in spaces with a 2-hour fire resistance rating.

(4) Source Control Wiring.

Control conductors installed between the emergency power supply system/stored-energy power supply system (EPSS/SEPSS) and transfer equipment or control systems that initiate the operation of emergency sources or initiate the automatic connection to emergency loads shall be kept entirely independent of all other wiring and shall meet the conditions of 700.10(D)(2). The integrity of source control wiring shall be monitored for broken, disconnected, or shorted wires. Loss of integrity shall result in the following actions:

(1) *Generators*. Shall start the generator(s).

(2) *All other sources*. Shall be considered a system malfunction and initiate the designated signal(s) in 700.6(A).

700.11 Wiring, Class-2-Powered Emergency Lighting Systems.

(A) General.

Line voltage supply wiring and installation of Class 2 emergency lighting control devices shall comply with 700.10. Class 2 emergency circuits shall comply with 700.11(B) through (D).

(B) Identification.

Emergency circuits shall be permanently marked so they will be readily identified as a component of an emergency circuit or system by the following methods:

(1) All boxes and enclosures for Class 2 emergency circuits shall be permanently marked as a component of an emergency circuit or system.

(2) Exposed cable, cable tray, or raceway systems shall be permanently marked to be identified as a component of an emergency circuit or system, within 900 mm (3 ft) of each connector and at intervals not to exceed 7.6 m (25 ft).

(C) Separation of Circuits.

Class 2 emergency circuits shall be wired in a listed, jacketed cable or with one of the wiring methods of Chapter 3. If installed alongside nonemergency Class 2 circuits that are bundled, Class 2 emergency circuits shall be bundled separately. If installed alongside nonemergency Class 2 circuits that are not bundled, Class 2 emergency circuits shall be separated by a nonconductive sleeve or nonconductive barrier from all other Class 2 circuits. Separation from other circuits shall comply with 725.136.

(D) Protection.

Wiring shall comply with the requirements of 300.4 and be installed in a raceway, armored or metal-clad cable, or cable tray.

Exception No. 1: Section 700.11(D) shall not apply to wiring that does not exceed 1.83 m (6 ft) in length and that terminates at an emergency luminaire or an emergency lighting control device.

Exception No. 2: Section 700.11(D) shall not apply to locked rooms or locked enclosures that are accessible only to qualified persons.

Informational Note: Locked rooms accessible only to qualified persons include locked telecommunications rooms, locked electrical equipment rooms, or other access-controlled areas.

Part III. Sources of Power

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(C) through (H). Unit equipment in accordance with 700.12(H) shall satisfy the applicable requirements of this article.

(A) Power Source Considerations.

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.

(B) Equipment Design and Location.

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(C) through (H) shall be installed either in spaces fully protected by approved automatic fire protection systems or in spaces with a 2-hour fire rating where located within the following:

(1) Assembly occupancies for more than 1000 persons

(2) Buildings above 23 m (75 ft) in height

(3) Educational occupancies with more than 300 occupants

Informational Note No. 1: See NFPA *101*-2021, *Life Safety Code*, Section 6.1, for information on occupancy classifications.

Informational Note No. 2: See IEEE 3006.5-2014, *Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems*, for information regarding power system reliability.

(C) Supply Duration.

The emergency power source shall be of suitable rating and capacity to supply and maintain the total load for the duration determined by the system design. In no case shall the duration be less than 2 hours of system operation unless used for emergency illumination in 700.12(C)(4) or unit equipment in 700.12(H). Additionally, the power source shall comply with 700.12(C)(1) through (C)(5) as applicable.

Informational Note: See NFPA 110-2022, *Standard for Emergency and Standby Power Systems,* for information on classification of emergency power supply systems (EPSS).

(1) On-Site Fuel Supply.

An on-site fuel supply shall be provided, sufficient for not less than 2 hours operation of the system.

(2) Fuel Transfer Pumps.

Where power is needed for the operation of the fuel transfer pumps to deliver fuel to the source, these pumps shall be connected to the emergency power system.

(3) Public Gas System, Municipal Water Supply.

Sources shall not be solely dependent on a public utility gas system for their fuel supply or municipal water supply for their cooling systems.

Exception: Where approved by the authority having jurisdiction, the use of other than on-site fuels shall be permitted where there is a low probability of a simultaneous failure of both the off-site fuel delivery system and power from the outside electrical utility company. Where the public gas system is approved, the requirements of 700.12(C)(1) shall not apply.

(4) Storage Batteries and UPS.

Storage batteries and UPS used to supply emergency illumination shall be of suitable rating and capacity to supply and maintain the total load for a minimum period of 1½ hours, without the voltage applied to the load falling below 87½ percent of nominal voltage. Automotive-type batteries shall not be used. An automatic battery charging means shall be provided.

(5) Automatic Fuel Transfer

Where dual fuel sources are used, means shall be provided for automatically transferring from one fuel source to another.

(D) Generator Set.

(1) Prime Mover-Driven.

For a generator set driven by a prime mover approved by the authority having jurisdiction and sized in accordance with 700.4, means shall be provided for automatically starting the prime mover on failure of the normal power source and for automatic transfer and operation of all required electrical circuits. A time-delay feature shall be provided to avoid retransfer in case of short-time reestablishment of the normal source.

(2) Battery Power and Dampers.

Where a storage battery is used for control or signal power or as the means of starting the prime mover, it shall be suitable for the purpose and shall be equipped with an automatic charging means independent of the generator set. Where the battery charger is required for the operation of the generator set, it shall be connected to the emergency system. Where power is required for the operation of dampers used to ventilate the generator set, the dampers shall be connected to the emergency system.

(3) Auxiliary Power Supply.

Generator sets that require more than 10 seconds to develop power shall be permitted if an auxiliary power supply energizes the emergency system until the generator can pick up the load.

(4) Outdoor Generator Sets.

Where an outdoor-housed generator set is equipped with a readily accessible disconnecting means in accordance with 445.18, and the disconnecting means is located within sight of the building or structure supplied, an additional disconnecting means shall not be required where ungrounded conductors serve or pass through the building or structure. Where the generator supply conductors terminate at a disconnecting means in or on a building or structure, the disconnecting means shall meet the requirements of 225.36.

Exception: For installations under single management, where conditions of maintenance and supervision ensure that only qualified persons will monitor and service the installation and where documented safe switching procedures are established and maintained for disconnection, the generator set disconnecting means shall not be required to be located within sight of the building or structure served.

(E) Stored-Energy Power Supply Systems (SEPSS).

Stored energy power supply systems shall comply with 700.12(E)(1) and (E)(2).

(1) Types.

Systems shall consist of one or more of the following system types:

(1) Uninterruptible power supply (UPS)

Informational Note: See UL 1778, *Uninterruptible Power Systems*, for further information.

(2) Fuel cell system

(3) Energy storage system (ESS)

(4) Storage battery

(5) Other approved equivalent stored energy sources that comply with 700.12

(2) Fire Protection, Suppression, Ventilation, and Separation.

The systems in 700.12(E)(1) shall be installed with the fire protection, suppression, ventilation, and separation requirements specified in the manufacturer’s instructions or equipment listing.

Informational Note: See NFPA 853-2020, *Standard for the Installation of Stationary Fuel Cell Power Systems,* and NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems,* for additional information on fire protection installation requirements.

(F) Separate Service.

Where approved by the authority having jurisdiction as suitable for use as an emergency source of power, an additional service shall be permitted. This service shall be in accordance with the applicable provisions of Article 230 and the following additional requirements:

(1) Separate overhead service conductors, service drops, underground service conductors, or service laterals shall be installed.

(2) The service conductors for the separate service shall be installed sufficiently remote electrically and physically from any other service conductors to minimize the possibility of simultaneous interruption of supply.

(G) Microgrid Systems.

On-site sources, designated as emergency sources, shall be permitted to be connected to a microgrid system.

The system shall isolate the emergency system from all nonemergency loads when the normal electric supply is interrupted or shall meet the requirements of 700.4(B). Interruption or partial or complete failure of the normal or nonemergency source(s) shall not impact the availability, capacity, and duration provided by the designated emergency sources.

The designated stored-energy electrical emergency power source(s) of a microgrid system shall be permitted to remain interconnected to any available power production source during operation of the emergency source(s) where the lack of, or failure of, the interconnected power production source(s), or related controls, does not impact system operation. Interconnected power production sources, other than the designated stored emergency power source(s), shall not be required to meet the requirements of this article.

(H) Battery-Equipped Emergency Luminaires.

(1) Listing.

All battery-equipped emergency luminaires shall be listed.

> Informational Note No. 1: See ANSI/UL 924, *Emergency Lighting and Power Equipment*, for the requirements covering battery-equipped emergency luminaires and emergency battery packs. A listed emergency battery pack installed in a listed luminaire will provide similar functionality as a listed battery-equipped emergency luminaire.

> Informational Note No. 2: Unit equipment is a type of battery-equipped emergency luminaire.

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

    a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

    b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area’s normal lighting branch circuit ahead of any local switches.

    c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

Part IV. Emergency System Circuits for Lighting and Power

700.15 Loads on Emergency Branch Circuits.

No appliances and no lamps, other than those specified as required for emergency use, shall be supplied by emergency lighting circuits.

700.16 Emergency Illumination.

(A) General.

Emergency illumination shall include means of egress lighting, illuminated exit signs, and all other luminaires specified as necessary to provide required illumination.

(B) System Reliability.

Emergency lighting systems shall be designed and installed so that the failure of any illumination source cannot leave in total darkness any space that requires emergency illumination. Emergency lighting control devices in the emergency lighting system shall be listed for use in emergency systems. Listed unit equipment in accordance with 700.12(H) shall be considered as meeting the provisions of this section.

Informational Note: See 700.23 through 700.26 for applications of emergency system control devices.

(C) Discharge Lighting.

Where high-intensity discharge lighting such as high- and low-pressure sodium, mercury vapor, and metal halide is used as the sole source of normal illumination, the emergency lighting system shall be required to operate until normal illumination has been restored.

(D) Disconnecting Means.

Where an emergency system is installed, emergency illumination shall be provided in the area of the disconnecting means required by 225.31 and 230.70, as applicable, where the disconnecting means are installed indoors.

Exception: Alternative means that ensure that the emergency lighting illumination level is maintained shall be permitted.

700.17 Branch Circuits for Emergency Lighting.

Branch circuits that supply emergency lighting shall be installed to provide service from a source complying with 700.12 when the normal supply for lighting is interrupted. Such installations shall provide either of the following:

(1) An emergency lighting supply, independent of the normal lighting supply, with provisions for automatically transferring the emergency lights upon the event of failure of the normal lighting supply.

(2) Two or more branch circuits supplied from separate and complete systems with independent power sources. One of the two power sources and systems shall be part of the emergency system, and the other shall be permitted to be part of the normal power source and system. Each system shall provide sufficient power for emergency lighting purposes.

Unless both systems are used for regular lighting purposes and both are kept lighted, means shall be provided for automatically energizing either system upon failure of the other. Either system or both systems shall be permitted to be a part of the general lighting of the protected occupancy if circuits supplying lights for emergency illumination are installed in accordance with other sections of this article.

700.18 Circuits for Emergency Power.

For branch circuits that supply equipment classed as emergency, there shall be an emergency system supply source to which the load will be transferred automatically upon the failure of the normal supply.

700.19 Multiwire Branch Circuits.

The branch circuit serving emergency lighting and power circuits shall not be part of a multiwire branch circuit.

Part V. Control — Emergency Lighting Circuits

700.20 Switch Requirements.

The switch or switches installed in emergency lighting circuits shall be arranged so that only authorized persons have control of emergency lighting.

Exception No. 1: Where two or more single-throw switches are connected in parallel to control a single circuit, at least one of these switches shall be accessible only to authorized persons.

Exception No. 2: Additional switches that act only to put emergency lights into operation but not disconnect them shall be permissible.

Switches connected in series or 3- and 4-way switches shall not be used.

700.21 Switch Location.

All manual switches for controlling emergency circuits shall be in locations convenient to authorized persons responsible for their actuation. In facilities covered by Articles 518 and 520, a switch for controlling emergency lighting systems shall be located in the lobby or at a place conveniently accessible thereto.

In no case shall a control switch for emergency lighting be placed in a motion-picture projection booth or on a stage or platform.

Exception: Where multiple switches are provided, one such switch shall be permitted in such locations where arranged so that it can only energize the circuit but cannot de-energize the circuit.

700.22 Exterior Lights.

Those lights on the exterior of a building that are not required for illumination when there is sufficient daylight shall be permitted to be controlled by an automatic light-actuated device.

700.23 Dimmer and Relay Systems.

A dimmer or relay system containing more than one dimmer or relay and listed for use in emergency systems shall be permitted to be used as a control device for energizing emergency lighting circuits. Upon failure of normal power, the dimmer or relay system shall be permitted to selectively energize only those branch circuits required to provide minimum emergency illumination using a control bypass function. Where the dimmer or relay system is fed by a normal/emergency power source from an upstream transfer switch, normal power sensing for this function shall be permitted to be from a normal-only power source upstream of the transfer switch. All branch circuits supplied by the dimmer or relay system cabinet shall comply with the wiring methods of Part II of Article 700.

700.24 Directly Controlled Emergency Luminaires.

Where emergency illumination is provided by one or more directly controlled emergency luminaires that, upon loss of normal power, respond to an external control input to establish the required emergency illumination level, such directly controlled emergency luminaries shall be listed for use in emergency systems. Luminaires that are energized to the required emergency illumination level by disconnection of their control input by a listed emergency lighting control device shall not be required to be listed for use in emergency systems.

700.25 Branch Circuit Emergency Lighting Transfer Switch.

Emergency lighting loads supplied by branch circuits rated at not greater than 20 amperes shall be permitted to be transferred from the normal branch circuit to an emergency branch circuit using a listed branch circuit emergency lighting transfer switch. The mechanically held requirement of 700.5(C) shall not apply to listed branch circuit emergency lighting transfer switches.

700.26 Automatic Load Control Relay.

If an emergency lighting load is automatically energized upon loss of the normal supply, a listed automatic load control relay shall be permitted to energize the load. The load control relay shall not be used as transfer equipment.

700.27 Class 2 Powered Emergency Lighting Systems.

Devices that combine control signals with Class 2 emergency power on a single circuit shall be listed as emergency lighting control devices.

> Informational Note: An example of a device combining control signals with Class 2 emergency power sources is a Power over Ethernet (PoE) switch.

Part VI. Overcurrent Protection

700.30 Accessibility.

The branch-circuit overcurrent devices in emergency circuits shall be accessible to authorized persons only.

700.31 Ground-Fault Protection of Equipment.

The alternate source for emergency systems shall not be required to provide ground-fault protection of equipment with automatic disconnecting means. Ground-fault indication at the emergency source shall be provided in accordance with 700.6(D) if ground-fault protection of equipment with automatic disconnecting means is not provided.

700.32 Selective Coordination.

(A) General.

Emergency system(s) overcurrent protective devices (OCPDs) shall be selectively coordinated with all supply-side and load-side OCPDs.

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.

(B) Replacements.

Where emergency system(s) OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

(C) Modifications.

If modifications, additions, or deletions to the emergency system(s) occur, selective coordination of the emergency system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note: See Informational Note Figure 700.32(C) for an example of how emergency system OCPDs selectively coordinate with all supply-side OCPDs.

OCPD D selectively coordinates with OCPDs C, F, E, B, and A.

OCPD C selectively coordinates with OCPDs F, E, B, and A.

OCPD F selectively coordinates with OCPD E.

OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not an emergency system OCPD.

Figure Informational Note Figure 700.32(C) Emergency System Selective Coordination.

Statement of Problem and Substantiation for Public Input

Adding 'Standby' to the title to make it consistent with Article 701 Legally Required Standby Systems and Article 702 Optional Standby Systems. All three of these systems have different purposes but all three systems are standby and turn on once loss of power.

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Public Input No. 3094-NFPA 70-2023 [Section No. 700.1]

700.1 Scope.

This article applies to the electrical safety of the installation, operation, and maintenance of emergency systems consisting of circuits and equipment intended to supply, distribute, and control electricity for illumination, power, or both, to required facilities when the normal electrical supply or system is interrupted.

Informational Note No. 1: Emergency systems are generally installed in places of assembly where artificial illumination is required for safe exiting and for panic control in buildings subject to occupancy by large numbers of persons, such as hotels, theaters, sports arenas, health care facilities, and similar institutions. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, fire detection and alarm systems, elevators, fire pumps, public safety communications systems, industrial processes where current interruption would produce serious life safety or health hazards, and similar functions.

Informational Note No. 2: See Article 517, Health Care Facilities, for further information regarding wiring and installation of emergency systems in health care facilities.

Informational Note No. 3: See NFPA 99-2018, *Health Care Facilities Code*, for further information regarding performance and maintenance of emergency systems in health care facilities.

Informational Note No. 4: See NFPA *101*-2018, *Life Safety Code*, for specification of locations where emergency lighting is considered essential to life safety.

Informational Note No. 5: See NFPA 110-2019, *Standard for Emergency and Standby Power Systems*, and NFPA 111-2019, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, for further information regarding performance of emergency and standby power systems. Emergency systems are considered Level 1 systems when applying NFPA 110.

Informational Note No. 6: Definitions. Each of the following terms has a definition in Article 100 that is unique to its use in Article 700:

Control Device, Emergency Lighting (ELCD) (Emergency Lighting Control Device)

Emergency Luminaire, Directly Controlled (DCL) (Directly Controlled Emergency Luminaire)

Luminaire, Directly Controlled (DCL) (Directly Controlled Luminaire)

Normal/Emergency Power Source

Relay, Automatic Load Control (Automatic Load Control Relay)

Transfer Switch, Branch-Circuit Emergency Lighting (BCELTS) (Branch-Circuit Emergency Lighting Transfer Switch)

Informational Note No. 7: Definitions. Each of the following terms has a definition in Article 100 that appears in several articles but is important in its use in Article 700:

Battery

Battery, Flow

Battery, Sealed

Battery, Stationary Standby (Stationary Standby Battery)

Cell (as applied to batteries)

Cell, Sealed (Sealed Cell)

Charge Controller

Control

Commissioning

Control Circuits, Fault-Tolerant External. (Fault-Tolerant External Control Circuits)

Diversion Controller (Diversion Charge Controller) (Diversion Load Controller)

Electrolyte

Emergency Luminaire, Battery-Equipped (Battery-Equipped Emergency Luminaire)

Emergency Power Supply (EPS)

Emergency Power Supply System (EPSS)

Emergency Systems

Transfer Switch

Transfer Switch, Bypass Isolation. (Bypass Isolation Transfer Switch)

Transfer Switch, Meter-Mounted (Meter-Mounted Transfer Switch)

Uninterruptible Power Supply (UPS)

Unit Equipment

Statement of Problem and Substantiation for Public Input

The change to locations of definitions in the 2023 Edition of the NEC was controversial for many people because it reduced usability. Even though other NFPA standards use this structure and was stated as a justification to the change in the 'NEC Style Manual' (some NFPA codes and standards include definitions within articles *), many believe this relocation leads to confusion among users, especially for those articles that are specialty topics – i.e., the articles in Chapters 5 through 8. There are over 37 pages of definitions in Article 100 to search through.

Common language terms often have more specific meanings within an article. One only needs to look at the multiple definitions for 'Portable Equipment' to get a sense of this issue. While the term 'Directly Controlled Emergency Luminaire' seems self-explanatory, the actual definition is quite important, especially in comparison to the new (proposed) definition for 'Directly controlled Luminaire' (Public Input #1621). Without the proximate reference within Article 700, that distinction is not clear.

Under the current structure, important specialty definitions are lost in the sheer size of the Article 100 list. The usability of the NEC has been damaged, and users of specialty articles in Chapters 5 through 8 need help with this structure.

There are several acronyms proposed to be included with some definitions under different Public Inputs #1620, #1622, #1623, and #1625), and a new definition under Public Input #1621.

To restore the usability of the NEC, what is needed is a way to clearly identify and point to specialty definitions in a standardized location within articles, while leaving the definitions themselves in Article 100. NFPA Link and the NEC Handbook add this information as Enhanced Content. Additionally, this "definition identification" model has proven its usability in other codes such as NFPA 1, NFPA 99, and NFPA 101. The NEC deserves no less.

* Example: NFPA 101 – Section 6.1.2.1 ‘Assembly Occupancy’ is one of several definitions in an Article; and in this instance it is duplicated from 3.3.205.2]. In fact, there are multiple definitions throughout NFPA 101.

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Public Input No. 3326-NFPA 70-2023 [Section No. 700.1]

700.1 Scope.

This article applies to the electrical safety of the installation, operation, and maintenance of emergency systems consisting of circuits and equipment intended to supply, distribute, and control electricity for illumination, power, or both, to required facilities when the normal electrical supply or system is interrupted.

Informational Note No. 1: Emergency systems are generally installed in places of assembly where artificial illumination is required for safe exiting and for panic control in buildings subject to occupancy by large numbers of persons, such as hotels, theaters, sports arenas, health care facilities, and similar institutions. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, fire detection and alarm systems, elevators, fire pumps, public safety communications systems, industrial processes where current interruption would produce serious life safety or health hazards, and similar functions.

Informational Note No. 2: See Article 517, ~~Health Care Facilities~~ Parts I through IV , for ~~further information regarding wiring~~ requirements on wiring and installation of emergency systems in health care facilities.

Informational Note No. 3: See NFPA 99-2018, *Health Care Facilities Code*, for further information regarding performance and maintenance of emergency systems in health care facilities.

Informational Note No. 4: See NFPA *101*-2018, *Life Safety Code*, for specification of locations where emergency lighting is considered essential to life safety.

Informational Note No. 5: See NFPA 110-2019, *Standard for Emergency and Standby Power Systems*, and NFPA 111-2019, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, for further information regarding performance of emergency and standby power systems. Emergency systems are considered Level 1 systems when applying NFPA 110.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the NEC(r) Style Manual prohibits referencing an entire article with the exception of Article 100 or where required for context. In this case, it is suggested that we point the user to Parts I through IV of Article 517 as it appears the requirements described would be found in those parts. The language "further information regarding" was revised to "requirements on" as these are requirements in a health care facility, not just further information.

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Public Input No. 4393-NFPA 70-2023 [Section No. 700.1]

700.1 Scope.

This article applies to the electrical safety of the installation, operation, and maintenance of emergency systems consisting of circuits and equipment intended to supply, distribute, and control electricity for illumination, power, or both, to required facilities when the normal electrical supply or system is interrupted.

Informational Note No. 1: Emergency systems are generally installed in places of assembly where artificial illumination is required for safe exiting and for panic control in buildings subject to occupancy by large numbers of persons, such as hotels, theaters, sports arenas, health care facilities, and similar institutions. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, fire detection and alarm systems, elevators, fire pumps, public safety communications systems, industrial processes where current interruption would produce serious life safety or health hazards, and similar functions.

Informational Note No. 2: See Article 517, Health Care Facilities, for further information regarding wiring and installation of emergency systems in health care facilities.

Informational Note No. 3: See NFPA 99-2018, *Health Care Facilities Code*, for further information regarding performance and maintenance of emergency systems in health care facilities.

Informational Note No. 4: See NFPA *101*-2018, *Life Safety Code*, for specification of locations where emergency lighting is considered essential to life safety.

Informational Note No. 5: See NFPA 110-2019, *Standard for Emergency and Standby Power Systems*, and NFPA 111-2019, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, for further information regarding performance of emergency and standby power systems. Emergency systems are considered Level 1 systems when applying NFPA 110.

<u>Informational Note No. 6: For further information regarding power systemreliability, see IEEE 3006.2 Recommended Practice for Evaluating the Reliability of Existing Industrial& Commercial Power Systems</u>

<u>Informational Note No. 7: For further information, see IEEE 3005.4 RecommendedPractice for Design and Operational Considerations for Improving the Reliabilityof Emergency and Stand-By Power Systems</u>

Statement of Problem and Substantiation for Public Input

These are more slices of updated content from the legacy "Red Book" IEEE 141, "Gray Book": IEEE 241 and "Orange Book" IEEE 446 which are now being mapped into the IEEE 3000 Standards Collection. From the project prospectuses:

3006.2: Data supporting the reliability evaluation of existing industrial and commercial power systems are described. This recommended practice is likely to be of greatest value to the power-oriented engineer with limited experience in the area of reliability. It can also be an aid to all engineers responsible for the electrical design of industrial and commercial power systems.

https://standards-stg.ieee.org/standard/3006_2-2016.html

3005.4 This recommended practice describes how to improve the reliabiity of emergency and stand-by power systems. Some of the factors examined include the specific application of the emergency or standby equipment, environmental concerns, specification and acceptance testing of the equipment, and the operations and maintenance of the equipment.

https://standards.ieee.org/standard/3005_4-2020.html

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Public Input No. 2616-NFPA 70-2023 [Section No. 700.2]

700. ~~2~~ **3** Reconditioned Equipment.

Reconditioned transfer switches shall not ~~be permitted~~ be installed .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to comply with the NEC Style Manual Section 2.2.1 regarding reconditioned equipment.
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Public Input No. 1329-NFPA 70-2023 [Section No. 700.3]

700.3 Tests and Maintenance.

(A) Commissioning Witness Test.

The authority having jurisdiction shall conduct or witness the commissioning of the complete system upon installation and periodically afterward.

Informational Note: See NECA 90, *Standard for Commissioning Building Electrical Systems*.

(B) Tested Periodically.

Systems shall be tested periodically on a schedule approved by 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.

(E) Testing Under Load.

Means for testing all emergency lighting and power systems during maximum anticipated load conditions shall be provided.

Informational Note: See NFPA 110-2019, *Standard for Emergency and Standby Power Systems*, for information on testing and maintenance of emergency power supply systems (EPSSs).

(F) Temporary Source of Power for Maintenance or ~~Repair of~~ Servicing of the Alternate Source of Power.

If the emergency system relies on a single alternate source of power, which will be disabled for maintenance or ~~repair~~ servicing , the emergency system shall include permanent switching means to connect a portable or temporary alternate source of power that shall be available for the duration of the maintenance or ~~repair~~ servicing . The permanent switching means to connect a portable or temporary alternate source of power shall comply with the following:

(1) Connection to the portable or temporary alternate source of power shall not require modification of the permanent system wiring.

(2) Transfer of power between the normal power source and the emergency power source shall be in accordance with 700.12.

(3) The connection point for the portable or temporary alternate source shall be marked with the phase rotation and system bonding requirements.

(4) The switching means, including the interlocks, shall be listed and provided with mechanical or mechanical and electrical interlocking to prevent inadvertent interconnection of power sources.

(5) The switching means shall include a contact point that shall annunciate at a location remote from the generator or at another facility monitoring system to indicate that the permanent emergency source is disconnected from the emergency system.

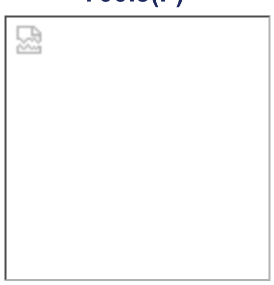
(6) The permanent connection point for the temporary generator shall be located outdoors and shall not have cables from the connection point to the temporary generator routed through exterior windows, doors, or similar openings.

(7) A permanent label shall be field applied at the permanent connection point to identify the system voltage, maximum amperage, short-circuit current rating of the load side of equipment supplied, and ungrounded conductor identification in accordance with 210.5.

It shall be permissible to use manual switching to switch from the permanent source of power to the portable or temporary alternate source of power and to use the switching means for connection of a load bank.

Informational Note: See Informational Note Figure 700.3(F) for one example of many possible methods to achieve the requirements of 700.3(F).

Figure Informational Note Figure 700.3(F)



Exception: The permanent switching means to connect a portable or temporary alternate source of power for the duration of the maintenance or repair shall not be required where any 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 protection 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 Input

Servicing is a defined term and includes repairs. Using a defined term adds more clarity and helps avoid confusion between activities that are deemed as servicing and those that are deemed as reconditioning.

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Public Input No. 2555-NFPA 70-2023 [Section No. 700.3]

700.3 ~~Tests~~ Commissioning and Maintenance.

(A) Commissioning Witness Test.

The authority having jurisdiction shall conduct or witness the commissioning of the complete system upon installation and periodically afterward.

Informational Note: See NECA 90, *Standard for Commissioning Building Electrical Systems*.

(B) Tested Periodically.

Systems shall be tested periodically on a schedule approved by 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.

(E) Testing Under Load.

Means for testing all emergency lighting and power systems during maximum anticipated load conditions shall be provided.

Informational Note: See NFPA 110-2019, *Standard for Emergency and Standby Power Systems*, for information on testing and maintenance of emergency power supply systems (EPSSs).

(F) 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 will be disabled for maintenance or repair, the emergency system shall include permanent switching means to connect a portable or temporary alternate source of power that shall be available for the duration of the maintenance or repair. The permanent switching means to connect a portable or temporary alternate source of power shall comply with the following:

(1) Connection to the portable or temporary alternate source of power shall not require modification of the permanent system wiring.

(2) Transfer of power between the normal power source and the emergency power source shall be in accordance with 700.12.

(3) The connection point for the portable or temporary alternate source shall be marked with the phase rotation and system bonding requirements.

(4) The switching means, including the interlocks, shall be listed and provided with mechanical or mechanical and electrical interlocking to prevent inadvertent interconnection of power sources.

(5) The switching means shall include a contact point that shall annunciate at a location remote from the generator or at another facility monitoring system to indicate that the permanent emergency source is disconnected from the emergency system.

(6) The permanent connection point for the temporary generator shall be located outdoors and shall not have cables from the connection point to the temporary generator routed through exterior windows, doors, or similar openings.

(7) A permanent label shall be field applied at the permanent connection point to identify the system voltage, maximum amperage, short-circuit current rating of the load side of equipment supplied, and ungrounded conductor identification in accordance with 210.5.

It shall be permissible to use manual switching to switch from the permanent source of power to the portable or temporary alternate source of power and to use the switching means for connection of a load bank.

Informational Note: See Informational Note Figure 700.3(F) for one example of many possible methods to achieve the requirements of 700.3(F).

Figure Informational Note Figure 700.3(F)

Exception: The permanent switching means to connect a portable or temporary alternate source of power for the duration of the maintenance or repair shall not be required where any 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 protection 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 Input

Revising "Tests" with "Commissioning" corelates with 701.3

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Public Input No. 1671-NFPA 70-2023 [Section No. 700.3(A)]

(A) ~~Commissioning~~ Witness ~~Test~~ Testing .

The authority having jurisdiction shall conduct or witness the ~~commissioning~~ testing of the complete system upon installation and periodically afterward.

Informational Note: See NECA 90, *Standard for Commissioning Building Electrical Systems*.

Additional Proposed Changes

File Name	Description	Approved
90-2015.pdf	NECA 90, Standard for Commissioning Building Electrical Systems	

Statement of Problem and Substantiation for Public Input

Substantiation: Commissioning of a system is much different than witness testing a system and requiring an AHJ to perform commissioning. In many cases AHJs are not equipped to perform Commissioning of electrical systems. It is a common misperception that electrical commissioning and acceptance testing are the same thing or that electrical commissioning is the same as equipment startup. In reality, acceptance testing and equipment startup, are only two subsets of the electrical commissioning process. Upon completion of acceptance testing and contractor/vendor startup (pre-functional testing), functional performance `testing (FPT) and integrated systems testing (IST). In the ANSI/International Electrical Testing Association — Standard for Electrical Commissioning Specifications for Electrical Power Equipment and Systems (NETA ECS-2015), electrical commissioning is defined as the systematic process of verifying, documenting, and placing into service newly installed or retrofitted electrical power equipment and systems. The process focuses on verifying and documenting that all of the electrical commissioned equipment, systems, and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements (OPRs). Commissioning processes should be performed by a commissioning authority. The change in the 2023 NEC is excessive and imposes significant requirements that go beyond the scope or the NEC and beyond the responsibilities of the AHJ. These changes create significantly more steps in the approval processes required by the NEC. This proposed change is to either remove the word "commissioning" from each of these sections or to specifically state which parts of the overall commissioning process is required by the NEC rules. Commissioning is too broad of a term and the associated processes are extensive in many cases. (See attached copy of NECA 90 to PI).

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Public Input No. 1276-NFPA 70-2023 [Section No. 700.3(B)]

(B) Tested Periodically.

Systems shall be tested periodically on a schedule approved by the authority having jurisdiction to ensure the systems are maintained in proper operating condition.

Statement of Problem and Substantiation for Public Input

The added language is the same already used in other portions of the code and provides consistency and clarity that this record does not only have to exist somewhere, it must also be easily available to those that may need it.

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Public Input No. 2291-NFPA 70-2023 [Section No. 700.3(D)]

(D) Written Record.

A written record shall be kept of such tests and maintenance <u>and made available to those authorized to design, install, inspect, maintain, and operate the system</u> .

Statement of Problem and Substantiation for Public Input

The proposed new language is the same already used in other portions of the Code. Including it at this location provides consistency and clarity this this record does not only have to exist somewhere, but must also be readily available to those that may need it.

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Public Input No. 2496-NFPA 70-2023 [Section No. 700.3(D)]

(D) Written Record.

A written or digital record or both shall be kept of such tests and maintenance.

Statement of Problem and Substantiation for Public Input

Provide clarity to the article or add an Informational Note as to what constitutes a written record. A common definition of written defines written as a "mark (letters, words, or other symbols) on a surface, typically paper, with a pen, pencil, or similar implement". Many Facility Management operations, for example, have moved away from maintaining a physical logbook next to a generator which can be easily lost, damaged, manipulated, etc. to software-based recordkeeping. I recommend evolving this article to recognize that digital records are acceptable.

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Public Input No. 3720-NFPA 70-2023 [Section No. 700.3(F)]

(F) 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 will be disabled for maintenance or repair, the emergency system shall include permanent switching means to connect a portable or temporary alternate source of power that shall be available for the duration of the maintenance or repair. The permanent switching means to connect a portable or temporary alternate source of power shall comply with the following:

(1) Connection to the portable or temporary alternate source of power shall not require modification of the permanent system wiring.

(2) Transfer of power between the normal power source and the emergency power source shall be in accordance with 700.12.

(3) The connection point for the portable or temporary alternate source shall be marked with the phase rotation and system bonding requirements.

(4) The switching means, including the interlocks, shall be listed and provided with mechanical or mechanical and electrical interlocking to prevent inadvertent interconnection of power sources.

(5) The switching means shall include a contact point that shall annunciate at a location remote from the generator or at another facility monitoring system to indicate that the permanent emergency source is disconnected from the emergency system.

(6) The permanent connection point for the temporary generator shall be located outdoors and shall not have cables from the connection point to the temporary generator routed through exterior windows, doors, or similar openings.

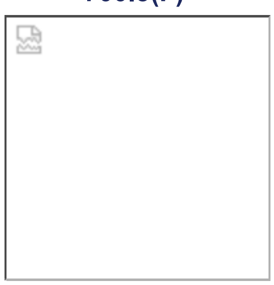
(7) A permanent label shall be field applied at the permanent connection point to identify the system voltage, maximum amperage, short-circuit current rating of the load side of equipment supplied, and ungrounded conductor identification in accordance with 210.5.

(8) The connection point for the portable or temporary power source shall include an Overcurrent Protective Device (OCPD) with the same characteristics as the OCPD for the permanent emergency source.

It shall be permissible to use manual switching to switch from the permanent source of power to the portable or temporary alternate source of power and to use the switching means for connection of a load bank.

Informational Note: See Informational Note Figure 700.3(F) for one example of many possible methods to achieve the requirements of 700.3(F).

Figure Informational Note Figure 700.3(F)



Exception: The permanent switching means to connect a portable or temporary alternate source of power for the duration of the maintenance or repair shall not be required where any 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 protection 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 Input

The additional requirement for an OCPD at the connection point for the portable or temporary power source is needed to assure that the permanent system will be properly protected and coordinated for all cases of portable or rental gensets that might be used with the emergency system.

Submitter Information Verification

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Submittal Date:	Tue Sep 05 14:46:11 EDT 2023
Committee:	NEC-P13

Public Input No. 2935-NFPA 70-2023 [Section No. 700.4]

700.4 Capacity and Rating.

(A) Capacity.

An emergency system shall have adequate capacity in accordance with Article 220, Parts I through ~~IV of Article~~ 220 ~~or~~ IV or by another approved method. The system capacity shall be sufficient for the rapid load changes and transient power and energy requirements associated with any expected loads.

(B) Selective Load Management.

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 load management (that includes automatic selective load pickup and load shedding) is provided as needed to ensure adequate power to the following in order of priority:

(1) Emergency circuits

(2) Legally required standby circuits

(3) Optional standby circuits

(C) Parallel Operation.

Parallel operation of the emergency source(s) shall consist of the sources specified in 700.4(C)(1) and (C)(2).

(1) Normal Source.

The emergency source shall be permitted to operate in parallel with the normal source in compliance with Article 705, Part I or ~~Part II of Article 705 where~~ Part II where the capacity required to supply the emergency load is maintained at all times. Any operating condition that results in less than the required emergency source capacity shall initiate a system malfunction signal in accordance with 700.6(A).

Parallel operation shall be permitted for satisfying the test requirements of 700.3(B), provided all other conditions of 700.3 are met.

Informational Note: Peak load shaving is one application for parallel source operation.

(2) Emergency Source.

Emergency sources shall be permitted to operate in parallel where the necessary equipment to establish and maintain a synchronous condition is provided.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Public Input No. 206-NFPA 70-2023 [Section No. 700.4(A)]

(A) Capacity.

An emergency system shall have adequate capacity in accordance with Parts I through IV of Article 220 or by another approved method. The system capacity shall be sufficient for the rapid load changes and transient power and energy requirements associated with any expected loads.

(B) Rating. The emergency system equipment shall be suitable for the available fault current at its terminals.

Statement of Problem and Substantiation for Public Input

700.4 section is still titled Rating & Capacity but the rating portion was left out of the section. The problem is the equipment needs to be rated to withstand the available fault current.

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Committee:	NEC-P13

Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]

(B) Selective Load Management.

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 ~~load management (~~ Power Circuit Management (PCM) in accordance with 750.30 (that includes automatic selective load pickup and load shedding) is provided as needed to ensure adequate power to the following in order of priority:

(1) Emergency circuits

(2) Legally required standby circuits

(3) Optional standby circuits

Statement of Problem and Substantiation for Public Input

Activities, such as the electrification of the transportation sector and replacement of gas-fired appliance with all electric appliances, coupled with widespread adoption of on-site storage and generation, will place significant new demands on the premises wiring systems covered by the NEC. These activities are complicated by the need to facilitate this shift in energy generation, storage, and use, with an existing (and aging) infrastructure.

An emerging trend is to leverage the technology offered by "Energy Management Systems" to manage these complex electrical systems in a way that prevents overloading of the premises wiring system. These types of systems require functional reliability in order to prevent overloading of the premises wiring, as well as utility owned assets serving the facility. Energy management systems (EMS) historically have not been evaluated for functional reliability to address electrical overload.

While other PI's may address this need for a more robust "Energy Management System", this must co-exist with the realization that there is still a place for the traditional Energy Management devices that are not being relied upon for these functions and should not be mandated to meet functional safety requirements.

Recognizing that these existing products will continue to exist in the marketplace, a new term is needed to differentiate between the historic EMS application of energy optimization for appliance control versus electrical overload and/or grid interconnection applications where safety is paramount. With this in mind, this PI focuses on introducing the term Power Circuit Management (PCM) where functional reliability has been applied.

Equipment that provides Load Management to Emergency and Legally Required Standby Systems also performs a critical function, and the functional reliability of this equipment is important. The evolution of requirements for PCM affords the opportunity to utilize equipment that has been evaluated to these more robust requirements to ensure reliable operation of the load management function. PCM should be specified for these critical systems.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling "q".]	Related due to addition of new PCM definition / term
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	Related due to addition of new PCM definition / term

Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	Related due to addition of new PCM definition / term
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	Related due to addition of new PCM definition / term
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	Related due to addition of new PCM definition / term
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	Related due to addition of new PCM definition / term
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	Related due to addition of new PCM definition / term
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	Related due to addition of new PCM definition / term
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	Related due to addition of new PCM definition / term
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling “q”.]	
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	

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Committee:	NEC-P13

Public Input No. 1403-NFPA 70-2023 [Section No. 700.4(C)(1)]

(1) Normal Source.

The emergency source shall be permitted to operate in parallel with the normal source in compliance with Part I or Part II of Article 705 where the capacity ~~required~~ in accordance with 700.4(A) or supply duration in accordance with 700.12(C) required to supply the emergency load is maintained at all times. Any operating condition that results in less than the required emergency source ~~capacity shall~~ capacity or supply duration shall initiate a system malfunction signal in accordance with 700.6(A).

Parallel operation shall be permitted for satisfying the test requirements of 700.3(B), provided all other conditions of 700.3 are met.

Informational Note: Peak load shaving is one application for parallel source operation.

Statement of Problem and Substantiation for Public Input

As written the article tells you the only needed requirement would be a maintaining of capacity referenced above in 700.4(A). That article only mentions the availability of current. There is no demand to maintain a minimum level of on site fuel or battery capacity to meet an emergency. The fear would be generators running themselves dry in the name of peak load shaving.

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Submittal Date: Thu Jul 13 16:22:11 EDT 2023
Committee: NEC-P13

Public Input No. 3288-NFPA 70-2023 [Section No. 700.5]

700.5 Transfer Equipment.

(A) General.

Transfer equipment shall be automatic, listed, and marked for emergency use. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and emergency 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. Meter-mounted transfer switches shall not be permitted for emergency system use.

(B) ~~Bypass Isolation Transfer Switches.~~

~~Means shall be permitted to bypass and isolate the transfer equipment. Where bypass isolation transfer switches are used, inadvertent parallel operation shall be prevented.~~

~~**(C)** Automatic Transfer Switches.~~

~~Automatic transfer switches shall be electrically operated and mechanically held.~~

~~(D) Redundant Transfer Equipment.~~

~~If emergency loads are supplied by a single feeder, the emergency~~

Maintenance of Transfer Equipment.

The emergency power system shall include ~~redundant transfer equipment or~~ a bypass isolation transfer switch to facilitate maintenance as required ~~in~~ in **700.3(C)** - ~~without~~ without jeopardizing continuity of power. If the ~~redundant transfer equipment or~~ bypass isolation transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair. Where bypass isolation transfer switches are used, inadvertent parallel operation shall be prevented.

Exception No. 1 :

The requirement for

~~redundancy with the transfer equipment~~

a bypass isolation transfer switch shall not apply where any of the following conditions exist:

(1) All processes that rely on the emergency system source are capable of being disabled during maintenance or repair activities without jeopardizing the safety to human life.

(2) The building or structure is unoccupied and fire protection systems are fully functional and do not require an alternate power source.

(3) Other temporary means

~~shall be permitted~~

are available to be substituted for the emergency system.

(4) A written emergency plan that includes mitigation actions and responsibilities for qualified persons to address the recognized site hazards for the duration of the maintenance or repair activities shall be developed and implemented. The emergency plan shall be made available to the authority having jurisdiction.

~~(E)~~

Exception No. 2:

Redundant transfer switches may be used in lieu of a bypass isolation transfer switch when all of the following conditions exist:

(1) *The redundant transfer switches are provided with interlocking to prevent inadvertent parallel operation.*

(1) *Means are provided to completely isolate each transfer switch to facilitate maintenance of the transfer switch without jeopardizing continuity of power.*

(1) *If the redundant transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair.*

(C) Automatic Transfer Switches.

Automatic transfer switches shall be electrically operated and mechanically held.

(D) Use.

Transfer equipment shall supply only emergency loads.

Informational Note: Transfer equipment that supplies emergency loads provides separation of this load type from any others and is independent of any equipment used to combine or parallel sources.

(

~~F~~

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.

Additional Proposed Changes

File Name	Description	Approved
2023-08-30_proposed_PI_for_700.5_to_submit_to_Terraview.docx	I am uploading my file created in Word in case the Terraview version is hard to follow	

Statement of Problem and Substantiation for Public Input

Rationale:

Proper maintenance of transfer equipment in emergency systems is critical. The addition of 700.5(D) in the 2023 NEC was intended to make provisions for safe maintenance without jeopardizing continuity of power, but only applies when the emergency loads are supplied by a single feeder.

There may be cases where the emergency loads are separated, with some loads supplied by one feeder, and other loads supplied by a second feeder. As currently written 700.5(D) only applies to emergency loads supplied by a single feeder. In reality, every emergency transfer switch must be maintained, and the provisions for safe maintenance apply regardless of how many feeders are used in an emergency system. This PI ensures this by requiring a bypass isolation transfer switch for all transfer equipment, regardless of the number of feeders in the emergency system. This is accomplished by combining 700.5(B) and 700.5(D). While 700.5(B) is currently a permissive statement, there is no situation where a bypass isolation transfer switch is not required, unless provided with redundant transfer switches as discussed below.

The allowance for redundant transfer switches was added during the second draft of 2023 Code cycle, but is missing some critical information. The use of redundant transfer switches alone does not facilitate the safe maintenance of the emergency power system, as there is no way to connect two transfer switches together that would allow safe maintenance of one transfer switch while the other is supplying power to the load. Using only redundant transfer switches, the switch being serviced can not be completely isolated from whichever source is providing power to the load. This is true whether the switches are connected in series or in parallel.

Furthermore, using redundant transfer switches without interlocking between the transfer switches could result in inadvertent paralleling of the normal and emergency sources. Rather than remove the allowance for redundant transfer switches, this PI allows the use of redundant switches an alternative to the bypass isolation transfer switch, and includes the requirements needed to facilitate safe maintenance when a bypass isolation transfer switch is not used.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3289-NFPA 70-2023 [Section No. 701.5(B)]	

Submitter Information Verification

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Organization: UL LLC
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Zip:

Submittal Date: Thu Aug 31 15:14:59 EDT 2023
Committee: NEC-P13

700.5 Transfer Equipment.

(A) General.
Transfer equipment shall be automatic, listed, and marked for emergency use. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and emergency 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**. Meter-mounted transfer switches shall not be permitted for emergency system use.

(B) ~~Bypass Isolation~~ Maintenance of Transfer Switches.
The emergency power system shall include a bypass isolation transfer switch to facilitate maintenance as required in **700.3(C)** without jeopardizing continuity of power. If the bypass isolation transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair. ~~Means shall be permitted to bypass and isolate the transfer equipment.~~ Where bypass isolation transfer switches are used, inadvertent parallel operation shall be prevented.

Exception No. 1:
The requirement for a bypass isolation transfer switch shall not apply where any of the following conditions exist:

(1) All processes that rely on the emergency system source are capable of being disabled during maintenance or repair activities without jeopardizing the safety to human life.

(2) The building or structure is unoccupied and fire protection systems are fully functional and do not require an alternate power source.

(3) Other temporary means are available to be substituted for the emergency system.

(4) A written emergency plan that includes mitigation actions and responsibilities for qualified persons to address the recognized site hazards for the duration of the maintenance or repair activities shall be developed

and implemented. The emergency plan shall be made available to the authority having jurisdiction.

Exception No. 2:
Redundant transfer switches may be used in lieu of a bypass isolation transfer switch when all of the following conditions exist:

(1) *The redundant transfer switches are provided with interlocking to prevent inadvertent parallel operation.*

(2) *Means are provided to completely isolate each transfer switch to facilitate maintenance of the transfer switch without jeopardizing continuity of power.*

(3) *If the redundant transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair.*

(C) Automatic Transfer Switches.
Automatic transfer switches shall be electrically operated and mechanically held.

~~**(D) Redundant Transfer Equipment.**~~
~~If emergency loads are supplied by a single feeder, the emergency power system shall include redundant transfer equipment or a bypass isolation transfer switch to facilitate maintenance as required in **700.3(C)** without jeopardizing continuity of power. If the redundant transfer equipment or bypass isolation transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair.~~
~~*Exception:*~~
~~*The requirement for redundancy with the transfer equipment shall not apply where any of the following conditions exist:*~~

~~*(1) All processes that rely on the emergency system source are capable of being disabled during maintenance or repair activities without jeopardizing the safety to human life.*~~

~~*(2) The building or structure is unoccupied and fire protection systems are fully functional and do not require an alternate power source.*~~

~~*(3) Other temporary means shall be permitted to be substituted for the emergency system.*~~

~~*(4) A written emergency plan that includes mitigation actions and responsibilities for qualified persons to address the recognized site hazards for the duration of the maintenance or repair activities shall be developed and implemented. The emergency plan shall be made available to the authority having jurisdiction.*~~

~~(E)~~ (D) Use.

Transfer equipment shall supply only emergency loads.

Informational Note: Transfer equipment that supplies emergency loads provides separation of this load type from any others and is independent of any equipment used to combine or parallel sources.

~~(F)~~ (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.

Rationale:

Proper maintenance of transfer equipment in emergency systems is critical. The addition of 700.5(D) in the 2023 NEC was intended to make provisions for safe maintenance without jeopardizing continuity of power, but only applies when the emergency loads are supplied by a single feeder.

There may be cases where the emergency loads are separated, with some loads supplied by one feeder, and other loads supplied by a second feeder. As currently written 700.5(D) only applies to emergency loads supplied by a single feeder. In reality, every emergency transfer switch must be maintained, and the provisions for safe maintenance apply regardless of how many feeders are used in an emergency system. This PI ensures this by requiring a bypass isolation transfer switch for all transfer equipment, regardless of the number of feeders in the emergency system. This is accomplished by combining 700.5(B) and 700.5(D). While 700.5(B) is currently a permissive statement, there is no situation where a bypass isolation transfer switch is not required, unless provided with redundant transfer switches as discussed below.

The allowance for redundant transfer switches was added during the second draft of 2023 Code cycle, but is missing some critical information. The use of redundant transfer switches alone does not facilitate the safe maintenance of the emergency power system, as there is no way to connect two transfer switches together that would allow safe maintenance of one transfer switch while the other is supplying power to the load. Using only redundant transfer switches, the switch being serviced can not be completely isolated from whichever source is providing power to the load. This is true whether the switches are connected in series or in parallel.

Furthermore, using redundant transfer switches without interlocking between the transfer switches could result in inadvertent paralleling of the normal and emergency sources. Rather than remove the allowance for redundant transfer switches, this PI allows the use of redundant switches an alternative to the bypass isolation transfer switch, and includes the requirements needed to facilitate safe maintenance when a bypass isolation transfer switch is not used.

Public Input No. 3327-NFPA 70-2023 [Section No. 700.5(A)]

(A) General.

Transfer equipment shall be automatic, listed, and marked for emergency use. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and emergency 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~~ of 705. 6 . Meter-mounted transfer switches shall not be permitted for emergency system use.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the NEC(r) Style Manual prohibits referencing an entire article with the exception of Article 100 or where required for context. This requirement is revised to point the user to 705.6, where the equipment approval requirements are found for sources operating in parallel.

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Public Input No. 1341-NFPA 70-2023 [Section No. 700.5(B)]

(B) Bypass Isolation ~~Transfer~~ Switches.

Means shall be permitted to bypass and isolate the transfer equipment. Where bypass isolation ~~transfer~~ switches are used, inadvertent parallel operation shall be prevented.

Statement of Problem and Substantiation for Public Input

this public input recognizes the defined term bypass isolation switch and properly uses this term. This change adds clarity and properly addresses the fact that a bypass isolation switch can be both a part of a transfer switch and separate from a transfer switch. This also aligns with the direction that NFPA 110 is taking for this same type of application.

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Committee:	NEC-P13

Public Input No. 1330-NFPA 70-2023 [Section No. 700.5(D)]

(D) Redundant Transfer Equipment.

If emergency loads are supplied by a single feeder, the emergency power system shall include redundant transfer equipment or a bypass isolation transfer switch to facilitate maintenance as required in 700.3(C) without jeopardizing continuity of power. If the redundant transfer equipment or bypass isolation transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or ~~repair~~ servicing .

Exception: The requirement for redundancy with the transfer equipment shall not apply where any of the following conditions exist:

(1) All processes that rely on the emergency system source are capable of being disabled during maintenance or ~~repair~~ servicing activities without jeopardizing the safety to human life.

(2) The building or structure is unoccupied and fire protection systems are fully functional and do not require an alternate power source.

(3) Other temporary means shall be permitted to be substituted for the emergency system.

(4) A written emergency plan that includes mitigation actions and responsibilities for qualified persons to address the recognized site hazards for the duration of the maintenance or ~~repair~~ servicing activities shall be developed and implemented. The emergency plan shall be made available to the authority having jurisdiction.

Statement of Problem and Substantiation for Public Input

Servicing is a defined term and includes repairs. Using a defined term adds more clarity and helps avoid confusion between activities that are deemed as servicing and those that are deemed as reconditioning.

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Submittal Date: Sat Jul 08 11:49:16 EDT 2023
Committee: NEC-P13

Public Input No. 3435-NFPA 70-2023 [Section No. 700.5(D)]

(D) Redundant Transfer Equipment.

If emergency loads are supplied by a single feeder, the emergency power system shall include redundant transfer equipment or a bypass isolation transfer switch to facilitate maintenance as required in 700.3(C) without jeopardizing continuity of power. If the redundant transfer equipment or bypass isolation transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair. <u>Where redundant transfer equipment is used, inadvertent parallel operation shall be prevented.</u>

Exception: The requirement for redundancy with the transfer equipment shall not apply where any of the following conditions exist:

(1) All processes that rely on the emergency system source are capable of being disabled during maintenance or repair activities without jeopardizing the safety to human life.

(2) The building or structure is unoccupied and fire protection systems are fully functional and do not require an alternate power source.

(3) Other temporary means shall be permitted to be substituted for the emergency system.

(4) A written emergency plan that includes mitigation actions and responsibilities for qualified persons to address the recognized site hazards for the duration of the maintenance or repair activities shall be developed and implemented. The emergency plan shall be made available to the authority having jurisdiction.

Statement of Problem and Substantiation for Public Input

As currently worded in the Code, redundant transfer equipment could be as simple as two transfer switches connected in parallel. The Code does not require any additional isolation devices between the two to prevent inadvertent parallel operation. Parallel operation could result in damage to one or both sources and loss of power to the emergency loads. The proposed additional sentence requires that appropriate additional equipment be provided to prevent inadvertent parallel operation.

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Committee: NEC-P13

Public Input No. 1252-NFPA 70-2023 [New Section after 700.8]

TITLE OF NEW CONTENT

Type your content here ...

700.9. Cybersecurity

Emergency Systems that are connected to a communication network and have the capability to be controlled or permit control of any portion of the premises shall comply with either of the following:

(1) The ability to control the system is limited to a direct connection through a local nonnetworked interface.

(2) The Emergency Sytem is connected through a networked interface complying with both of the following methods:

a. The Emergency System and associated software are identified as being evaluated for cybersecurity.

b. A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to cyber attacks.

The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals.

Documentation of the evaluation, assessment, identification, and certification shall be made available to those authorized to inspect, operate, and maintain the system.

Informational Note No. 1: See ANSI/ISA 62443, Cybersecurity Standards series; UL 2900, Cybersecurity Standards series; and the NIST Framework for Improving Critical Infrastructure Cybersecurity, Version 1.1, for assessment guidelines.

Informational Note No. 2: Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

(1) The ISA Security Compliance Institute (ISCI) conformity assessment program

(2) Certification of compliance by a nationally recognized test laboratory

Statement of Problem and Substantiation for Public Input

Most of the cybersecurity focus has been on IT systems. There has been very little public discussion about cybersecurity for Operational Technology (OT), but cyber attacks on OT, by both domestic and foreign actors, occur on almost a daily basis. Hackers can easily destroy unprotected equipment and shut down entire unprotected facilities. Our adversaries such as Russia, China, North Korea, and Iran, are continuously mounting cyber attacks. They understand their limits and, so far, prohibit catastrophic attacks on our financial/banking system and electrical grid. In the mean time, they attack our infrastructure, such as the southeast gas pipeline. We have the ability, and obligation, to prevent this type of damage to our infrastructure from malicious cyber attacks. This Public Input is based upon 240.6(D) and 708.7 in the 2023 NEC. Pay particular attention to the word "identified" in (2) a. "Identified" as applied to equipment, is defined 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. 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 organization concerned with product evaluation." This Public Input simply requires that an Emergency System either not be connected to the internet, or if it is connected to the internet, that it be identified for cybersecurity and that an assessment is provided.

Submitter Information Verification

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Submittal Date:	Fri Jun 30 14:52:31 EDT 2023
Committee:	NEC-P13

Public Input No. 1672-NFPA 70-2023 [New Section after 700.8]

700.9 Qualified Persons.

Emergency Systems covered by this Article shall be installed by Qualified Persons.

Informational Note: See definition of *Qualified Person* in Article 100.

Statement of Problem and Substantiation for Public Input

Emergency Systems and equipment covered by article 700 should be installed by qualified persons.

Emergency systems are becoming more complicated and, in most cases, requiring far more training and experience. These systems are often part of essential electrical systems and critical operations power systems requiring a greater degree of training and experience, in design, planning, installation, and programing in many instances. These systems and others require trained qualified personnel and contractors. Qualified contractors, electricians and technicians are a crucial element of safety, related to these installations and systems. See companion PIs related to Qualified Persons.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1708-NFPA 70-2023 [New Section after 800.3]	
Public Input No. 1706-NFPA 70-2023 [New Section after 770.3]	
Public Input No. 1701-NFPA 70-2023 [New Section after 760.3]	
Public Input No. 1698-NFPA 70-2023 [New Section after 726.3]	
Public Input No. 1695-NFPA 70-2023 [New Section after 725.3]	
Public Input No. 1694-NFPA 70-2023 [New Section after 724.3]	
Public Input No. 1690-NFPA 70-2023 [New Section after 722.3]	
Public Input No. 1686-NFPA 70-2023 [New Section after 708.8]	
Public Input No. 1684-NFPA 70-2023 [New Section after 701.7]	
Public Input No. 4394-NFPA 70-2023 [New Section after 625.6]	
Public Input No. 1629-NFPA 70-2023 [New Section after 393.6]	
Public Input No. 1557-NFPA 70-2023 [Section No. 90.2(A)]	
Public Input No. 1557-NFPA 70-2023 [Section No. 90.2(A)]	
Public Input No. 1629-NFPA 70-2023 [New Section after 393.6]	
Public Input No. 1684-NFPA 70-2023 [New Section after 701.7]	
Public Input No. 1686-NFPA 70-2023 [New Section after 708.8]	
Public Input No. 1690-NFPA 70-2023 [New Section after 722.3]	
Public Input No. 1694-NFPA 70-2023 [New Section after 724.3]	
Public Input No. 1695-NFPA 70-2023 [New Section after 725.3]	
Public Input No. 1698-NFPA 70-2023 [New Section after 726.3]	
Public Input No. 1701-NFPA 70-2023 [New Section after 760.3]	
Public Input No. 1706-NFPA 70-2023 [New Section after 770.3]	
Public Input No. 1708-NFPA 70-2023 [New Section after 800.3]	
Public Input No. 4394-NFPA 70-2023 [New Section after 625.6]	

Submitter Information Verification

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Submittal Date:	Fri Jul 28 13:29:03 EDT 2023
Committee:	NEC-P13

Public Input No. 1030-NFPA 70-2023 [Section No. 700.10(A)]

(A) Identification.

Emergency circuits shall be permanently marked in yellow so they will be readily identified as a component of an emergency circuit or system by the following methods:

(1) All boxes and enclosures (including transfer switches, generators, and power panels) for emergency circuits shall be permanently ~~marked~~ marked in yellow as a component of an emergency circuit or system.

(2) Where boxes or enclosures are not encountered, exposed cable or raceway systems shall be permanently marked in yellow to be identified as a component of an emergency circuit or system, at intervals not to exceed 7.6 m (~~25 ft~~ 10 ft).

Receptacles supplied from the emergency system shall have a distinctive color or marking on the receptacle ~~cover plates or the receptacles.~~ . Cover plates shall be marked in yellow.

Exception 1 Existing structures that already have a marking system that complies with 700.10(A).

Statement of Problem and Substantiation for Public Input

By using yellow as a color for life safety in the NEC other electrical contractor will not install unrelated electric device on the life safety branch.

Ever 3 years in NH, a code update is required and electrician and they will learn the color system of life safety branches.

The exception would be if the building already has a color coding system in place, the existing system can be extended, or modified.

Submitter Information Verification

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Submittal Date:	Mon Jun 12 10:27:12 EDT 2023
Committee:	NEC-P13

Public Input No. 3043-NFPA 70-2023 [Section No. 700.10(A)]

(A) Identification.

Emergency circuits shall be permanently marked so they will be readily identified as a component of an emergency circuit or system by the following methods:

(1) All boxes and enclosures (including transfer switches, interconnection equipment, generators, and power panels) for emergency circuits shall be permanently marked as a component of an emergency circuit or system.

(2) Where boxes or enclosures are not encountered, exposed cable or raceway systems shall be permanently marked to be identified as a component of an emergency circuit or system, at intervals not to exceed 7.6 m (25 ft).

Receptacles supplied from the emergency system shall have a distinctive color or marking on the receptacle cover plates or the receptacles.

Statement of Problem and Substantiation for Public Input

The term interconnection equipment is added to correlate with the permitted emergency sources in 700.12 which may include an interconnection to the normal power system. This term aligns with the product safety requirements for emergency systems in UL 3008. A separate public input revising the term "Microgrid Interconnect Device" to also include this term has been submitted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3039-NFPA 70-2023 [Definition: Microgrid Interconnect Device (MID).]	
Public Input No. 3045-NFPA 70-2023 [Section No. 700.10(B)]	
Public Input No. 3046-NFPA 70-2023 [Section No. 700.10(D)(3)]	
Public Input No. 3047-NFPA 70-2023 [Section No. 700.12(G)]	
Public Input No. 3048-NFPA 70-2023 [Section No. 700.18]	

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
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City:
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Zip:
Submittal Date: Tue Aug 29 08:36:22 EDT 2023
Committee: NEC-P13

Public Input No. 1608-NFPA 70-2023 [Section No. 700.10(B)]

(B) Wiring.

Wiring from an emergency source or emergency source distribution overcurrent protection to emergency loads shall be kept entirely independent of all other wiring and equipment unless otherwise permitted in the following:

(1) Wiring from the normal power source located in transfer equipment enclosures

(2) Wiring supplied from two sources in exit or emergency luminaires

(3) Wiring from two sources in a listed load control relay supplying exit or emergency luminaires, or in a common junction box, attached to exit or emergency luminaires

(4) Wiring within a common junction box attached to unit equipment, containing only the branch circuit supplying the unit equipment and the emergency circuit supplied by the unit equipment

(5) Wiring within a traveling cable to an elevator

(6) Wiring from an emergency source to supply emergency and other (nonemergency) loads in accordance with the following:

- a. Separate vertical switchgear sections or separate vertical switchboard sections, with or without a common bus, or individual disconnects mounted in separate enclosures shall be used to separate emergency loads from all other loads.
- b. The common bus of separate sections of the switchgear, separate sections of the switchboard, or the individual enclosures shall be either of the following:
  - i. Supplied by single or multiple feeders without overcurrent protection at the source
  - ii. Supplied by single or multiple feeders with overcurrent protection, provided that the overcurrent protection that is common to an emergency system and any nonemergency system(s) is selectively coordinated with the next downstream overcurrent protective device in the nonemergency system(s)

    Informational Note: See Informational Note Figure 700.10(B)(1) and Informational Note Figure 700.10(B)(2) for further information.

Figure Informational Note Figure 700.10(B)(1) Single or Multiple Feeders Without Overcurrent Protection.

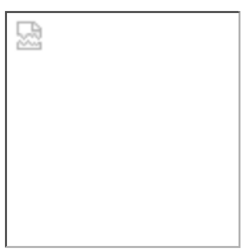

Figure Informational Note Figure 700.10(B)(2) Single or Multiple Feeders with Overcurrent Protection.

- c. Emergency circuits shall not originate from the same vertical switchgear section, vertical switchboard section, panelboard enclosure, or individual disconnect enclosure as other circuits.

d. It shall be permissible to use single or multiple feeders to supply distribution equipment between an emergency source and the point where the emergency loads are separated from all other loads.

e. At the emergency power source, such as a generator, multiple integral overcurrent protective devices shall each be permitted to supply a designated emergency or a designated nonemergency load, provided that there is complete separation between emergency and nonemergency loads beginning immediately after the overcurrent protective device line-side connections.

Wiring of two or more emergency circuits supplied from the same source shall be permitted in the same raceway, cable, box, or cabinet.

Additional Proposed Changes

File Name	Description	Approved
TIA_1632_70_20_18.pdf	NEC TIA 20-18 Log 1632	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 20-18 (Log 1632) issued by the Standards Council on August 12, 2022 and per the NFPA Regs., needs to be reconsidered by the Code-Making Panel for the next edition of the Document.

Substantiation: For Gensets with multiple set mounted circuit breakers in applications that feed emergency and non-emergency loads, there is significant confusion with 700.10(B)(5). There are four sub-sections (a-d), and people don't know which one(s) to use for this case. This includes AHJ's. Even code experts are having trouble with this and are coming up with different answers. This is wasting time and money and causing inconsistencies. The proposed new text clearly addresses this case with the correct requirement.

This issue was raised (via Public Comment) in the NFPA 70-2023 CMP-13 2nd draft meeting and the proposed text above was approved for the 2023 edition of the NEC. Since many states and localities will still be using the 2020 and 2017 editions for quite some time, this TIA is necessary so that the stakeholders (genset manufacturers, installers, electricians and AHJ's) can get the needed clarity for this very important case via the new subsection.

Emergency Nature: The standard contains an error or an omission that was overlooked during the regular revision process.

This TIA is of an emergency nature in alignment with the 1st factor in the list, which states: "The standard contains an error or an omission that was overlooked during the regular revision process". Approval of the TIA is necessary to: eliminate inconsistencies in the way that the code is enforced for the case with gensets that have multiple set mounted circuit breakers. Right now, the code doesn't have a clear requirement for this case, so AHJ's are inconsistent with their interpretation of the requirement. This is resulting in solutions that are all over the map, and lots of costly field re-work, which equates to wasted time and money.

Submitter Information Verification

Submitter Full Name: CMP on NEC-P13

Organization: Code-Making Panel 13

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City:

State:

Zip:

Submittal Date:	Thu Jul 27 11:34:38 EDT 2023
Committee:	NEC-P13

Tentative Interim Amendment

NFPA® 70®

National Electrical Code®

2020 Edition

Reference: 700.10(B)(5) item e. (new)
TIA 20-18
(SC 22-8-14 / TIA Log #1632)

Pursuant to Section 5 of the NFPA *Regulations Governing the Development of NFPA Standards*, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 70®, *National Electrical Code®*, 2020 edition. The TIA was processed by the NEC Code-Making Panel 13, and the NEC Correlating Committee, and was issued by the Standards Council on August 12, 2022, with an effective date of September 1, 2022.

1. Add a new item "e." to paragraph 700.10(B)(5) to read as follows:

700.10(B) Wiring. …
(1) …
(5) …
a. …
<u>e. At the emergency power source, such as a generator, multiple integral overcurrent protective devices shall each be permitted to supply a designated emergency or a designated nonemergency load, provided that there is complete separation between emergency and nonemergency loads beginning immediately after the overcurrent protective device line-side connections.</u>

Wiring of two or more emergency circuits supplied from the same source shall be permitted in the same raceway, cable, box, or cabinet.

Issue Date: August 12, 2022

Effective Date: September 1, 2022

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo)

Public Input No. 172-NFPA 70-2023 [Section No. 700.10(B)]

(B) Wiring.

Wiring from an emergency source or emergency source distribution overcurrent protection to emergency loads shall be kept entirely independent of all other wiring and equipment unless otherwise permitted in the following:

(1) Wiring from the normal power source located in transfer equipment enclosures

(2) Wiring supplied from two sources in exit or emergency luminaires

(3) Wiring from two sources in a listed automatic load control relay (ALCR) or listed emergency lighting control device (ELCD) supplying exit or emergency luminaires, or in a common junction box, attached to exit or emergency luminaires

(4) Wiring within a common junction box attached to unit equipment, containing only the branch circuit supplying the unit equipment and the emergency circuit supplied by the unit equipment

(5) Wiring within a traveling cable to an elevator

(6) Wiring from an emergency source to supply emergency and other (nonemergency) loads in accordance with the following:

  (7) Separate vertical switchgear sections or separate vertical switchboard sections, with or without a common bus, or individual disconnects mounted in separate enclosures shall be used to separate emergency loads from all other loads.

  (8) The common bus of separate sections of the switchgear, separate sections of the switchboard, or the individual enclosures shall be either of the following:

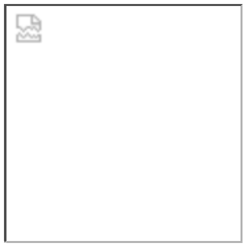
    (9) Supplied by single or multiple feeders without overcurrent protection at the source

    (10) Supplied by single or multiple feeders with overcurrent protection, provided that the overcurrent protection that is common to an emergency system and any nonemergency system(s) is selectively coordinated with the next downstream overcurrent protective device in the nonemergency system(s)

Informational Note: See Informational Note Figure 700.10(B)(1) and Informational Note Figure 700.10(B)(2) for further information.

Figure Informational Note Figure 700.10(B)(1) Single or Multiple Feeders Without Overcurrent Protection.

Figure Informational Note Figure 700.10(B)(2) Single or Multiple Feeders with Overcurrent Protection.



(11) Emergency circuits shall not originate from the same vertical switchgear section, vertical switchboard section, panelboard enclosure, or individual disconnect enclosure as other circuits.

(12) It shall be permissible to use single or multiple feeders to supply distribution equipment between an emergency source and the point where the emergency loads are separated from all other loads.

(13) At the emergency power source, such as a generator, multiple integral overcurrent protective devices shall each be permitted to supply a designated emergency or a designated nonemergency load, provided that there is complete separation between emergency and nonemergency loads beginning immediately after the overcurrent protective device line-side connections.

Wiring of two or more emergency circuits supplied from the same source shall be permitted in the same raceway, cable, box, or cabinet.

Statement of Problem and Substantiation for Public Input

The word "automatic" was added to conform to the defined term "automatic load control relay (ALCR)". In addition, an automatic load control relay is only one type of listed emergency lighting control device that requires connection of both normal and emergency sources. The more generic term "listed emergency lighting control device" was added to cover the wider range of ELCD's.

Also, acronyms ACLR and ELCD were added (respectively PI's 1622 and 1625).

Note that the only changes proposed in this PI are in 700.10(B)(3). Terra appears to have added spurious legislative text in other sections that are not valid.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1622-NFPA 70-2023 [Definition: Relay, Automatic Load Control. (Automatic Load ...]	Adds acronym ALCR
Public Input No. 1625-NFPA 70-2023 [Definition: Control Device, Emergency Lighting. (Emergency ...]	Adds acronym ELCD

Submitter Information Verification

Submitter Full Name: Steven Terry

Organization: Electronic Theatre Controls In

Affiliation: USITT

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Submittal Date:	Tue Jan 17 09:03:22 EST 2023
Committee:	NEC-P13

Public Input No. 3045-NFPA 70-2023 [Section No. 700.10(B)]

(B) Wiring.

Wiring from an emergency source or emergency source distribution overcurrent protection to emergency loads shall be kept entirely independent of all other wiring and equipment unless otherwise permitted in the following:

(1) Wiring from the normal power source located in transfer or interconnection equipment enclosures

(2) Wiring supplied from two sources in exit or emergency luminaires

(3) Wiring from two sources in a listed load control relay supplying exit or emergency luminaires, or in a common junction box, attached to exit or emergency luminaires

(4) Wiring within a common junction box attached to unit equipment, containing only the branch circuit supplying the unit equipment and the emergency circuit supplied by the unit equipment

(5) Wiring within a traveling cable to an elevator

(6) Wiring from an emergency source to supply emergency and other (nonemergency) loads in accordance with the following:

   (7) Separate vertical switchgear sections or separate vertical switchboard sections, with or without a common bus, or individual disconnects mounted in separate enclosures shall be used to separate emergency loads from all other loads.

   (8) The common bus of separate sections of the switchgear, separate sections of the switchboard, or the individual enclosures shall be either of the following:

      (9) Supplied by single or multiple feeders without overcurrent protection at the source

      (10) Supplied by single or multiple feeders with overcurrent protection, provided that the overcurrent protection that is common to an emergency system and any nonemergency system(s) is selectively coordinated with the next downstream overcurrent protective device in the nonemergency system(s)

Informational Note: See Informational Note Figure 700.10(B)(1) and Informational Note Figure 700.10(B)(2) for further information.

Figure Informational Note Figure 700.10(B)(1) Single or Multiple Feeders Without Overcurrent Protection.

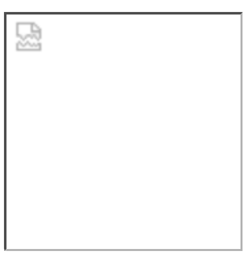
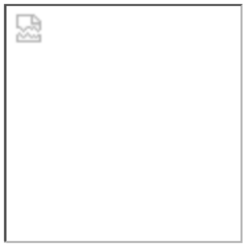


Figure Informational Note Figure 700.10(B)(2) Single or Multiple Feeders with Overcurrent Protection.



(11) Emergency circuits shall not originate from the same vertical switchgear section, vertical switchboard section, panelboard enclosure, or individual disconnect enclosure as other circuits.

(12) It shall be permissible to use single or multiple feeders to supply distribution equipment between an emergency source and the point where the emergency loads are separated from all other loads.

(13) At the emergency power source, such as a generator, multiple integral overcurrent protective devices shall each be permitted to supply a designated emergency or a designated nonemergency load, provided that there is complete separation between emergency and nonemergency loads beginning immediately after the overcurrent protective device line-side connections.

Wiring of two or more emergency circuits supplied from the same source shall be permitted in the same raceway, cable, box, or cabinet.

Statement of Problem and Substantiation for Public Input

This public input revised only 700.10(B)(1). The underlined portions shown elsewhere were not changed.

The term interconnection equipment is added to correlate with the permitted emergency sources in 700.12 which may include an interconnection to the normal power system. This term aligns with the product safety requirements for emergency systems in UL 3008. A separate public input revising the term "Microgrid Interconnect Device" to also include this term has been submitted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3043-NFPA 70-2023 [Section No. 700.10(A)]	

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
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Submittal Date: Tue Aug 29 08:55:39 EDT 2023
Committee: NEC-P13

Public Input No. 441-NFPA 70-2023 [Section No. 700.10(D)(1)]

(1) Occupancies.

Emergency systems shall meet the additional requirements in 700.10(D)(2) through (D)(4) in the following occupancies:

(1) Assembly occupancies for not less than 1000 persons

(2) ~~Buildings above 23 m (75 ft) in height~~ High-Rise Building

(3) Educational occupancies with more than 300 occupants

Statement of Problem and Substantiation for Public Input

The current wording in Article 700.10(D)(1) lacks specificity regarding how building height is determined, introducing opportunity for varying interpretations. The wording implies that the requirement is applicable to high-rise buildings.

Submitter Information Verification

Submitter Full Name:	Ross Bush
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Submittal Date:	Thu Mar 09 14:19:02 EST 2023
Committee:	NEC-P13

Public Input No. 2860-NFPA 70-2023 [Section No. 700.10(D)(2)]

(2) Feeder-Circuit Wiring.

Feeder-circuit wiring shall meet one of the following conditions:

(1) The cable or raceway is installed in spaces or areas that are fully protected by an approved automatic fire protection 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: See UL 1724, *Fire Tests for Electrical Circuit Protection Systems,* for one method of defining an electrical circuit protective system. The UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain a minimum 2-hour fire-resistive rating and is available from the certification body.

(3) The cable or raceway is a listed fire-resistive cable system with a minimum 2-hour fire rating.

> Informational Note No. 2: See ~~UL 2196~~ UL 2196 -2017 , *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*, for one method of defining a fire-resistive cable system.

(4) The cable or raceway is protected by a listed fire-rated assembly that has a minimum fire rating of 2 hours and contains only emergency circuits.

(5) The cable or raceway is encased in concrete located at or below grade with a minimum thickness of 50 mm (2 in.) ~~of concrete~~ from each point on the surface of the cable or raceway .

Statement of Problem and Substantiation for Public Input

This revision will clarify the requirement for encasement of emergency circuits in concrete. The language is commonly interpreted as requiring at least 2 inches thickness from the outer surface of the wiring method, but that is not clearly stated in previous codes. Additionally, the concrete encasement is subject to physical damage during an emergency event where not solidly supported along the length of the run.

Submitter Information Verification

Submitter Full Name: Christel Hunter
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Submittal Date: Fri Aug 25 16:25:19 EDT 2023
Committee: NEC-P13

Public Input No. 3707-NFPA 70-2023 [Section No. 700.10(D)(2)]

(2) Feeder-Circuit Wiring.

Feeder-circuit wiring shall meet one of the following conditions:

(1) The cable or raceway is installed in spaces or areas that are fully protected by an approved automatic fire protection 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: See UL 1724, *Fire Tests for Electrical Circuit Protection Systems,* for one method of defining an electrical circuit protective system. The UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain a minimum 2-hour fire-resistive rating and is available from the certification body.

(3) The cable or raceway is a listed fire-resistive cable system with a minimum 2-hour fire rating.

Informational Note No. 2: See UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*, for one method of defining a fire-resistive cable system.

(4) The cable or raceway is protected by a listed fire-rated assembly that has a minimum fire rating of 2 hours and contains only emergency circuits.

(5) The cable or raceway is encased in a minimum of ~~50 mm (2 in.~~ 127 mm (5 inches) of concrete and 200 ° C (392 °F) rated conductors are used [limited to the ampacity of 194°F (90°C)] within properly rated conduit .

Statement of Problem and Substantiation for Public Input

The NFPA Research Foundation published a report titled ‘Fire Resistance of Concrete for Electrical Conductors’ in December 2018 to provide insight to the National Electrical Code regarding concrete encasement meant to protect electrical conductors from the effects of fire.

Simply allowing concrete encasement for 2-hour fire protection as its currently written does not appear to hold the same level of scrutiny as those required for the remaining protection options as explained below:

1) The criteria to select concrete for thermal protection are either:
a. End-point heat transmission acceptance criterion of ASTM E119 limiting the temperature rise of the non-exposed concrete surface to an average of 250 F considering all measuring points or a maximum of 325 F at any single point.
b. End-point integrity acceptance criterion of ASTM E119 that prohibits the passage of flame or gases hot enough to ignite cotton waste within the selected test period.

2) Assuming that the NEC permits concrete encasement to provide 2-hour fire protection based on the end-point heat transmission acceptance criterion of item 1) a. above, as temperature of the unexposed surface could be used to relate to the ambient temperature that the conductors will be exposed to:
a. 250 °F (121.1 °C) average and 325 °F single point (162.8 °C) are higher than the rating of many conductor types listed in the NEC, and these are just the rise in temperature above the initial ambient temperature. NFPA 70 Article 310.14 (3) states that “No conductor shall be used in such a manner that its operating temperature exceeds that designated for the type of insulated conductor involved.”
b. Besides the high ambient temperature inside concrete encasement in the event of a fire, the

conductors will also heat up from the internal heat generated by resistance during power transmission and they will not be able to dissipate this heat into the surrounding ambient. In a fire event, the temperature of the conductors could become higher than the temperatures found in the concrete encased environment, due to the sum of these effects.

c. Most NEC conductor types would be outside their rated temperature if used in these conditions, thus infringing NFPA 70 Article 310.14 (3).

3) Concrete thickness required to provide 2-hour protection based on end-point heat transmission is up to 5” depending on the type of aggregate used. The ‘Fire Resistance of Concrete for Electrical Conductors’ cites several sources of information where this data can be found. Of notice is ACI 216.1-07 entitled ‘Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies’ by the American Concrete Institute, where tables and graphs clearly demonstrate how concrete thicknesses vary from 3.6 inches to 5 inches to provide 2-hours of protection where the temperature rise. Using only 2 inches of concrete would cause an increase of 250 °F above the initial temperature in less than 1-hour for most concrete types, based on figure 2.3 of the ACU document mentioned above. The only 2-inches thick concrete type that is able to limit the temperature rise of 250 °F above ambient for 1-hour is insulating concrete, and again, only for 1-hour.

In light of the presented concerns, it is evident that relying on 2 inches of concrete or even increasing to 5 inches, may not adequately ensure the thermal protection required to safeguard conductors during a 2-hour fire. Such an approach risks exposing conductors to temperatures far beyond their ratings and contravenes NEC safety standards.

Another proposal has been made to modify Article 230.6, where service conductors encased in 2-inches thick concrete are considered to be outside of the building. The proposed modification will clarify that that 2-inches of concrete grants mechanical protection only; fire-resistance is unrelated to this mechanical only consideration as seen in the arguments presented here that 2-inches of concrete may not provide adequate thermal protection to maintain the conductors’ insulation temperature within their rated range.

Therefore, it is important that concrete encasement be reevaluated as an option for providing 2-hour fire protection for conductors. This proposal underscores the need for a more comprehensive and safety-conscious approach to address this critical issue within the electrical code.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3688-NFPA 70-2023 [Section No. 695.6(A)(2)]	same topic

Submitter Information Verification

Submitter Full Name: Alex Marciano

Organization: Marmon IEI

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Submittal Date: Tue Sep 05 14:30:27 EDT 2023

Committee: NEC-P13

Public Input No. 3046-NFPA 70-2023 [Section No. 700.10(D)(3)]

(3) Feeder-Circuit Equipment.

Equipment for feeder circuits (including transfer switches, interconnection equipment, transformers, and panelboards) shall be located either in spaces fully protected by an approved automatic fire protection system or in spaces with a 2-hour fire resistance rating.

Statement of Problem and Substantiation for Public Input

The term interconnection equipment is added to correlate with the permitted emergency sources in 700.12 which may include an interconnection to the normal power system. This term aligns with the product safety requirements for emergency systems in UL 3008. A separate public input revising the term "Microgrid Interconnect Device" to also include this term has been submitted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3043-NFPA 70-2023 [Section No. 700.10(A)]	

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address:
City:
State:
Zip:

Submittal Date: Tue Aug 29 09:00:01 EDT 2023
Committee: NEC-P13

Public Input No. 4347-NFPA 70-2023 [Section No. 700.11]

700.11 Wiring, ~~Class-2-Powered~~ Limited Energy Emergency Lighting Systems.

(A) General.

Line voltage supply wiring and installation of Class 2 ~~emergency~~ , Class 3, and Class 4 emergency lighting control devices shall comply with 700.10. Class 2, Class 3, and Class 4 emergency circuits shall comply with 700.11(B) through (D).

(B) Identification.

Emergency circuits shall be permanently marked so they will be readily identified as a component of an emergency circuit or system by the following methods:

(1) All boxes and enclosures for Class 2, Class 3, and Class 4 emergency circuits shall be permanently marked as a component of an emergency circuit or system.

(2) Exposed cable, cable tray, or raceway systems shall be permanently marked to be identified as a component of an emergency circuit or system, within 900 mm (3 ft) of each connector and at intervals not to exceed 7.6 m (25 ft).

(C) Separation of Circuits.

Class 2, Class 3, and Class 4 emergency circuits shall be wired in a listed, jacketed cable or with one of the wiring methods of Chapter 3. If installed alongside nonemergency Class 2, Class 3, and Class 4 circuits that are bundled, ~~Class 2 emergency~~ emergency circuits shall be bundled separately. If installed alongside nonemergency Class 2, Class 3, and Class 4 circuits that are not bundled, ~~Class 2 emergency~~ emergency circuits shall be separated by a nonconductive sleeve or nonconductive barrier from all other Class 2, Class 3, and Class 4 circuits. Separation from other circuits shall comply with 725.136 and 726 . 136 .

(D) Protection.

Wiring shall comply with the requirements of 300.4 and be installed in a raceway, armored or metal-clad cable, or cable tray.

Exception No. 1: Section 700.11(D) shall not apply to wiring that does not exceed 1.83 m (6 ft) in length and that terminates at an emergency luminaire or an emergency lighting control device.

Exception No. 2: Section 700.11(D) shall not apply to locked rooms or locked enclosures that are accessible only to qualified persons.

Informational Note: Locked rooms accessible only to qualified persons include locked telecommunications rooms, locked electrical equipment rooms, or other access-controlled areas.

Statement of Problem and Substantiation for Public Input

Not sure why this article is restricted to just Class 2. Adding Class 3 and Class 4 as an alternative to Class 2 circuits. Class 3 circuits have similar voltage and power restrictions as Class 2, with a few more installation requirements. Class 4 systems were added in the 2023 code and have equivalent or better than fire and life safety requirements as Class 2 circuits with similar installation requirements (the Class 4 requirements were modeled after Article 725). An effort to analyze all the locations of Class 2 in the code to see if Class 4 was also appropriate in the application should have happened for the 2023 code and not doing it was an oversight.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4352-NFPA 70-2023 [Section No. 700.27]	same change, both should be analyzed together.
Public Input No. 4352-NFPA 70-2023 [Section No. 700.27]	

Submitter Information Verification

Submitter Full Name:	Chad Jones
Organization:	Cisco Systems
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Sep 07 12:19:43 EDT 2023
Committee:	NEC-P13

Public Input No. 4240-NFPA 70-2023 [Section No. 700.11(D)]

(D) Protection.

~~Wiring~~ Where subject to physical damage, wiring shall comply with the requirements of 300.4 ~~and be installed in a raceway, armored or metal-clad cable, or cable tray.~~

~~Exception No. 1: Section 700.11(D) shall not apply to wiring that does not exceed 1.83 m (6 ft) in length and that terminates at an emergency luminaire or an emergency lighting control device.~~

~~Exception No. 2~~

.

Exception

Exception : Section 700.11(D) shall not apply to locked rooms or locked enclosures that are accessible only to qualified persons.

Informational Note: Locked rooms accessible only to qualified persons include locked telecommunications rooms, locked electrical equipment rooms, or other access-controlled areas.

Statement of Problem and Substantiation for Public Input

During the 2023 NEC development process, the original proposal (PI 2850) was to require more robust wiring methods only "where subject to physical damage".
The reworded, final language from FR 8818 deleted the words "where subject to physical damage" and can be interpreted to always require a raceway, AC or MC cable, or a cable tray (unless the exceptions apply) even if wiring methods are not subject to physical damage.
I suggest reading aloud the current language and the original proposed language (from 2023 PI 2850) twice to hear the potential differences. The perspective completely changes without the words "where subject to physical damage" starting off the sentence.

As currently written, the section can be misinterpreted to contain the following two separate requirements; 1) Wiring shall comply with the requirements of 300.4,
2) wiring shall be installed in a raceway, armored or metal-clad cable, or cable tray.

Additionally, I suggest deleting the words "and be installed in a raceway, armored or metal-clad cable, or cable tray" since Section 300.4 provides suitable methods for most circumstances where a wiring method is determined to be subject to physical damage.

If the code panel intends for Section 700.11(D) to require Class 2 emergency lighting circuits to be installed in a raceway, armored or metal-clad cable, or cable tray even if not subject to physical damage, I would ask the code panel to share those reasons and to elaborate as to why the current language in 700.10(C) is insufficient.

The current language in 700.11(D) permits a "raceway" (without specifying the type) as a protection method if protection from physical damage is an issue. Many Chapter 3 raceways are not permitted to be used where subject to physical damage, so I would ask the code panel to specify which raceways are acceptable so as not to contradict the XXX.10 or XXX.12 sections in other chapters. Additionally, allowing type AC cable to be used as a method in this section to protect against physical damage would contradict the uses permitted for AC cable in 320.12(1). Same for Metal Clad cable in 330.12(1).

Currently Section 700.10(C) adequately addresses emergency wiring circuit protection by stating the following: "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". Some

jurisdictions misapply and use this code section as a basis to require AC cable, MC cable, raceways or cable trays for Class 2 PoE emergency lighting circuits since both 700.10(C) and 700.11(D) are in Part II of Article 700.
To my knowledge, basic product testing for typical Listed AC cables, MC cables, "raceways" or "cable trays" (unless specifically identified) does not include considering these wiring methods will be subject to "hazards that might cause failure due to flooding, fire, icing, vandalism, and other adverse conditions" as mentioned in 700.10(C). This being the case, AHJ's requiring and accepting these wiring methods for compliance with 700.10(C) are doing so based on their own preferences rather than the suitability of the product.

As currently written, Section 700.11(D) can present a huge hurdle for the POE industry to comply with (if cables need to be installed in a raceway) since data cables have RJ-45 terminals to plug directly into data ports on luminaires and network switches. PoE luminaires and network switches have no provisions to be connected by a raceway or metal clad/armored cable connector. That would leave the POE industry few options for running Class 2 data cables between network switches and POE luminaires/equipment.
I can't think of any similar emergency circuit protection requirements in Article 700 for line voltage emergency lighting systems. Currently, nonmetallic sheathed cable TYPE NM (chapter 3 wiring method) is permitted for line voltage emergency lighting in many occupancies. It can be argued that TYPE NM cable is no more robust and provides no additional protection over CAT 5,6 data cables.

Submitter Information Verification

Submitter Full Name:	Jeffrey Simpson
Organization:	ElectricalLicenseRenewal.com
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Sep 07 04:29:41 EDT 2023
Committee:	NEC-P13

Public Input No. 581-NFPA 70-2023 [Section No. 700.11(D)]

(D) Protection.

Wiring shall comply with the requirements of 300.4 and be installed in a raceway, armored or metal-clad cable, or cable tray.

Exception No. 1: Section 700.11(D) shall not apply to wiring that does not exceed 1.83 m (6 ft) in length and that terminates at an emergency luminaire or an emergency lighting control device.

Exception No. 2: Section 700.11(D) shall not apply to locked rooms or locked enclosures that are accessible only to qualified persons.

~~Informational Note: Locked rooms accessible only to qualified persons include locked telecommunications rooms, locked electrical equipment rooms, or other access-controlled areas.~~

Statement of Problem and Substantiation for Public Input

Are there really people that don't know what a locked door is?

Submitter Information Verification

Submitter Full Name: Ryan Jackson

Organization: Self-employed

Street Address:

City:

State:

Zip:

Submittal Date: Mon Apr 10 14:21:33 EDT 2023

Committee: NEC-P13

Public Input No. 2502-NFPA 70-2023 [Section No. 700.12(A)]

~~**(A)** Power Source Considerations.~~

~~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.~~

Statement of Problem and Substantiation for Public Input

This is not enforceable. I can't require a perosn to "consider" something. Even if I could, what then? Do I send them to George Orwell's thought police? If this language is retaining it should be made into an informational note.

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Self-employed
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City:
State:
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Submittal Date: Fri Aug 18 12:55:38 EDT 2023
Committee: NEC-P13

Public Input No. 417-NFPA 70-2023 [Section No. 700.12(F)]

(F) Separate Service.

Where approved by the authority having jurisdiction as suitable for use as an emergency source of power, an additional service shall be permitted. This service shall be in accordance with the applicable provisions of Article 230 and the following additional requirements:

(1) Separate overhead service conductors, ~~service drops~~ utility drops , underground service conductors, or ~~service laterals~~ utility laterals shall be installed.

(2) The service conductors for the separate service shall be installed sufficiently remote electrically and physically from any other service conductors to minimize the possibility of simultaneous interruption of supply.

Statement of Problem and Substantiation for Public Input

This PI is associated with several other PIs to recommend a global change from “service drop” to “utility drop” and from “service lateral” to “utility lateral.” “Service drop” appears 23 times in the Code and “service lateral” appears 15 times. There are 11 definitions that begin with the word ‘service.’ Of these, 9 are customer owned and only “service drop” and “service lateral” are utility owned and, therefore, outside the scope of the Code. “service drops” and “service laterals” are not service conductors as they do not fit the definition. Confining the word “service” to only those items that are customer owned would clear up much confusion on this topic. Appendix A shows UL 523 as having the title “telephone service drop wire” and the UL standard does, in fact, have that title. However, the text of UL 523 defines this wire as customer owned and Article 805 refers to this wire as a “drop wire.”

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 411-NFPA 70-2023 [Section No. 90.2(D)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 412-NFPA 70-2023 [Definition: Service Drop.]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 413-NFPA 70-2023 [Definition: Service-Entrance Conductors.]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 414-NFPA 70-2023 [Definition: Distribution Point (Center Yard Pole) (Meter Po...]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 415-NFPA 70-2023 [Definition: Service Lateral.]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 416-NFPA 70-2023 [Section No. 800.44(A)(4)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 418-NFPA 70-2023 [Section No. 701.12(F)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 419-NFPA 70-2023 [Section No. 770.44(A)(4)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 420-NFPA 70-2023 [Section No. 770.44(B)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 421-NFPA 70-2023 [Section No. 230.24(A)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'

Public Input No. 422-NFPA 70-2023 [Section No. 230.40]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 423-NFPA 70-2023 [Section No. 250.24(A)(1)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 424-NFPA 70-2023 [Section No. 250.24(F)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 425-NFPA 70-2023 [Section No. 250.64(D)(1)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 426-NFPA 70-2023 [Section No. 250.66 [Excluding any Sub-Sections]]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 411-NFPA 70-2023 [Section No. 90.2(D)]	
Public Input No. 412-NFPA 70-2023 [Definition: Service Drop.]	
Public Input No. 413-NFPA 70-2023 [Definition: Service-Entrance Conductors.]	
Public Input No. 414-NFPA 70-2023 [Definition: Distribution Point (Center Yard Pole) (Meter Po...]	
Public Input No. 415-NFPA 70-2023 [Definition: Service Lateral.]	
Public Input No. 416-NFPA 70-2023 [Section No. 800.44(A)(4)]	
Public Input No. 418-NFPA 70-2023 [Section No. 701.12(F)]	
Public Input No. 419-NFPA 70-2023 [Section No. 770.44(A)(4)]	
Public Input No. 420-NFPA 70-2023 [Section No. 770.44(B)]	
Public Input No. 421-NFPA 70-2023 [Section No. 230.24(A)]	
Public Input No. 422-NFPA 70-2023 [Section No. 230.40]	
Public Input No. 423-NFPA 70-2023 [Section No. 250.24(A)(1)]	
Public Input No. 424-NFPA 70-2023 [Section No. 250.24(F)]	
Public Input No. 425-NFPA 70-2023 [Section No. 250.64(D)(1)]	
Public Input No. 426-NFPA 70-2023 [Section No. 250.66 [Excluding any Sub-Sections]]	

Submitter Information Verification

Submitter Full Name: Eric Stromberg

Organization: Los Alamos National Laboratory

Affiliation: Self

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Submittal Date:	Sat Mar 04 16:38:49 EST 2023
Committee:	NEC-P13

Public Input No. 3047-NFPA 70-2023 [Section No. 700.12(G)]

(G) Microgrid Systems.

On-site sources, designated as emergency sources, shall be permitted to be connected to a microgrid system.

The system shall include interconnection equipment listed for emergency use to isolate the emergency system from all nonemergency loads when the normal electric supply is interrupted or shall meet the requirements of 700.4(B). Interruption or partial or complete failure of the normal or nonemergency source(s) shall not impact the availability, capacity, and duration provided by the designated emergency sources.

The designated stored-energy electrical emergency power source(s) of a microgrid system shall be permitted to remain interconnected to any available power production source during operation of the emergency source(s) where the lack of, or failure of, the interconnected power production source(s), or related controls, does not impact system operation. Interconnected power production sources, other than the designated stored emergency power source(s), shall not be required to meet the requirements of this article.

Statement of Problem and Substantiation for Public Input

The term interconnection equipment is added to correlate with the permitted emergency sources in 700.12 which may include an interconnection to the normal power system. This term aligns with the product safety requirements for emergency systems in UL 3008. A separate public input revising the term "Microgrid Interconnect Device" to also include this term has been submitted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3043-NFPA 70-2023 [Section No. 700.10(A)]	

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address:
City:
State:
Zip:

Submittal Date: Tue Aug 29 09:01:42 EDT 2023
Committee: NEC-P13

Public Input No. 1054-NFPA 70-2023 [Section No. 700.12(H)(2)]

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Where required. Exits and exit access doors shall be marked by an approved exit sign readily visible from any direction of egress travel. The path of egress travel to exits and within exits shall be marked by readily visible exit signs to clearly indicate the direction of egress travel in cases where the exit or the path of egress travel is not immediately visible to the occupants. Intervening means of egress doors within exits shall be marked by exit signs. Exit sign placement shall be such that any point in an exit access corridor or exit passageway is within 100 feet (30 480 mm) or the listed viewing distance of the sign, whichever is less, from the nearest visible exit sign.

Exceptions:

1. Exit signs are not required in rooms or areas that require only one exit or exit access.

2. Main exterior exit doors or gates that are obviously and clearly identifiable as exits need not have exit signs where approved by the building official.

(7) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

Additional Proposed Changes

File Name	Description	Approved
700.12_H_2_6_.jpg	Exit location in daylight.	

Statement of Problem and Substantiation for Public Input

The emergency exit luminaire signage may not be visible from all locations egressing into the exit area depending on the time of day. To align with IBC SECTION 1013
EXIT SIGNS 1013.1

There are several PI's with alternate wording for the panel to consider.

Submitter Information Verification

Submitter Full Name: Richard Hollander
Organization: Shums Coda Associates
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 12 20:28:37 EDT 2023
Committee: NEC-P13

Public Input No. 1442-NFPA 70-2023 [Section No. 700.12(H)(2)]

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

d. A multi-wire branch circuit shall be permitted as long as all ungrounded conductors are used for building lighting in the occupied area and are simultaneously disconnected.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

Statement of Problem and Substantiation for Public Input

I don't see any real world issue with using a multi-wire branch circuit for battery backed EM equipment.

Submitter Information Verification

Submitter Full Name: William Snyder
Organization: RCC Solutions
Street Address:
City:
State:
Zip:

Submittal Date:	Sun Jul 16 17:39:40 EDT 2023
Committee:	NEC-P13

Public Input No. 3431-NFPA 70-2023 [Section No. 700.12(H)(2)]

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable). Battery-equipped lamps shall not be considered permanently fixed in place.

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

Statement of Problem and Substantiation for Public Input

There are now lamps on the market that contain batteries and charging/transfer circuits in addition to a light source. While such battery containing lamps are suitable for auxiliary lighting use, they cannot be listed to UL 924 The Standard for Safety for Emergency Lighting and Power Equipment. This is because UL 924 requires emergency battery packs to have a means for permanent mounting to a luminaire. Since these lamps are user replaceable, they do not have a means for fixing in place to ensure permanent installation. Accordingly, there is nothing to prevent these lamps being replaced with lamps not equipped with batteries, thus emergency lighting system reliability is ignored, and emergency egress lighting is lost. Such replacement would likely occur during normal facility maintenance without AHJ knowledge. These lamps are certified (listed) as Self-ballasted, Light-emitting-diode Type lamps, to UL1993. The UL guide card for this listing category (OOLV) states: "These products have not been investigated for use in emergency lighting equipment or exit signs." The suggested revision to 700.12(H)(2) will help to clarify that these products do not represent battery-equipped emergency luminaires and will assist in enforcing this important system reliability requirement.

Submitter Information Verification

Submitter Full Name:	Megan Hayes
Organization:	NEMA
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sat Sep 02 20:46:11 EDT 2023
Committee:	NEC-P13

Public Input No. 3546-NFPA 70-2023 [Section No. 700.12(H)(2)]

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

  a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

  b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

  c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

Where required, Exits and exit access doors shall be marked by an approved exit sign readily visible from any direction of egress travel. The path of egress travel to exits and within exits shall be marked by readily visible exit signs to clearly indicate the direction of egress travel in cases where the exit or the path of egress travel is not immediately visible to the occupants. Intervening means of egress doors within exits shall be marked by exit signs. Exit sign placement shall be such that any point in an exit access corridor or exit passageway is within 100 feet (30 480 mm) or the listed viewing distance of the sign, whichever is less, from the nearest visible exit sign.

Exceptions:

1. Main exterior exit doors or gates that are obviously and clearly identifiable as exits need not have exit signs where approved by the AHJ.

Additional Proposed Changes

File Name	Description	Approved
700.12_H_2_6_.jpg	Exit Sign on the ceiling.	

Statement of Problem and Substantiation for Public Input

The emergency exit luminaire signage may not be visible from all locations egressing into the exit area depending on the time of day.

This will help to align with IBC SECTION 1013 EXIT SIGNS 1013.1 Electrical inspectors don’t always know where exit signs are required. Building inceptors look at exit signs but don’t always check electrical installation.

There are several PI's with alternate wording for the panel to consider.

Submitter Information Verification

Submitter Full Name: Richard Hollander
Organization: Shums Coda Associates
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 04 19:14:19 EDT 2023
Committee: NEC-P13


EXIT

Public Input No. 3548-NFPA 70-2023 [Section No. 700.12(H)(2)]

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

Access to exits shall be marked by approved, readily visible signs in all cases where the exit or way to reach the exit is not readily apparent to the occupants. New sign placement shall be such that no point in an exit access corridor is in excess of the rated viewing distance or 100 ft (30 m), whichever is less, from the nearest sign. The bottom of new egress markings shall be located at a vertical distance of not more than 6 ft 8 in. (2030 mm) above the top edge of the egress opening intended for designation by that marking. Egress markings shall be located at a horizontal distance of not more than the required width of the egress opening, as measured from the edge of the egress opening intended for designation by that marking to the nearest edge of the marking.

[101:7.10.1.5.1,7.10.1.5.27.10.1.9]

Additional Proposed Changes

File Name	Description	Approved
700.12_H_2_6_.jpg	Exit sign on the ceiling.	

Statement of Problem and Substantiation for Public Input

The emergency exit luminaire signage may not be visible from all locations egressing into the exit area depending on the time of day. This will help to align with NFPA 101 7.10.1.5.1, 7.10.1.5.2, and 7.10.1.9. Electrical inspectors don’t always know where exit signs are required. Building inceptors look at exit signs but don’t always check electrical installation.

There are several PI's with alternate wording for the panel to consider.

Submitter Information Verification

Submitter Full Name:	Richard Hollander
Organization:	Shums Coda Associates
Street Address:	
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Submittal Date:	Mon Sep 04 19:21:37 EDT 2023
Committee:	NEC-P13

Public Input No. 3554-NFPA 70-2023 [Section No. 700.12(H)(2)]

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote ~~luminaires~~ luminaires

(7) Remote Luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by

~~the~~

(a) battery-equipped emergency luminaire serving the area immediately inside the exit door.

(b) Access to exits shall be marked by approved, readily visible signs in all cases where the exit or way to reach the exit is not readily apparent to the occupants.

(c) New sign placement shall be such that no point in an exit access corridor is in excess of the rated viewing distance or 100 ft (30 m), whichever is less, from the nearest sign.

(d) The bottom of new egress markings shall be located at a vertical distance of not more than 6 ft 8 in. (2030 mm) above the top edge of the egress opening intended for designation by that marking. Egress markings shall be located at a horizontal distance of not more than the required width of the egress opening, as measured from the edge of the egress opening intended for designation by that marking to the nearest edge of the marking.

[101:7.10.1.5.1,7.10.1.5.27.10.1.9]

Additional Proposed Changes

File Name	Description	Approved
700.12_H_2_6_.jpg	Exit sign on ceiling.	

Statement of Problem and Substantiation for Public Input

The emergency exit luminaire signage may not be visible from all locations egressing into the exit area depending on the time of day. This will help to align with NFPA 101 7.10.1.5.1, 7.10.1.5.2, and 7.10.1.9. Electrical inspectors don’t always know where exit signs are required. Building inceptors look at exit signs but don’t always check electrical installation.

There are several PI's with alternate wording for the panel to consider.

Submitter Information Verification

Submitter Full Name:	Richard Hollander
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State:	
Zip:	
Submittal Date:	Mon Sep 04 19:33:22 EDT 2023
Committee:	NEC-P13

Public Input No. 3557-NFPA 70-2023 [Section No. 700.12(H)(2)]

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

. Exit access signs shall be readily visible to all occupants from a viewing distance or 100 ft (30 m), whichever is less, from the nearest sign and a vertical distance of not more than 6 ft 8 in. (2030 mm) above the top edge of the egress opening between daylight and dark situations.

Additional Proposed Changes

File Name	Description	Approved
700.12_H_2_6_.jpg	Exit sign on ceiling.	

Statement of Problem and Substantiation for Public Input

The emergency exit luminaire signage may not be visible from all locations egressing into the exit area depending on the time of day. This will help inspectors understand where signs shall be located. Electrical inspectors don't always know where exit signs are required. Building inceptors look at exit signs but don't always check electrical installation.

Submitter Information Verification

Submitter Full Name:	Richard Hollander
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Submittal Date:	Mon Sep 04 19:37:55 EDT 2023
Committee:	NEC-P13


EXIT

Public Input No. 3559-NFPA 70-2023 [Section No. 700.12(H)(2)]

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

(7)

Where required, Exits and exit access doors shall be marked by an approved exit sign readily visible from any direction of egress travel. The path of egress travel to exits and within exits shall be marked by readily visible exit signs to clearly indicate the direction of egress travel in cases where the exit or the path of egress travel is not immediately visible to the occupants. Intervening means of egress doors within exits shall be marked by exit signs. Exit sign placement shall be such that any point in an exit access corridor or exit passageway is within 100 feet (30 480 mm) or the listed viewing distance of the sign, whichever is less, from the nearest visible exit sign.

Exceptions:

1. Main exterior exit doors or gates that are obviously and clearly identifiable as exits need not have exit signs where approved by the AHJ.

Additional Proposed Changes

File Name	Description	Approved

700.12_H_2_6_.jpg	Exit sign on ceiling.

Statement of Problem and Substantiation for Public Input

The emergency exit luminaire signage may not be visible from all locations egressing into the exit area depending on the time of day.

This will help to align with IBC SECTION 1013 EXIT SIGNS 1013.1 Electrical inspectors don’t always know where exit signs are required. Building inceptors look at exit signs but don’t always check electrical installation.

There are several PI's with alternate wording for the panel to consider.

Submitter Information Verification

Submitter Full Name:	Richard Hollander
Organization:	Shums Coda Associates
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City:	
State:	
Zip:	
Submittal Date:	Mon Sep 04 19:40:29 EDT 2023
Committee:	NEC-P13

Public Input No. 3562-NFPA 70-2023 [Section No. 700.12(H)(2)]

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

  a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

  b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

  c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

(7)

Access to exits shall be marked by approved, readily visible signs in all cases where the exit or way to reach the exit is not readily apparent to the occupants. New sign placement shall be such that no point in an exit access corridor is in excess of the rated viewing distance or 100 ft (30 m), whichever is less, from the nearest sign. The bottom of new egress markings shall be located at a vertical distance of not more than 6 ft 8 in. (2030 mm) above the top edge of the egress opening intended for designation by that marking. Egress markings shall be located at a horizontal distance of not more than the required width of the egress opening, as measured from the edge of the egress opening intended for designation by that marking to the nearest edge of the marking.

[101:7.10.1.5.1,7.10.1.5.27.10.1.9]

Additional Proposed Changes

File Name	Description	Approved
700.12_H_2_6_.jpg	Exit sign on ceiling.	

Statement of Problem and Substantiation for Public Input

The emergency exit luminaire signage may not be visible from all locations egressing into the exit area depending on the time of day.

This will help to align with NFPA 101 7.10.1.5.1, 7.10.1.5.2, and 7.10.1.9. Electrical inspectors don't always know where exit signs are required. Building inceptors look at exit signs but don't always check electrical installation.

There are several PI's with alternate wording for the panel to consider.

Submitter Information Verification

Submitter Full Name: Richard Hollander

Organization: Shums Coda Associates

Street Address:

City:

State:

Zip:

Submittal Date: Mon Sep 04 19:45:17 EDT 2023

Committee: NEC-P13


EXIT

Public Input No. 3565-NFPA 70-2023 [Section No. 700.12(H)(2)]

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

(7) **Exit Signage**

(8) Access to exits shall be marked by approved, readily visible signs in all cases where the exit or way to reach the exit is not readily apparent to the occupants.

(9) New sign placement shall be such that no point in an exit access corridor is in excess of the rated viewing distance or 100 ft (30 m), whichever is less, from the nearest sign.

(10) The bottom of new egress markings shall be located at a vertical distance of not more than 6 ft 8 in. (2030 mm) above the top edge of the egress opening intended for designation by that marking. Egress markings shall be located at a horizontal distance of not more than the required width of the egress opening, as measured from the edge of the egress opening intended for designation by that marking to the nearest edge of the marking.

[101:7.10.1.5.1,7.10.1.5.27.10.1.9]

Additional Proposed Changes

File Name	Description	Approved
700.12_H_2_6_.jpg	Exit sign on ceiling.	

Statement of Problem and Substantiation for Public Input

The emergency exit luminaire signage may not be visible from all locations egressing into the exit area depending on the time of day.

This will help to align with NFPA 101 7.10.1.5.1, 7.10.1.5.2, and 7.10.1.9. Electrical inspectors don’t always know where exit signs are required. Building inceptors look at exit signs but don’t always check electrical installation.

There are several PI's with alternate wording for the panel to consider.

Submitter Information Verification

Submitter Full Name:	Richard Hollander
Organization:	Shums Coda Associates
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Sep 04 19:48:30 EDT 2023
Committee:	NEC-P13


EXIT

Public Input No. 3568-NFPA 70-2023 [Section No. 700.12(H)(2)]

(2) Installation.

Battery-equipped emergency luminaires shall be installed in accordance with the following:

(1) Battery-equipped emergency luminaires shall be permanently fixed in place (i.e., not portable).

(2) Wiring to each luminaire shall be installed in accordance with the requirements of any of the wiring methods in Chapter 3 unless otherwise specified in Part II, IV, or V of this article. Flexible cord-and-plug connection shall be permitted for unit equipment, provided that the cord does not exceed 900 mm (3 ft) in length. Flexible cord, with or without a plug, shall also be permitted for battery-equipped emergency luminaires installed in accordance with 410.62(C)(1).

(3) The branch circuit feeding the battery-equipped emergency luminaire shall be one of the following:

a. The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.

b. The same or a different branch circuit as that serving the normal lighting in the area if that circuit is equipped with means to monitor the status of that area's normal lighting branch circuit ahead of any local switches.

c. A separate branch circuit originating from the same panelboard as one or more normal lighting circuits. This separate branch circuit disconnecting means shall be provided with a lock-on feature.

(4) The branch circuit that feeds battery-equipped emergency luminaires shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a battery-equipped emergency luminaire shall be wired to the battery-equipped emergency luminaires as required in Part II, IV, or V of this article.

(6) Remote luminaires providing lighting for the exterior of an exit door shall be permitted to be supplied by the battery-equipped emergency luminaire serving the area immediately inside the exit door.

(7) Exit access signs shall be readily visible to all occupants from a viewing distance or 100 ft (30 m), whichever is less, from the nearest sign and a vertical distance of not more than 6 ft 8 in. (2030 mm) above the top edge of the egress opening between daylight and dark situations.

Additional Proposed Changes

File Name	Description	Approved
700.12_H_2_6_.jpg	Exit sign on ceiling.	

Statement of Problem and Substantiation for Public Input

The emergency exit luminaire signage may not be visible from all locations egressing into the exit area depending on the time of day. This will help inspectors understand where signs shall be located. Electrical inspectors don't always know where exit signs are required. Building inceptors look at exit signs but don't always check electrical installation.

There are several PI's with alternate wording for the panel to consider.

Submitter Information Verification

Submitter Full Name:	Richard Hollander
Organization:	Shums Coda Associates
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City:	
State:	
Zip:	
Submittal Date:	Mon Sep 04 19:55:04 EDT 2023
Committee:	NEC-P13


EXIT

Public Input No. 2391-NFPA 70-2023 [Section No. 700.12 [Excluding any Sub-Sections]]

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(C) through (H). ~~Unit equipment in~~ Battery-equipped emergency luminaire in accordance with 700.12(H) shall satisfy the applicable requirements of this article.

Statement of Problem and Substantiation for Public Input

700.12(H) is a requirement about battery-equipped emergency luminaires, not unit equipment. This proposed revision will make the requirement technically correct.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 16 16:13:52 EDT 2023

Committee: NEC-P13

Public Input No. 3048-NFPA 70-2023 [Section No. 700.18]

700.18 Circuits for Emergency Power.

For branch circuits that supply equipment classed as emergency, there shall be an emergency system supply source to which the load is interconnected or will be transferred automatically upon the failure of the normal supply.

Statement of Problem and Substantiation for Public Input

The permitted emergency sources in 700.12 may utilize interconnection equipment to supply emergency power rather than performing a load transfer operation. This revision aligns the requirements to apply in either case.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3043-NFPA 70-2023 [Section No. 700.10(A)]	
Public Input No. 3049-NFPA 70-2023 [Section No. 701.12(H)]	

Submitter Information Verification

Submitter Full Name: Chad Kennedy
Organization: Schneider Electric
Street Address:
City:
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Zip:
Submittal Date: Tue Aug 29 09:04:12 EDT 2023
Committee: NEC-P13

Public Input No. 2936-NFPA 70-2023 [Section No. 700.23]

700.23 Dimmer and Relay Systems.

A dimmer or relay system containing more than one dimmer or relay and listed for use in emergency systems shall be permitted to be used as a control device for energizing emergency lighting circuits. Upon failure of normal power, the dimmer or relay system shall be permitted to selectively energize only those branch circuits required to provide minimum emergency illumination using a control bypass function. Where the dimmer or relay system is fed by a normal/emergency power source from an upstream transfer switch, normal power sensing for this function shall be permitted to be from a normal-only power source upstream of the transfer switch. All branch circuits supplied by the dimmer or relay system cabinet shall comply with the wiring methods of ~~Part II of~~ Article 700 , Part II .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.

4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.

The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name: David Williams

Organization: Delta Charter Township

Street Address:

City:

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Zip:

Submittal Date: Mon Aug 28 12:25:50 EDT 2023

Committee: NEC-P13

Public Input No. 1710-NFPA 70-2023 [Section No. 700.24]

700.~~24~~ 24

Luminaires with Control Inputs that provide emergency illumination. Luminaires with control inputs that provide emergency illumination shall comply with 700.24(A) or 700.24(B).

(A) Directly Controlled Emergency Luminaires (DCEL) .

~~Where emergency illumination is provided by one or more~~

~~directly controlled emergency luminaires~~
~~DCEL's that, upon loss of normal power, respond to an external active control signal on their control input from a listed ELCD to establish the required emergency illumination level, such~~

~~directly controlled emergency luminaires~~
~~DCEL's shall be listed for use in emergency systems.~~

~~Luminaires that are energized to the required emergency illumination level by~~

~~**(B) Directly Controlled Luminaires (DCL)** . Where emergency illumination is provided by one or more DCL's by disconnection of their control input by a listed~~

~~emergency lighting control device~~
~~ELCD upon loss of normal power, such DCL's shall not be required to be listed for use in emergency systems. If a DCL has configurable behavior for control input disconnection, it shall be set to provide full luminaire output upon control input disconnection.~~

Additional Proposed Changes

File Name	Description	Approved
PI_1710_Revised_text.docx	Word file of PI 1710 text to clarify Terra errors	

Statement of Problem and Substantiation for Public Input

The existing wording of 700.24 can be subject to misinterpretation because it covers a single device (directly controlled emergency luminaire) than can have two different listing requirements depending on the application and control system topology. In fact, two different device names are needed for clear differentiation of listing requirements: Directly Controlled Emergency Luminaire (DCEL) covered in 700.24(A), and Directly Controlled Luminaire (DCL) covered in 700.24(B). DCEL's must be listed for use in emergency systems, while DCL's do not require a listing for use in emergency systems.

The majority of DCL's such as those that use 0-10V control, have a default behavior upon disconnection of their control input that causes the DCL to provide full output. However, some DCL's such as those using the DALI control protocol, may have configurable behavior when the control input is disconnected. This is the reason for the configurable behavior full-output mandate in 700.24(B).
The following PI's are related to this PI:

PI 1620--adds acronym DCEL to definition of directly controlled emergency luiminaire
PI 1621--adds definition and acronym for directly controlled luminaire (DCL)
PI 1625--adds acronym ELCD to definition of emergency lighting control device

NOTE--Terra made repeated errors in legislative text of this PI. The complete new wording of 700.24 is attached in a Word file.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1620-NFPA 70-2023 [Definition: Emergency Luminaire, Directly Controlled. (Dire...]	adds DCEL acronym
Public Input No. 1621-NFPA 70-2023 [New Definition after Definition: Luminaire.]	adds defintion and acronym of directly controlled luminaire (DCL)
Public Input No. 1625-NFPA 70-2023 [Definition: Control Device, Emergency Lighting. (Emergency ...]	adds acronym ELCD to defintion of emergency lighting control device
Public Input No. 1620-NFPA 70-2023 [Definition: Emergency Luminaire, Directly Controlled. (Dire...]	
Public Input No. 1621-NFPA 70-2023 [New Definition after Definition: Luminaire.]	
Public Input No. 1625-NFPA 70-2023 [Definition: Control Device, Emergency Lighting. (Emergency ...]	

Submitter Information Verification

Submitter Full Name: Steven Terry

Organization: Electronic Theatre Controls In

Affiliation: US Institute for Theatre Technology

Street Address:

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Submittal Date: Sat Jul 29 09:45:30 EDT 2023

Committee: NEC-P13

PI 1710 revised text—this file is provided as Terra created legislative text errors in PI 1710

700.24 Luminaires with control inputs that provide emergency illumination. Luminaires with control inputs that provide emergency illumination shall comply with 700.24(A) or 700.24(B).

(A) Directly Controlled Emergency Luminaire (DCEL). Where emergency illumination is provided by one or more DCEL's that, upon loss of normal power, respond to an external active control signal on their control input from a listed ELCD to establish the required emergency illumination level, such DCEL's shall be listed for use in emergency systems.

(B) Directly Controlled Luminaire (DCL). Where emergency illumination is provided by one or more DCL's by disconnection of their control input by a listed ELCD upon loss of normal power, such DCL's shall not be required to be listed for use in emergency systems. If a DCL has configurable behavior for control input disconnection, it shall be set to provide full luminaire output upon control input disconnection.

Public Input No. 4352-NFPA 70-2023 [Section No. 700.27]

700.27 ~~Class 2 Powered~~ Limited Energy Emergency Lighting Systems.

Devices that combine control signals with Class 2, Class 3, or Class 4 emergency power on a single circuit shall be listed as emergency lighting control devices.

Informational Note: An example of a device combining control signals with Class 2 emergency power sources is a Power over Ethernet (PoE) switch.

Statement of Problem and Substantiation for Public Input

Not sure why this article is restricted to just Class 2. Adding Class 3 and Class 4 as an alternative to Class 2 circuits. Class 3 circuits have similar voltage and power restrictions as Class 2, with a few more installation requirements. Class 4 systems were added in the 2023 code and have equivalent or better than fire and life safety requirements as Class 2 circuits with similar installation requirements (the Class 4 requirements were modeled after Article 725). An effort to analyze all the locations of Class 2 in the code to see if Class 4 was also appropriate in the application should have happened for the 2023 code and not doing it was an oversight.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4347-NFPA 70-2023 [Section No. 700.11]	same change, both should be analyzed together.
Public Input No. 4347-NFPA 70-2023 [Section No. 700.11]	

Submitter Information Verification

Submitter Full Name: Chad Jones
Organization: Cisco Systems
Street Address:
City:
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Submittal Date: Thu Sep 07 12:32:41 EDT 2023
Committee: NEC-P13

Public Input No. 767-NFPA 70-2023 [Section No. 700.32]

700.32 Selective Coordination.

(A) General.

Emergency system(s) overcurrent protective devices (OCPDs) shall be selectively coordinated with all Emergency supply-side and load-side OCPDs.

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.

(B) Replacements.

Where emergency system(s) OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

(C) Modifications.

If modifications, additions, or deletions to the emergency system(s) occur, selective coordination of the emergency system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note: See Informational Note Figure 700.32(C) for an example of how emergency system OCPDs selectively coordinate with all supply-side OCPDs.

OCPD D selectively coordinates with OCPDs C, F, and E~~, B, and A~~ .

OCPD C selectively coordinates with OCPDs F, and E~~, B, and A~~ .

OCPD F selectively coordinates with OCPD E.

OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not an emergency system OCPD.

OCPD C and D shall be selectively coordinated to the higher available fault current provided by either the Normal or Emergency Source.

Figure Informational Note Figure 700.32(C) Emergency System Selective Coordination.

Statement of Problem and Substantiation for Public Input

If a normal supply side OCPD and a load side emergency OCPD are not totally coordinated no additional loss of emergency load occurs. In this case the automatic transfer switch (ATS) would see a loss of power, the Emergency Source will start, and the ATS will switch to the Emergency Source. The remaining loads served by the ATS will be served by the Emergency Source. When using circuit breakers, the current requirement can force the use of increased size of breakers on the Normal Source side of the ATS which then requires larger conductors. This will have an effect of a larger available fault current on the emergency system load side equipment and may result in a higher arc flash hazard rating. An alternative to increased feeder sizes on the normal source equipment is to force all circuit breakers to be of one manufacturer in tested combination. In existing buildings where multiple manufacturers are already installed this will drive large scale replacements for a requirement that does not result in any additional loss of emergency load.

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Committee:	NEC-P13

Public Input No. 1674-NFPA 70-2023 [Section No. 700.32(A)]

(A) General.

Emergency system(s) overcurrent protective devices (OCPDs) shall be selectively coordinated with all supply-side and load-side OCPDs.

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.

Informational Note No. 1: See definition of *Coordination, Selective (Selective Coordination)* in Article 100.

Informational Note No. 2: For additional information on how to achieve selective coordination see NECA 700, *Standard for Installing Overcurrent Protection to Achieve Selective Coordination,* or other ANSI-approved installation standards.

Additional Proposed Changes

File Name	Description	Approved
700-2016.pdf	NECA 700, Standard for Installing Overcurrent Protection to Achieve Selective Coordination.	

Statement of Problem and Substantiation for Public Input

Selective Coordination continues to be one of the most misunderstood and inconsistently enforced requirements. By referencing the definiton in Article 100 it will build awareness that Selective Coordination is not coordination to a specific measurement of time but for the entire time current curve. Additionally referenceing an ANSI approved installation standard on selective coordination will provide an additional resource on how selective coordination is accomplished.

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Public Input No. 4502-NFPA 70-2023 [Section No. 700.32(A)]

(A) General.

Emergency system(s) overcurrent protective devices (OCPDs) shall be selectively coordinated with all supply-side and load-side OCPDs for the period of time that a fault's duration extends beyond 0 . 1 second .

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.

Statement of Problem and Substantiation for Public Input

In 2012, NFPA 99 the Technical Committee on Electrical System realized this issue and stated that 4.4.2.1.2.1 Selective Coordination – Overcurrent devices serving the essential electrical systems shall be selectively coordinated down to 0.1 second. This then became part of the National Electrical Code in Article 517.31(G) stating that "Coordination. Overcurrent protective devices serving the essential electrical system shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second."

Health care is a critical system that deemed this to be a safer way to proceed with their electrical systems.

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Public Input No. 4106-NFPA 70-2023 [Section No. 700.32(B)]

(B) Replacements.

Where emergency system(s) OCPDs or normal system OCPDs that supply emergency load(s) are replaced, they shall be reevaluated to ensure selective coordination of the emergency system(s) is maintained with all supply-side and load-side OCPDs.

Statement of Problem and Substantiation for Public Input

Selective coordination is vital to ensure the reliability of emergency systems, which are important to life and public safety. The NEC, by including 700.32(B) and (C), has established that it is important that selective coordination be maintained throughout the life of the system.

Selective coordination is achieved and verified based on the specific OCPDs and their ratings and settings at the time of installation. Since selective coordination applies to all supply-side and load-side OCPDs, the OCPDs in the normal system that supply the emergency system are included in this evaluation. Therefore, if one of the OCPDs in the normal system supplying the emergency system is replaced, it will directly affect whether the system remains selectively coordinated. The Code language, as written, does not address this potential problem. Therefore, to close this gap in the language, and maintain selective coordination through the life of the system, selective coordination should also be re-evaluated after OCPDs supplying the emergency system are replaced.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4112-NFPA 70-2023 [Section No. 701.32(B)]	

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Committee: NEC-P13

Public Input No. 4109-NFPA 70-2023 [Section No. 700.32(C)]

(C) Modifications.

If modifications, additions, or deletions to the emergency system(s) or the normal system supplying the emergency load(s) occur, selective coordination of the emergency system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note: See Informational Note Figure 700.32(C) for an example of how emergency system OCPDs selectively coordinate with all supply-side OCPDs.

OCPD D selectively coordinates with OCPDs C, F, E, B, and A.

OCPD C selectively coordinates with OCPDs F, E, B, and A.

OCPD F selectively coordinates with OCPD E.

OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not an emergency system OCPD.

Figure Informational Note Figure 700.32(C) Emergency System Selective Coordination.

Statement of Problem and Substantiation for Public Input

Selective coordination is vital to ensure the reliability of emergency systems, which are important to life and public safety. The NEC, in including 700.32(B) and (C), has established that it is important that selective coordination be maintained throughout the life of the system.

Selective coordination is achieved and verified based on the equipment and the available fault current at the time of installation. Modifications to the normal system supplying the emergency system(s), including transformers or conductor lengths, may result in changes to the available fault currents throughout the emergency system(s), which directly affects whether the system(s) remain(s) selectively coordinated. The Code language, as written, does not address this potential problem. Therefore, to close this gap in the language, and maintain selective coordination through the life of the system, selective coordination should be re-evaluated after changes are made to the normal system supplying the emergency system(s). This is consistent with similar requirements that exist in 110.24(B).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4114-NFPA 70-2023 [Section No. 701.32(C)]	

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Public Input No. 2617-NFPA 70-2023 [Section No. 701.2]

701. ~~2~~ **3** Reconditioned Equipment.

Reconditioned transfer switches shall not ~~be permitted~~ be installed .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to comply with the NEC Style Manual Section 2.2.1 regarding reconditioned equipment.
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Public Input No. 1675-NFPA 70-2023 [Section No. 701.3(A)]

(A) ~~Commissioning~~ Witness ~~Test~~ Testing .

The authority having jurisdiction shall conduct ~~or~~ witness testing of the ~~commissioning of the~~ complete system upon installation.

Additional Proposed Changes

File Name	Description	Approved
90-2015.pdf	NECA 90, Standard for Commissioning Building Electrical Systems.	

Statement of Problem and Substantiation for Public Input

Commissioning of a system is much different than witness testing a system, and requiring an AHJ to perform commissioning. In many cases AHJs are not equipped to perform Commissioning of electrical systems. It is a common misperception that electrical commissioning and acceptance testing are the same thing or that electrical commissioning is the same as equipment startup. In reality, acceptance testing and equipment startup, are only two subsets of the electrical commissioning process. Upon completion of acceptance testing and contractor/vendor startup (pre-functional testing), functional performance `testing (FPT) and integrated systems testing (IST). In the ANSI/International Electrical Testing Association — Standard for Electrical Commissioning Specifications for Electrical Power Equipment and Systems (NETA ECS-2015), electrical commissioning is defined as the systematic process of verifying, documenting, and placing into service newly installed or retrofitted electrical power equipment and systems. The process focuses on verifying and documenting that all of the electrical commissioned equipment, systems, and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements (OPRs). Commissioning processes should be performed by a commissioning authority. The change in the 2023 NEC is excessive and imposes significant requirements that go beyond the scope or the NEC and beyond the responsibilities of the AHJ. These changes create significantly more steps in the approval processes required by the NEC. This proposed change is to either remove the word “commissioning” from each of these sections or to specifically state which parts of the overall commissioning process is required by the NEC rules. Commissioning is too broad of a term and the associated processes are extensive in many cases. (See a copy of NECA 90 attached to this PI).

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Committee: NEC-P13

Public Input No. 2557-NFPA 70-2023 [Section No. 701.3(A)]

(A) Commissioning Witness Test.

The authority having jurisdiction shall conduct or witness the commissioning of the complete system upon installation and periodically afterward .

Informational Note: See NECA 90, *Standard for Commissioning Building Electrical Systems.*

Statement of Problem and Substantiation for Public Input

Change correlates with 700.3 for consistency.

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Public Input No. 1574-NFPA 70-2023 [Section No. 701.3(D)]

(D) Written Record.

A written record shall be kept on such tests and maintenance <u>and made available to those authorized to design, install, inspect, maintain, and operate the system .</u>

-

Statement of Problem and Substantiation for Public Input

The added language is the same already used in other portions of the code and provides consistency and clarity that this record does not only have to exist somewhere, it must also be easily available to those that may need it.

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Committee: NEC-P13

Public Input No. 2295-NFPA 70-2023 [Section No. 701.3(D)]

(D) Written Record.

A written record shall be kept on such tests and maintenance <u>and made available to those authorized to design, install, inspect, maintain, and operate the system</u> ..

Statement of Problem and Substantiation for Public Input

The proposed new language is the same already used in other portions of the Code. Including it at this location provides consistency and clarity this this record does not only have to exist somewhere, but must
also be readily available to those that may need it.

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Committee: NEC-P13

Public Input No. 2498-NFPA 70-2023 [Section No. 701.3(D)]

(D) Written Record.

A written ~~record~~ or digital record or both shall be kept ~~on~~ of such tests and maintenance.

Statement of Problem and Substantiation for Public Input

Provide clarity to the article or add an Informational Note as to what constitutes a written record. A common definition of written defines written as a “mark (letters, words, or other symbols) on a surface, typically paper, with a pen, pencil, or similar implement”. Many Facility Management operations, for example, have moved away from maintaining a physical logbook next to a generator which can be easily lost, damaged, manipulated, etc. to software-based recordkeeping. I recommend evolving this article to recognize that digital records are acceptable.

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Committee: NEC-P13

Public Input No. 1683-NFPA 70-2023 [Section No. 701.3(E)]

(E) Testing Under Load.

Means for testing all legally required standby systems under maximum anticipated load conditions shall be provided.

Informational Note: See NFPA 110-2019, *Standard for Emergency and Standby Power Systems*, for information on testing and maintenance of emergency power supply systems (EPSSs).

Statement of Problem and Substantiation for Public Input

The language is unclear compared to Section 700.3(E). Legally required standby systems are a vital part of the the life safety system of a building, it should be tested in under maximum load to ensure proper capabilities. Modify the language in 701.3(E) to match 700.3(E).

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Public Input No. 2938-NFPA 70-2023 [Section No. 701.4]

701.4 Capacity and Rating.

(A) Rating.

Legally required standby system equipment shall be suitable for the available fault current at its terminals.

(B) Capacity.

A legally required standby system shall have adequate capacity in accordance with Article 220, Parts I through ~~IV of Article 220 or~~ IV or by another approved method. The system capacity shall be sufficient for the rapid load changes and transient power and energy requirements associated with any expected loads.

(C) Load Management.

The alternate power source shall be permitted to supply legally required standby and optional standby system loads where the alternate source has adequate capacity or where load management (that includes automatic selective load pickup and load shedding)is provided that will ensure adequate power to the legally required standby circuits.

(D) Parallel Operation.

Parallel operation shall comply with Article 705, Part I or ~~Part II of Article 705 where~~ Part II where the legally required source capacity required to supply the legally required load is maintained at all times. Parallel operation of the legally required source(s) shall consist of the sources specified in 701.4(D)(1) and (D)(2).

(1) Normal Source.

The alternate power source shall be permitted to operate in parallel with the normal source in compliance with Article 705, Part I or ~~Part II of Article 705 where~~ Part II where the capacity required to supply the legally required standby load is maintained at all times. Any operating condition that results in less than the required source capacity shall initiate a legally required standby source malfunction signal in 701.6(A).

Parallel operation shall be permitted for satisfying the test requirements of 701.3(B), provided all other conditions of 701.3 are met.

Informational Note: Peak load shaving is one application for parallel source operation.

(2) Alternate Source.

Legally required standby sources shall be permitted to operate in parallel where the necessary equipment to establish and maintain a synchronous condition is provided.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Committee:	NEC-P13

Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]

(C) Load Management.

The alternate power source shall be permitted to supply legally required standby and optional standby system loads where the alternate source has adequate capacity or where ~~load management (~~ Power Circuit Management (PCM) (that includes automatic selective load pickup and load shedding)is provided that will ensure adequate power to the legally required standby circuits.

Statement of Problem and Substantiation for Public Input

Activities, such as the electrification of the transportation sector and replacement of gas-fired appliance with all electric appliances, coupled with widespread adoption of on-site storage and generation, will place significant new demands on the premises wiring systems covered by the NEC. These activities are complicated by the need to facilitate this shift in energy generation, storage, and use, with an existing (and aging) infrastructure.

An emerging trend is to leverage the technology offered by “Energy Management Systems” to manage these complex electrical systems in a way that prevents overloading of the premises wiring system. These types of systems require functional reliability in order to prevent overloading of the premises wiring, as well as utility owned assets serving the facility. Energy management systems (EMS) historically have not been evaluated for functional reliability to address electrical overload.

While other PI’s may address this need for a more robust “Energy Management System”, this must co-exist with the realization that there is still a place for the traditional Energy Management devices that are not being relied upon for these functions and should not be mandated to meet functional safety requirements.

Recognizing that these existing products will continue to exist in the marketplace, a new term is needed to differentiate between the historic EMS application of energy optimization for appliance control versus electrical overload and/or grid interconnection applications where safety is paramount. With this in mind, this PI focuses on introducing the term Power Circuit Management (PCM) where functional reliability has been applied.

Equipment that provides Load Management to Emergency and Legally Required Standby Systems also performs a critical function, and the functional reliability of this equipment is important. The evolution of requirements for PCM affords the opportunity to utilize equipment that has been evaluated to these more robust requirements to ensure reliable operation of the load management function. PCM should be specified for these critical systems.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling “q”.]	Related due to addition of new PCM definition / term
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	Related due to addition of new PCM definition / term
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	Related due to addition of new PCM definition / term
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	Related due to addition of new PCM definition / term

Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	Related due to addition of new PCM definition / term
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	Related due to addition of new PCM definition / term
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	Related due to addition of new PCM definition / term
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	Related due to addition of new PCM definition / term
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	Related due to addition of new PCM definition / term
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling "q".]	
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	

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Public Input No. 2558-NFPA 70-2023 [Section No. 701.4(D)(2)]

(2) ~~Alternate~~ Legally Required Standby Source.

Legally required standby sources shall be permitted to operate in parallel where the necessary equipment to establish and maintain a synchronous condition is provided.

Statement of Problem and Substantiation for Public Input

Change correlates with 700.4(D)(2) for consistency.

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Public Input No. 3331-NFPA 70-2023 [Section No. 701.5(A)]

(A) General.

Transfer equipment shall be automatic, listed, and marked for emergency system or legally required standby use. Transfer equipment shall be designed and installed 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~~ of 705. 6 . Meter-mounted transfer switches shall not be permitted for legally required system use.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the NEC(r) Style Manual prohibits referencing an entire article with the exception of Article 100 or where required for context. This requirement is revised to point the user to 705.6, where the equipment approval requirements are found for sources operating in parallel.

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Public Input No. 3289-NFPA 70-2023 [Section No. 701.5(B)]

(B) ~~**Bypass Isolation Switches.**~~

~~Means to bypass and isolate the transfer switch equipment shall be permitted. Where bypass isolation switches are used, inadvertent parallel operation shall be avoided.~~

Maintenance of Transfer Equipment.

The legally required standby system shall be permitted to include bypass isolation transfer switches or redundant transfer switches to facilitate maintenance without jeopardizing continuity of power when all of the following conditions exist:

(1) If the bypass isolation transfer switch or redundant transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair.

(1) Interlocking is provided to prevent inadvertent parallel operation.

(1) Means are provided to completely isolate each transfer switch to facilitate maintenance of the transfer switch without jeopardizing continuity of power.

Statement of Problem and Substantiation for Public Input

Rationale:

When maintenance is required on a transfer switch, and it is desirable to maintain continuity of power during the maintenance period, bypass isolation transfer switches may be used. The existing text of 701.5(B) makes allowances for these but does not make allowance for the use of redundant transfer switches to perform a similar function. This PI adds the possibility of redundant transfer switches in lieu of bypass isolation transfer switches and provides the necessary minimum requirements when either solution is implemented. This PI provides similar requirements to those proposed in section 700.5(B) when such equipment is used, but since legally required systems are not specifically for life safety applications, the use of these devices is not mandatory, but is permitted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3288-NFPA 70-2023 [Section No. 700.5]	similar topic
Public Input No. 3290-NFPA 70-2023 [Section No. 708.24]	

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Committee:	NEC-P13

Public Input No. 1253-NFPA 70-2023 [New Section after 701.7]

TITLE OF NEW CONTENT

Type your content here ...

701.8. Cybersecurity

Legally Required Standby Systems that are connected to a communication network and have the capability to be controlled or permit control of any portion of the premises shall comply with either of the following:

(1) The ability to control the system is limited to a direct connection through a local nonnetworked interface.

(2) The Legally Required Standby Sytem is connected through a networked interface complying with both of the following methods:

a. The Legally Required Standby System and associated software are identified as being evaluated for cybersecurity.

b. A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to cyber attacks.

The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals.

Documentation of the evaluation, assessment, identification, and certification shall be made available to those authorized to inspect, operate, and maintain the system.

Informational Note No. 1: See ANSI/ISA 62443, Cybersecurity Standards series; UL 2900, Cybersecurity Standards series; and the NIST Framework for Improving Critical Infrastructure Cybersecurity, Version 1.1, for assessment guidelines.

Informational Note No. 2: Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

(1) The ISA Security Compliance Institute (ISCI) conformity assessment program

(2) Certification of compliance by a nationally recognized test laboratory

Statement of Problem and Substantiation for Public Input

Most of the cybersecurity focus has been on IT systems. There has been very little public discussion about cybersecurity for Operational Technology (OT), but cyber attacks on OT, by both domestic and foreign actors, occur on almost a daily basis. Hackers can easily destroy unprotected equipment and shut down entire unprotected facilities. Our adversaries such as Russia, China, North Korea, and Iran, are continuously mounting cyber attacks. They understand their limits and, so far, prohibit catastrophic attacks on our financial/banking system and electrical grid. In the mean time, they attack our infrastructure, such as the southeast gas pipeline. We have the ability, and obligation, to prevent this type of damage to our infrastructure from malicious cyber attacks. This Public Input is based upon 240.6(D) and 708.7 in the 2023 NEC. Pay particular attention to the word "identified" in (2) a. "Identified" as applied to equipment, is defined 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. 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 organization concerned with product evaluation." This Public Input simply requires that a Legally Required Standby System either not be connected to the internet, or if it is connected to the internet, that it be identified for cybersecurity and that an assessment is provided.

Submitter Information Verification

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Public Input No. 1684-NFPA 70-2023 [New Section after 701.7]

701.9 Qualified Persons.

Legally required standby systems and equipment covered by this Article shall be installed by qualified persons.

Informational Note: See definition of *Qualified Person* in Article 100.

Statement of Problem and Substantiation for Public Input

Legally required standby systems are becoming more complicated and, in most cases, requiring far more training and experience. These systems are often part of essential electrical systems and critical operations power systems requiring a greater degree of training and experience, in design, planning, installation, and programing in many instances. These systems and others require trained qualified personnel and contractors.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1708-NFPA 70-2023 [New Section after 800.3]	
Public Input No. 1706-NFPA 70-2023 [New Section after 770.3]	
Public Input No. 1701-NFPA 70-2023 [New Section after 760.3]	
Public Input No. 1698-NFPA 70-2023 [New Section after 726.3]	
Public Input No. 1695-NFPA 70-2023 [New Section after 725.3]	
Public Input No. 1694-NFPA 70-2023 [New Section after 724.3]	
Public Input No. 1690-NFPA 70-2023 [New Section after 722.3]	
Public Input No. 1686-NFPA 70-2023 [New Section after 708.8]	
Public Input No. 1672-NFPA 70-2023 [New Section after 700.8]	
Public Input No. 4394-NFPA 70-2023 [New Section after 625.6]	
Public Input No. 1629-NFPA 70-2023 [New Section after 393.6]	
Public Input No. 1557-NFPA 70-2023 [Section No. 90.2(A)]	
Public Input No. 1557-NFPA 70-2023 [Section No. 90.2(A)]	
Public Input No. 1629-NFPA 70-2023 [New Section after 393.6]	
Public Input No. 1672-NFPA 70-2023 [New Section after 700.8]	
Public Input No. 1686-NFPA 70-2023 [New Section after 708.8]	
Public Input No. 1690-NFPA 70-2023 [New Section after 722.3]	
Public Input No. 1694-NFPA 70-2023 [New Section after 724.3]	
Public Input No. 1695-NFPA 70-2023 [New Section after 725.3]	
Public Input No. 1698-NFPA 70-2023 [New Section after 726.3]	
Public Input No. 1701-NFPA 70-2023 [New Section after 760.3]	
Public Input No. 1706-NFPA 70-2023 [New Section after 770.3]	
Public Input No. 1708-NFPA 70-2023 [New Section after 800.3]	
Public Input No. 4394-NFPA 70-2023 [New Section after 625.6]	

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Committee:	NEC-P13

Public Input No. 3432-NFPA 70-2023 [New Section after 701.7(B)]

701.8 Surge Protection.

A listed SPD shall be installed in or on all legally required standby system switchgear, switchboards, and panelboards.

Statement of Problem and Substantiation for Public Input

This public input will add surge protection to switchgear, switchboards, and panelboards that supply legally required standby systems. Legally required standby systems typically supply elevators, platform lifts, smoke control systems, membrane structures, horizontal sliding doors, and circuits within high-rise buildings and underground buildings. The safety and reliability of these systems can be negatively impacted by overvoltages and surge currents. This new rule will ensure legally required standby systems are protected against transient energy equivalent to emergency systems in accordance with 700.8. The impact of this public input will improve life and property safety.

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Submittal Date: Sat Sep 02 20:51:04 EDT 2023
Committee: NEC-P13

Public Input No. 2501-NFPA 70-2023 [Sections 701.12(A), 701.12(B)]

~~**Sections 701.12(A), 701.12(B)**~~

~~**(A)** Power Source Considerations.~~

~~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.~~

~~**(B)** Equipment Design and Location.~~

~~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.~~

> ~~Informational Note: See ANSI/IEEE 493-2007, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems* , for further information.~~

Statement of Problem and Substantiation for Public Input

This is not enforceable. I can't require a perosn to "consider" something. Even if I could, what then? Do I send them to George Orwell's thought police? If this language is retaining it should be made into an informational note.

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Committee: NEC-P13

Public Input No. 1717-NFPA 70-2023 [Section No. 701.12(D)(3)]

(3) Outdoor Generator Sets.

~~If~~ Where an outdoor-housed generator set is equipped with a readily accessible disconnecting means in accordance with 445.18, and the disconnecting means is located within sight of the building or structure supplied, an additional disconnecting means shall not be required where ungrounded conductors serve or pass through the building or structure. Where the generator supply conductors terminate at a disconnecting means in or on a building or structure, the disconnecting means shall meet the requirements of 225.36.

Statement of Problem and Substantiation for Public Input

This is a minor grammatical change to create consistent wording between 700.12(D)(4) and 701.12(D)(3)

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Committee: NEC-P13

Public Input No. 1951-NFPA 70-2023 [Section No. 701.12(D)(3)]

(3) Outdoor Generator Sets.

~~If~~ Where an outdoor-housed generator set is equipped with a readily accessible disconnecting means in accordance with 445.18, and the disconnecting means is located within sight of the building or structure supplied, an additional disconnecting means shall not be required where ungrounded conductors serve or pass through the building or structure. Where the generator supply conductors terminate at a disconnecting means in or on a building or structure, the disconnecting means shall meet the requirements of 225.36.

Statement of Problem and Substantiation for Public Input

This is a minor grammatical change to create consistent wording between 700.12(D)(4) and 701.12(D)(3).

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Public Input No. 1127-NFPA 70-2023 [Section No. 701.12(F)]

(F) Separate Service.

Where approved, by the authority having jurisdiction as suitable for use as a legally required source of power, an additional service shall be permitted. This service shall be in accordance with Article 230.2 and the following additional requirements:

(1) Separate overhead service conductors, service drops, underground service conductors, or service laterals shall be installed.

(2) The service conductors for the separate service shall be installed sufficiently remote electrically and physically from any other service conductors to minimize the possibility of simultaneous interruption of supply.

Statement of Problem and Substantiation for Public Input

Referring to an entire Article violates Section 4.1.4 of the NEC Style Manual. Added .2 for clarity.

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Committee: NEC-P13

Public Input No. 418-NFPA 70-2023 [Section No. 701.12(F)]

(F) Separate Service.

Where approved, by the authority having jurisdiction as suitable for use as a legally required source of power, an additional service shall be permitted. This service shall be in accordance with Article 230 and the following additional requirements:

(1) Separate overhead service conductors, ~~service drops~~ utility drops , underground service conductors, or ~~service laterals~~ utility laterals shall be installed.

(2) The service conductors for the separate service shall be installed sufficiently remote electrically and physically from any other service conductors to minimize the possibility of simultaneous interruption of supply.

Statement of Problem and Substantiation for Public Input

This PI is associated with several other PIs to recommend a global change from “service drop” to “utility drop” and from “service lateral” to “utility lateral.” “Service drop” appears 23 times in the Code and “service lateral” appears 15 times. There are 11 definitions that begin with the word ‘service.’ Of these, 9 are customer owned and only “service drop” and “service lateral” are utility owned and, therefore, outside the scope of the Code. “service drops” and “service laterals” are not service conductors as they do not fit the definition. Confining the word “service” to only those items that are customer owned would clear up much confusion on this topic. Appendix A shows UL 523 as having the title “telephone service drop wire” and the UL standard does, in fact, have that title. However, the text of UL 523 defines this wire as customer owned and Article 805 refers to this wire as a “drop wire.”

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 411-NFPA 70-2023 [Section No. 90.2(D)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 412-NFPA 70-2023 [Definition: Service Drop.]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 413-NFPA 70-2023 [Definition: Service-Entrance Conductors.]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 414-NFPA 70-2023 [Definition: Distribution Point (Center Yard Pole) (Meter Po...]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 415-NFPA 70-2023 [Definition: Service Lateral.]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 416-NFPA 70-2023 [Section No. 800.44(A)(4)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 417-NFPA 70-2023 [Section No. 700.12(F)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 419-NFPA 70-2023 [Section No. 770.44(A)(4)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 420-NFPA 70-2023 [Section No. 770.44(B)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 421-NFPA 70-2023 [Section No. 230.24(A)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'

Public Input No. 422-NFPA 70-2023 [Section No. 230.40]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 423-NFPA 70-2023 [Section No. 250.24(A)(1)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 424-NFPA 70-2023 [Section No. 250.24(F)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 425-NFPA 70-2023 [Section No. 250.64(D)(1)]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'
Public Input No. 426-NFPA 70-2023 [Section No. 250.66 [Excluding any Sub-Sections]]	Global change from 'service drop' to 'utility drop' and 'service lateral' to 'utility lateral'

Public Input No. 411-NFPA 70-2023 [Section No. 90.2(D)]

Public Input No. 412-NFPA 70-2023 [Definition: Service Drop.]

Public Input No. 413-NFPA 70-2023 [Definition: Service-Entrance Conductors.]

Public Input No. 414-NFPA 70-2023 [Definition: Distribution Point (Center Yard Pole) (Meter Po...]

Public Input No. 415-NFPA 70-2023 [Definition: Service Lateral.]

Public Input No. 416-NFPA 70-2023 [Section No. 800.44(A)(4)]

Public Input No. 417-NFPA 70-2023 [Section No. 700.12(F)]

Public Input No. 419-NFPA 70-2023 [Section No. 770.44(A)(4)]

Public Input No. 420-NFPA 70-2023 [Section No. 770.44(B)]

Public Input No. 421-NFPA 70-2023 [Section No. 230.24(A)]

Public Input No. 422-NFPA 70-2023 [Section No. 230.40]

Public Input No. 423-NFPA 70-2023 [Section No. 250.24(A)(1)]

Public Input No. 424-NFPA 70-2023 [Section No. 250.24(F)]

Public Input No. 425-NFPA 70-2023 [Section No. 250.64(D)(1)]

Public Input No. 426-NFPA 70-2023 [Section No. 250.66 [Excluding any Sub-Sections]]

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Public Input No. 3049-NFPA 70-2023 [Section No. 701.12(H)]

(H) Microgrid Systems.

On-site sources, designated as legally required standby sources, shall be permitted to be connected to a microgrid system.

The system shall include interconnection equipment listed for emergency use to isolate the legally required standby system from all nonlegally required loads when the normal electric supply is interrupted or shall meet the requirements of 701.4(C). Interruption or partial or complete failure of the normal source(s) shall not impact the availability, capacity, and duration provided by the designated legally required standby sources.

The designated stored-energy legally required standby power source(s) of a microgrid system shall be permitted to remain interconnected to any available power production source during operation of the legally required standby source(s) where the lack of, or failure of, the interconnected power production source(s), or related controls, does not impact system operation. Interconnected power production sources, other than the designated SEPSS, shall not be required to meet the requirements of this article.

Statement of Problem and Substantiation for Public Input

The term interconnection equipment is added to correlate with the permitted emergency sources in 701.12 which may include an interconnection to the normal power system. This term aligns with the product safety requirements for emergency systems in UL 3008. A separate public input revising the term "Microgrid Interconnect Device" to also include this term has been submitted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3048-NFPA 70-2023 [Section No. 700.18]	

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Committee: NEC-P13

Public Input No. 2559-NFPA 70-2023 [Section No. 701.12 [Excluding any Sub-Sections]]

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 (~~I~~ H). Unit equipment in accordance with 701.12(I) shall satisfy the applicable requirements of this article.

Statement of Problem and Substantiation for Public Input

The correct reference is 701.12(A) through (H).

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Public Input No. 4398-NFPA 70-2023 [Section No. 701.32]

701.32 Selective Coordination.

(A) General.

Legally required standby system(s) overcurrent protective devices (OCPDs shall be selectively coordinated with all supply-side and load-side OCPDs.

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.

(B) Replacements.

Where legally required standby OCPDs are replaced, they shall be reevaluated to ensure selective coordination is maintained with all supply-side and load-side OCPDs.

(C) Modifications.

If modifications, additions, or deletions to the legally required standby system(s) occur, selective coordination of the legally required system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note No. 1 : See definition of *Coordination, Selective (Selective Coordination)* in Article 100.

Informational Note No. 2: For additional information on selective coordination see NECA 701, *Standard for Installing Overcurrent Protection to Achieve Selective Coordination*, or other ANSI approved installation standards.

Informational Note No. 3: See Informational Note Figure 701.32(C) for an example of how legally required standby system OCPDs selectively coordinate with all supply-side OCPDs.

OCPD D selectively coordinates with OCPDs C, F, E, B, and A.

OCPD C selectively coordinates with OCPDs F, E, B, and A.

OCPD F selectively coordinates with OCPD E.

OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.

Figure Informational Note Figure 701.32(C) Legally Required Standby System Selective Coordination.

Statement of Problem and Substantiation for Public Input

Selective Coordination continues to be one of the most misunderstood and inconsistently enforced requirements. By referencing the definition in Article 100 it will build awareness that Selective Coordination is not coordination to a specific measurement of time but for the entire time current curve. Additionally, referencing an ANSI approved installation standard on selective coordination will provide an additional resource on how selective coordination is accomplished. See companion PI.

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Committee:	NEC-P13

Public Input No. 4505-NFPA 70-2023 [Section No. 701.32(A)]

(A) General.

Legally required standby system(s) overcurrent protective devices (OCPDs shall be selectively coordinated with all supply-side and load-side OCPDs for the period of time that a fault's duration extends beyond 0 . 1 second .

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.

Statement of Problem and Substantiation for Public Input

In 2012, NFPA 99 the Technical Committee on Electrical System realized this issue and stated that 4.4.2.1.2.1 Selective Coordination – Overcurrent devices serving the essential electrical systems shall be selectively coordinated down to 0.1 second. This then became part of the National Electrical Code in Article 517.31(G) stating that "Coordination. Overcurrent protective devices serving the essential electrical system shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second."
Health care is a critical system that deemed this to be a safer way to proceed with their electrical systems.

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Committee: NEC-P13

Public Input No. 4112-NFPA 70-2023 [Section No. 701.32(B)]

(B) Replacements.

Where legally required standby OCPDs or normal system OCPDs that supply legally required standby load(s) are replaced, they shall be reevaluated to ensure selective ~~coordination~~ coordination of the legally required standby system is maintained with all supply-side and load-side OCPDs.

Statement of Problem and Substantiation for Public Input

Selective coordination is vital to ensure the reliability of legally required standby systems, which are important to life and public safety. The NEC, by including 708.54(B) and (C), has established that it is important that selective coordination be maintained throughout the life of the system.
Selective coordination is achieved and verified based on the specific OCPDs and their ratings and settings at the time of installation. Since selective coordination applies to all supply-side and load-side OCPDs, the OCPDs in the normal system that supply the legally required standby system are included in this evaluation. Therefore, if one of the OCPDs in the normal system supplying the legally required standby system is replaced, it will directly affect whether the system remains selectively coordinated. The Code language, as written, does not address this potential problem. Therefore, to close this gap in the language, and maintain selective coordination through the life of the system, selective coordination should also be re-evaluated after OCPDs supplying the legally required standby system are replaced.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4106-NFPA 70-2023 [Section No. 700.32(B)]	

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Committee: NEC-P13

Public Input No. 4114-NFPA 70-2023 [Section No. 701.32(C)]

(C) Modifications.

If modifications, additions, or deletions to the legally required standby system(s) or the normal system supplying the legally required standby system load(s) occur, selective coordination of the legally required system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note: See Informational Note Figure 701.32(C) for an example of how legally required standby system OCPDs selectively coordinate with all supply-side OCPDs.

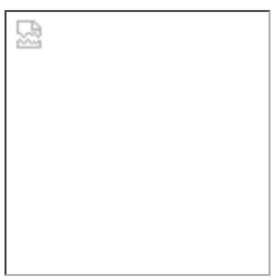
OCPD D selectively coordinates with OCPDs C, F, E, B, and A.

OCPD C selectively coordinates with OCPDs F, E, B, and A.

OCPD F selectively coordinates with OCPD E.

OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.

Figure Informational Note Figure 701.32(C) Legally Required Standby System Selective Coordination.



Statement of Problem and Substantiation for Public Input

Selective coordination is vital to ensure the reliability of legally required standby systems, which are important to life and public safety. The NEC, in including 701.32(B) and (C), has established that it is important that selective coordination be maintained throughout the life of the system.

Selective coordination is achieved and verified based on the equipment and the available fault current at the time of installation. Modifications to the normal system supplying the legally required standby system, including transformers or conductor lengths, may result in changes to the available fault currents throughout the legally required standby system, which directly affects whether the systems remain selectively coordinated. The Code language, as written, does not address this potential problem. Therefore, to close this gap in the language, and maintain selective coordination through the life of the system, selective coordination should be re-evaluated after changes are made to the normal system supplying the legally required standby system. This is consistent with similar requirements that exist in 110.24(B).

Related Public Inputs for This Document

Related Input	Relationship

Public Input No. 4109-NFPA 70-2023 [Section No. 700.32(C)]

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Public Input No. 4199-NFPA 70-2023 [Section No. 702.1]

702.1 Scope.

This article applies to the installation and operation of optional standby systems.

The systems covered by this article consist of those that are permanently installed in their entirety, including prime movers, and those that are arranged for a connection to a premises wiring system from a portable alternate power supply. <u>Energy storage systems shall not be required to comply with this Article when such systems are in compliance with other applicable articles found this code.</u>

Informational Note: Optional standby systems are typically installed to provide an alternate source of electric power for such facilities as industrial and commercial buildings, farms, and residences and to serve loads such as heating and refrigeration systems, data processing and communications systems, and industrial processes that, when stopped during any power outage, could cause discomfort, serious interruption of the process, damage to the product or process, or the like.

Statement of Problem and Substantiation for Public Input

There is much confusion in the industry on whether or not the requirements of Article 702 apply to energy storage systems (ESS) when such system is optionally installed. The requirements of Article 702 were originally developed based on the concerns related to generators and automatic transfer of loads. ESS does not function the same as a generator and cannot be damaged by overloading. When an ESS is overloaded it simply shuts down. This is a nuisance issue, not a safety-related issue. Requiring an ESS to be able to handle 100% of the loads it serves (since it has automatic switching) is simply unreasonable and unnecessary. Articles 706 and 710 already address the issues of loads in relation to ESS, and requirements for wiring and signage are covered as well. There is simply no need for an ESS to comply with the requirements currently found in Article 702 and clarity is needed in the NEC for the enforcement community.

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Public Input No. 2618-NFPA 70-2023 [Section No. 702.2]

702. ~~2~~ **3** Reconditioned Equipment.

Reconditioned transfer switches shall not be ~~permitted~~ installed .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to comply with the NEC Style Manual Section 2.2.1 regarding reconditioned equipment.
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

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Committee:	NEC-P13

Public Input No. 41-NFPA 70-2023 [Section No. 702.2]

~~**702.2** Reconditioned Equipment.~~

~~Reconditioned transfer switches shall not be permitted.~~

Statement of Problem and Substantiation for Public Input

What would the substantiation be for prohibiting reconditioned transfer switches from being used on optional standby systems?

On emergency systems, perhaps there may be some concern about the reliability of a reconditioned transfer switch. In an optional system, the facility owner has made the risk decision to install the generator on their own, and should thus be allowed to make a risk decision on the reliability of the generator and its switching equipment.

If the issue is that simply there is no recognized standard for reconditioning, then it would seem such a rule would belong in a more general article (such as article 110 or 404) if it belongs in the NEC at all. This way it would apply generally.

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Submittal Date: Wed Jan 04 16:09:11 EST 2023

Committee: NEC-P13

Public Input No. 2939-NFPA 70-2023 [Section No. 702.4(A)(2)]

(2) Automatic Load Connection.

If the connection of load is automatic, an optional standby system shall comply with 702.4(A)(2)(a) or (A)(2)(b) in accordance with Article 220, Parts I through ~~IV of Article~~ 220 ~~or~~ IV or by another approved method.

(a) *Full Load.* The standby source shall be capable of supplying the full load that is automatically connected.

(b) *Energy Management System (EMS).* Where a system is employed in accordance with 750.30 that will automatically manage the connected load, the standby source shall have a capacity sufficient to supply the maximum load that will be connected by the EMS.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Committee: NEC-P13

Public Input No. 4142-NFPA 70-2023 [Section No. 702.4(A)(2)]

(2) Automatic Load Connection.

If the connection of load is automatic, an optional standby system shall comply with 702.4(A)(2)(a) ~~or~~ , (A)(2)(b), or (A)(2)(c) in accordance with Parts I through IV of Article 220 or by another approved method.

(a) *Full Load.* The standby source shall be capable of supplying the full load that is automatically connected.

(b) *Energy Management System (EMS).* Where a system is employed in accordance with 750.30 that will automatically manage the connected load, the standby source shall have a capacity sufficient to supply the maximum load that will be connected by the EMS.

(c) Multimode Inverter(s). Multimode inverter(s) capable of operating in interactive or island mode shall have standby capacity sufficient for the supply of combined loads intended to be operated at one time. The multimode inverter shall cease to energize loads in the event of overload or loss of energy source.

Informational Note: Multimode inverters are listed to control the voltage and frequency within prescribed limits according to its ratings, and to shut down safely in overload conditions.

Statement of Problem and Substantiation for Public Input

Multi-mode inverters are by definition capable of operating in both interactive and island modes. Multimode inverters are inherent in the ESS and solar systems common particularly in residential installations. To be installed and interconnected to a primary source per the NEC, these inverters must be listed. An important requirement of this listing is to demonstrate through their UL 9540, UL 1741 or UL 62109 certification testing a safe response to overload conditions, or to a loss of energy supply. They are also in compliance with Part III of Article 705, which addresses suitable supply for island mode operation.

Many ESS and solar integrators have developed product offerings where system capacity is designed and installed to cover typical loads both on-grid and off-grid. This is fundamental to the value proposition of an energy storage system because it maximizes the production and self-consumption of renewable energy. There are hundreds of thousands of such systems configured to provide whole home backup in the event of an outage. These systems provide customers the flexibility to select which loads they want to backup during an outage. These designs also allow their interactive system to transition to island mode automatically if the output capacity of the supply is sufficient for the load operating at the time.

According to data supplied to this group by Tesla, systems meeting 2017 and 2020 NEC capacity requirements have proven sufficient to automatically connect loads in over 90% of millions of recorded outage events. In the less than 10% of events where the multimode inverter capacity is insufficient at the time of transfer, the systems shut down safely with no impact to power sources or loads. Customers are notified through applications that their system is down and that they need to reduce loads, after which they can then manually restart their systems.

The changes made in Articles 702 and 710 of the 2023 NEC no longer permit customers to choose this option anymore. The proposed addition of Option C in 702.4(A)(2) would restore the ability for customers to choose this configuration option while ensuring that they are properly and safely applied.

The Solar and Storage Industry Forum (SSIF) is a coalition of individuals and organizations convened by the Solar Energy Industry Association (SEIA) to organize, support, and mentor renewable energy

industry professionals in codes and standards development. Our objective is to submit industry consensus-based recommendations for changes to the National Electrical Code. We believe that this effort improves the Code-making process by consolidating multiple industry member's points of view into fewer, common proposals.
SSIF members are dedicated to continually improving the installation safety of PV and storage systems in the U.S. A list of members can be found here:
https://www.seia.org/industry-forum

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Committee:	NEC-P13

Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]

(2) Automatic Load Connection.

If the connection of load is automatic, an optional standby system shall comply with 702.4(A)(2)(a) or (A)(2)(b) in accordance with Parts I through IV of Article 220 or by another approved method.

(a) *Full Load.* The standby source shall be capable of supplying the full load that is automatically connected.

(b) ~~*Energy Management System (EMS)*~~ *Power Circuit Management* . Where ~~a system~~ PCM is employed in accordance with 750.30 that will automatically manage the connected load, the standby source shall have a capacity sufficient to supply the maximum load that will be connected by the ~~EMS~~ PCM device or system .

Statement of Problem and Substantiation for Public Input

Activities, such as the electrification of the transportation sector and replacement of gas-fired appliance with all electric appliances, coupled with widespread adoption of on-site storage and generation, will place significant new demands on the premises wiring systems covered by the NEC. These activities are complicated by the need to facilitate this shift in energy generation, storage, and use, with an existing (and aging) infrastructure.

An emerging trend is to leverage the technology offered by "Energy Management Systems" to manage these complex electrical systems in a way that prevents overloading of the premises wiring system. These types of systems require functional reliability in order to prevent overloading of the premises wiring, as well as utility owned assets serving the facility. Energy management systems (EMS) historically have not been evaluated for functional reliability to address electrical overload.

While other PI's may address this need for a more robust "Energy Management System", this must co-exist with the realization that there is still a place for the traditional Energy Management devices that are not being relied upon for these functions and should not be mandated to meet functional safety requirements.

Recognizing that these existing products will continue to exist in the marketplace, a new term is needed to differentiate between the historic EMS application of energy optimization for appliance control versus electrical overload and/or grid interconnection applications where safety is paramount. With this in mind, this PI focuses on introducing the term Power Circuit Management (PCM) where functional reliability has been applied.

This PI utilizes the new term that is proposed in a Related PI (refer to "Related PI's") to mark the distinction between "Energy Management" and "PCM". As described above, the requirement for this section should reflect the more robust requirements for "PCM".

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling "q".]	Related due to addition of new PCM definition / term
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	Related due to addition of new PCM definition / term

Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	Related due to addition of new PCM definition / term
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	Related due to addition of new PCM definition / term
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	Related due to addition of new PCM definition / term
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	Related due to addition of new PCM definition / term
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	Related due to addition of new PCM definition / term
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	Related due to addition of new PCM definition / term
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	Related due to addition of new PCM definition / term
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling “q”.]	
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	

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Public Input No. 4510-NFPA 70-2023 [Section No. 702.4(A)(2)]

(2) Automatic Load Connection.

If the connection of load is automatic, an optional standby system shall comply with 702.4(A)(2)(a) or (A)(2)(b) in accordance with Parts I through IV of Article 220 or by another approved method.

(a) *Full Load.* The standby source shall be capable of supplying the full load that is automatically connected, or the standby source shall be capable of safely turning off when connected to the full load that is automatically connected .

(b) *Energy Management System (EMS).* Where a system is employed in accordance with 750.30 that will automatically manage the connected load, the standby source shall have a capacity sufficient to supply the maximum load that will be connected by the EMS.

Statement of Problem and Substantiation for Public Input

Providing an allowance in the Code for safe installation practices that exist today. Some optional standby systems are capable of being connected to far larger loads than that system can supply. In response to these conditions some optional standby systems safely turn themselves off, with no hazards or damage. The NEC should not govern user experiences, which is the only possible impact in the stated example.

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Public Input No. 1926-NFPA 70-2023 [Section No. 702.5(A)]

(A) General.

~~Interconnection~~ Interlocking or transfer equipment shall be required for all standby systems subject to the requirements of this article. Equipment shall be suitable for the intended use and shall be listed, designed, and installed so as to prevent the inadvertent interconnection of all sources of supply in any operation of the equipment.

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.

Statement of Problem and Substantiation for Public Input

According to the UL Guide Information for the Installation, Use, and Marking of Panelboards (QEUY), the term "interconnection" is for panelboards that are operated in parallel with another power source. Interconnection of power sources is covered by Article 705.

This rule is about preventing such interconnection. The use of the term "interlock" or "interlocking" would more correctly describe the requirement of this rule. The following is from the UL Guide Information referenced above.

"Some panelboards, constructed with interlocked main switching and overcurrent protective devices, have been investigated for use in optional standby systems in accordance with Article 702 of the NEC and are marked "Suitable for use in accordance with Article 702 of the National Electrical Code ANSI/NFPA 70," or, if provided within kit form, "Suitable for use in accordance with Article 702 of the National Electrical Code ANSI/NFPA 70 when provided with interlock kit Cat No. _____."

Some panelboards may be intended for interconnection with one or more electric power production sources operating in parallel with a primary source of electricity, in accordance with Article 705 of the NEC. These panelboards may be marked, "Suitable for use with interconnected parallel electric power production sources," "Suitable for use in accordance with Article 705 of the National Electrical Code, NFPA 70," or the equivalent."

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Committee: NEC-P13

Public Input No. 673-NFPA 70-2023 [Section No. 702.5(B)]

~~**(B)** Meter-Mounted Transfer Switches.~~

~~Transfer switches installed between the utility meter and the meter enclosure shall be listed meter-mounted transfer switches and shall be approved.~~

~~Informational Note No. 1: See UL 1008M, *Transfer Switch Equipment, Meter Mounted* , for more information.~~

~~Informational Note No. 2: Manual and nonautomatic transfer equipment use human intervention.~~

Statement of Problem and Substantiation for Public Input

The listing requirement is already in 702.5(A), the approval requirement is already in 110.2.

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Public Input No. 2940-NFPA 70-2023 [Section No. 702.5(D)]

(D) Parallel Installation.

Systems installed to permit operation in parallel with the normal source shall also meet Article 705, Part I or Part II ~~of Article 705~~ .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Committee: NEC-P13

Public Input No. 1254-NFPA 70-2023 [New Section after 702.7]

TITLE OF NEW CONTENT

Type your content here ...

702.8. Cybersecurity

Optional Standby Systems that are connected to a communication network and have the capability to be controlled or permit control of any portion of the premises shall comply with either of the following:

(1) The ability to control the system is limited to a direct connection through a local nonnetworked interface.

(2) The Optional Standby Sytem is connected through a networked interface complying with both of the following methods:

a. The Optional Standby System and associated software are identified as being evaluated for cybersecurity.

b. A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to cyber attacks.

The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals.

Documentation of the evaluation, assessment, identification, and certification shall be made available to those authorized to inspect, operate, and maintain the system.

Informational Note No. 1: See ANSI/ISA 62443, Cybersecurity Standards series; UL 2900, Cybersecurity Standards series; and the NIST Framework for Improving Critical Infrastructure Cybersecurity, Version 1.1, for assessment guidelines.

Informational Note No. 2: Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

(1) The ISA Security Compliance Institute (ISCI) conformity assessment program

(2) Certification of compliance by a nationally recognized test laboratory

Statement of Problem and Substantiation for Public Input

Most of the cybersecurity focus has been on IT systems. There has been very little public discussion about cybersecurity for Operational Technology (OT), but cyber attacks on OT, by both domestic and foreign actors, occur on almost a daily basis. Hackers can easily destroy unprotected equipment and shut down entire unprotected facilities. Our adversaries such as Russia, China, North Korea, and Iran, are continuously mounting cyber attacks. They understand their limits and, so far, prohibit catastrophic attacks on our financial/banking system and electrical grid. In the mean time, they attack our infrastructure, such as the southeast gas pipeline. We have the ability, and obligation, to prevent this type of damage to our infrastructure from malicious cyber attacks. This Public Input is based upon 240.6(D) and 708.7 in the 2023 NEC. Pay particular attention to the word "identified" in (2) a. "Identified" as applied to equipment, is defined 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. 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 organization concerned with product evaluation." This Public Input simply requires that an Optional Standby System either not be connected to the internet, or if it is connected to the internet, that it be identified for cybersecurity and that an assessment is provided.

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Committee:	NEC-P13

Public Input No. 2264-NFPA 70-2023 [Section No. 702.7(A)]

(A) Standby.

A sign shall be placed at the service equipment for other than one- and two-family dwellings that indicates the type and location of each on-site optional standby power source. For one- and two-family dwelling units, a sign shall be placed at the disconnecting means required in 225.41 and 230.85 that indicates the location of each permanently installed on-site optional standby power source disconnect or means to shut down the prime mover as required in 445.19(C).

Statement of Problem and Substantiation for Public Input

Adding section 225.41 to this requirement for those one- and two-family dwellings supplied by a feeder required to have an outside emergency disconnect.

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Submittal Date: Tue Aug 15 14:23:44 EDT 2023

Committee: NEC-P13

Public Input No. 3171-NFPA 70-2023 [Section No. 702.7(A)]

(A) Standby.

(1) Other Than Dwelling Units. A sign shall be placed at the service equipment for other than one- and two-family dwellings that indicates the type and location of each on-site optional standby power source. ~~For~~

(2) One- and Two-Family Dwelling Units. For one- and two-family dwelling units, a sign shall be placed at the disconnecting means required in 230.85 that indicates the location of each permanently installed on-site optional standby power source disconnect or means to shut down the prime mover as required in 445.19(C).

Statement of Problem and Substantiation for Public Input

702.7(A) has multiple requirements dependent on different applications, therefore adding 2 new second level subdivisions to clarify this point for Code users. In accordance with NFPA Style Manual section 3.5.1.2 additional subdivisions shall be used where multiple requirements can be broken into independent requirements.

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Submittal Date: Tue Aug 29 20:54:38 EDT 2023

Committee: NEC-P13

Public Input No. 3173-NFPA 70-2023 [Section No. 702.11]

702.11 Portable Generator Grounding.

(A) Separately Derived System.

Where a portable ~~optional standby source~~ generator is used as a separately derived system, it shall be grounded ~~to a grounding electrode~~ and bonded in accordance with 250.30.

(B) Nonseparately Derived System.

Where a portable ~~optional standby source~~ generator is used as a nonseparately derived system, the equipment grounding conductor shall be bonded to the system grounding electrode.

Statement of Problem and Substantiation for Public Input

This section only applies to portable generators as the title heading states, however an optional standby source can be many different things other than a generator. For example, energy storage systems can be considered an optional standby source. Adding ‘and bonded’ to 702.11(A) because referenced rule 250.30 deals with both grounding and bonding. The proposed revisions increase clarity or usability and may eliminate confusion for Code users.

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Committee: NEC-P13

Public Input No. 2829-NFPA 70-2023 [New Section after 706.1]

706.2 Listing Requirements.

Energy storage systems shall be listed.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document when general listing requirements are covered within an article. The NEC Style Manual Section 2.2.1 Parallel Numbering Required, states that technical committees shall use the following section numbers for the same purposes within articles. The listing requirements are to be located in the .2 section.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2831-NFPA 70-2023 [Section No. 706.5]	Deleted and relocated to the .2 section.
Public Input No. 2831-NFPA 70-2023 [Section No. 706.5]	

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Public Input No. 633-NFPA 70-2023 [New Section after 706.1]

706.2 Reconditioned Equipment

Electrical Energy Storage Systems shall not be reconditioned.

Statement of Problem and Substantiation for Public Input

These items are not permitted to be reconditioned per the NEMA Technical Position on Reconditioned Equipment (NEMA CS 100-2020, Appendix B.1)

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 634-NFPA 70-2023 [New Section after 692.1]	

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Public Input No. 1098-NFPA 70-2023 [Section No. 706.1]

706.1 Scope.

This article applies to all energy storage systems (ESS) having a capacity greater than 3.6 MJ (1 kWh) that may be stand-alone or interactive with other electric power production sources. These systems are primarily intended to store and provide energy during normal operating conditions.

Informational Note No. 1: See Article 480 for installations that meet the definition of *stationary standby batteries*.

Informational Note No. ~~2: For batteries rated in ampere hours, kWh is equal to the nominal rated voltage times ampere-hour rating divided by 1000. Informational Note No.~~ 3: The following standards are frequently referenced for the installation of ESSs:

(1) NFPA 1-2021, *Fire Code*

(2) NFPA 111-2019, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*

(3) NECA 416-2016, *Recommended Practice for Installing Energy Storage Systems (ESS)*

(4) UL 810A, *Electrochemical Capacitors*

(5) NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems*

(6) UL 1973, *Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail (LER) Applications*

(7) UL 1989, *Standard for Standby Batteries*

(8) UL 9540, *Standard for Safety Energy Storage Systems and Equipment*

(9) UL Subject 2436, *Spill Containment For Stationary Lead Acid Battery Systems*

Statement of Problem and Substantiation for Public Input

This is a general electrical theory note. NEC s not a design guide or training manual. If we were to have these items in the NEC, it would seem more fitting they be in an annex in the back of the code book (along with many other helpful ohm's law calculation notes that could be included but aren't). However, including this type of information has not been the direction the NFPA has taken and thus this note seems out of place.

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Committee: NEC-P13

Public Input No. 3859-NFPA 70-2023 [Section No. 706.1]

706.1 Scope.

This article applies to all energy storage systems (ESS) having a capacity greater than 3.6 MJ (1 kWh) that may be stand-alone or interactive with other electric power production sources. ~~These systems are primarily intended to store and provide energy during normal operating conditions.~~

This Article does not apply to battery ESS systems that do not require a battery management system (BMS) for safety reasons, e.g. lead-acid, nickel-cadmium, sodium nickel chloride, or other aqueous battery systems .

Informational Note No. 1: See Article 480 ~~for installations that meet the definition of *stationary standby batteries* .~~ for battery requirements

Informational Note No. 2: For batteries rated in ampere hours, kWh is equal to the nominal rated voltage times ampere-hour rating divided by 1000.

Informational Note No. 3: The following standards are frequently referenced for the installation of ESSs:

(1) NFPA 1-2021, *Fire Code*

(2) NFPA 111-2019, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*

(3) NECA 416-2016, *Recommended Practice for Installing Energy Storage Systems (ESS)*

(4) UL 810A, *Electrochemical Capacitors*

(5) NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems*

(6) ~~UL 1973, *Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail (LER) Applications*~~

(7) ~~UL 1989, *Standard for Standby Batteries*~~

(8) UL 9540, *Standard for Safety Energy Storage Systems and Equipment*

(9) UL Subject 2436, *Spill Containment For Stationary Lead Acid Battery Systems*

(10) *UL 1741, Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources .*

Statement of Problem and Substantiation for Public Input

Electrical safety issues connected with batteries are covered in Article 480. See updated Informational Note No. 1.

There has been confusion of whether article 480 or 706 should apply to a particular energy storage system. This change, with the associated change in article 480, makes it clear that article 480 will apply to all batteries and article 706 will cover other energy storage components that are part of the energy storage system.

Deleted reference that apply only to batteries, not ESS. Added a reference that is important for ESS.

Related Public Inputs for This Document

Related Input	Relationship

Public Input No. 3808-NFPA 70-2023 [Article 480]
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]
Public Input No. 3808-NFPA 70-2023 [Article 480]
Public Input No. 3820-NFPA 70-2023 [Section No. 480.1]
Public Input No. 3863-NFPA 70-2023 [Definition: Energy Storage System (ESS).]

Submitter Information Verification

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Public Input No. 4449-NFPA 70-2023 [Section No. 706.1]

706.1 Scope.

This article applies to all energy storage systems (ESS) having a capacity greater than 3.6 MJ (1 kWh) that may be stand-alone or interactive with other electric power production sources. These systems are primarily intended to store and provide energy during normal operating conditions.

Informational Note No. 1: See Article 480 for installations that meet the definition of *stationary standby batteries*.

Informational Note No. 2: For batteries rated in ampere hours, kWh is equal to the nominal rated voltage times ampere-hour rating divided by 1000.

Informational Note No. 3: The following standards are frequently referenced for the installation of Energy Storage Systems (ESSs) :

(1) NFPA 1~~-2021~~ , *Fire Code*

(2) NFPA 111~~-2019~~ , *Standard on Stored Electrical Energy Emergency and Standby Power Systems*

(3) NECA 416~~-2016~~ , *Recommended Practice for Installing Energy Storage Systems (ESS)*

(4) UL 810A, *Electrochemical Capacitors*

(5) NFPA 855~~-2020~~ , *Standard for the Installation of Stationary Energy Storage Systems*

(6) UL 1973, *Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail (LER) Applications*

(7) UL 1989, *Standard for Standby Batteries*

(8) UL 9540, *Standard for Safety Energy Storage Systems and Equipment*

(9) UL Subject 2436, *Spill Containment For Stationary Lead Acid Battery Systems*

Statement of Problem and Substantiation for Public Input

Revised informational Note removing the date to maintain shelf life of the reference. The reference will be maintained referring to the most recently published edition of the standard.

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Public Input No. 4478-NFPA 70-2023 [Section No. 706.4]

706.4 ~~System Requirements~~ Nameplate Requirements .

Each ESS shall be provided with a nameplate plainly visible after installation and marked with the following:

(1) Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for supplying the ESS can be identified

(2) Rated frequency

(3) Number of phases, if ac

(4) Rating (kW or kVA)

(5) Available fault current derived by the ESS at the output terminals

(6) Maximum output and input current of the ESS at the output terminals

(7) Maximum output and input voltage of the ESS at the output terminals

(8) Utility-interactive capability, if applicable

Statement of Problem and Substantiation for Public Input

Change the word "system" to "nameplate" for a more accurate and suitable name to Section 706.4.

Section 706.4 requirements refer exclusively to nameplate requirements, not overall system requirements as the current name describes. "Nameplate Requirements" is more appropriate.

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Committee: NEC-P13

Public Input No. 2831-NFPA 70-2023 [Section No. 706.5]

~~**706.5** Listing.~~

~~Energy storage systems shall be listed.~~

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document when general listing requirements are covered within an article. The NEC Style Manual Section 2.2.1 Parallel Numbering Required, states that technical committees shall use the following section numbers for the same purposes within articles. The listing requirements are to be located in the .2 section.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2829-NFPA 70-2023 [New Section after 706.1]	Deleted and relocated to the .2 section.
Public Input No. 2829-NFPA 70-2023 [New Section after 706.1]	

Submitter Information Verification

Submitter Full Name: Dean Hunter
Organization: Minnesota Department of Labor
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Submittal Date: Fri Aug 25 14:20:03 EDT 2023
Committee: NEC-P13

Public Input No. 1685-NFPA 70-2023 [Section No. 706.7]

706.7 ~~Commissioning~~ Testing and Maintenance.

(A) ~~Commissioning~~ Performance Testing .

ESSs shall be ~~commissioned~~ performance tested upon installation. This shall not apply in one- and two-family dwellings.

Informational Note: See NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems*, for information related to the commissioning of ESSs.

(B) Maintenance.

ESSs shall be maintained in proper and safe operating condition. The required maintenance shall be in accordance with the manufacturer's requirements and industry standards. A written record of the system maintenance shall be kept and shall include records of repairs and replacements necessary to maintain the system in proper and safe operating condition. This shall not apply in one- and two-family dwellings.

Informational Note: See NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance*, or ANSI/NETA ATS-2017, *Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems*, for information related to general electrical equipment maintenance and developing an effective electrical preventive maintenance (EPM) program.

Additional Proposed Changes

File Name	Description	Approved
90-2015.pdf	NECA 90, Standard for Commissioning Building Electrical Systems.	

Statement of Problem and Substantiation for Public Input

Commissioning of a system is much different than witness testing a system, and requiring an AHJ to perform commissioning. In many cases AHJs are not equipped to perform Commissioning of electrical systems. It is a common misperception that electrical commissioning and acceptance testing are the same thing or that electrical commissioning is the same as equipment startup. In reality, acceptance testing and equipment startup, are only two subsets of the electrical commissioning process. Upon completion of acceptance testing and contractor/vendor startup (pre-functional testing), functional performance `testing (FPT) and integrated systems testing (IST). In the ANSI/International Electrical Testing Association — Standard for Electrical Commissioning Specifications for Electrical Power Equipment and Systems (NETA ECS-2015), electrical commissioning is defined as the systematic process of verifying, documenting, and placing into service newly installed or retrofitted electrical power equipment and systems. The process focuses on verifying and documenting that all of the electrical commissioned equipment, systems, and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements (OPRs). Commissioning processes should be performed by a commissioning authority. The change in the 2023 NEC is excessive and imposes significant requirements that go beyond the scope or the NEC and beyond the responsibilities of the AHJ. These changes create significantly more steps in the approval processes required by the NEC. This proposed change is to either remove the word "commissioning" from each of these sections or to specifically state which parts of the overall commissioning process is required by the NEC rules. Commissioning is too broad of a term and the associated processes are extensive in many cases. (See attached copy of NECA 90 to PI)

Submitter Information Verification

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Submittal Date:	Fri Jul 28 18:32:30 EDT 2023
Committee:	NEC-P13

Public Input No. 1374-NFPA 70-2023 [Section No. 706.7(A)]

(A) Commissioning.

ESSs shall be commissioned upon installation ~~. This shall not apply in one- and two-family dwellings.~~ in accordance with the manufacturer's instructions.

Informational Note: See NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems*, for information related to the commissioning of ESSs.

Statement of Problem and Substantiation for Public Input

The 2023 NEC requirements in Section 706.7(A) imply that a residential ESS is not required to be commissioned upon installation. This does not align with manufacturer's instructions provided as part of the product listing required in Section 706.5. The UL 9540 Standard requires commissioning instructions be provided by the manufacturer in the installation instructions for the ESS in Section 42.1(a). This requirement applies to every listed ESS, including those installed in residential applications. Although this section does not require that AHJs witness or conduct the commissioning, the importance of commissioning for residential ESS should be reflected in this section.

The informational note should be revised to remove the date reference in compliance with Section 90.5(C).

Submitter Information Verification

Submitter Full Name:	Megan Hayes
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Submittal Date:	Tue Jul 11 13:11:54 EDT 2023
Committee:	NEC-P13

Public Input No. 379-NFPA 70-2023 [Section No. 706.7(A)]

~~**(A)** Commissioning.~~

~~ESSs shall be commissioned upon installation. This shall not apply in one- and two-family dwellings.~~

~~Informational Note: See NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems* , for information related to the commissioning of ESSs.~~

Statement of Problem and Substantiation for Public Input

Delete this section as NFPA 855, as pointed out in the informational note already requires what is required here. It is not necessary for redundant requirements.

Submitter Information Verification

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Submittal Date:	Wed Mar 01 13:23:00 EST 2023
Committee:	NEC-P13

Public Input No. 3852-NFPA 70-2023 [Sections 706.7(A), 706.7(B)]

Sections 706.7(A), 706.7(B)

(A) Commissioning.

ESSs shall be commissioned upon installation ~~. This shall not apply in one- and two-family dwellings~~ in accordance with the manufacturer's instructions .

Informational Note: See NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems*, for information related to the commissioning of ESSs.

(B) Maintenance.

ESSs shall be maintained in proper and safe operating condition. The required maintenance shall be in accordance with the manufacturer's requirements and industry standards. ~~A written~~ In other than one- and two-family dwelling units, a written record of the system maintenance shall be kept and shall include records of repairs and replacements necessary to maintain the system in proper and safe operating condition.~~ This shall not apply in one- and two-family dwellings.~~

Informational Note: See NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance*, or ANSI/NETA ATS-2017, *Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems*, for information related to general electrical equipment maintenance and developing an effective electrical preventive maintenance (EPM) program.

Additional Proposed Changes

File Name	Description	Approved
ACote_2026_PI-3852.pdf	PI-3852: Proposed Language, Substantiation, and Markup	

Statement of Problem and Substantiation for Public Input

The 2023 NEC language implies that a residential ESS is not required to be commissioned or maintained in a safe operating condition. I believe the intent of the 2023 NEC language was to correlate with NFPA 855 and not require commissioning plans to be submitted for AHJ approval and to not require maintenance logs to be maintained for residential systems.

The UL 9540 standard requires commissioning instructions to be provided by the manufacturer for the ESS in Section 42.1(a). This requirement applies to every listed ESS, including ones installed in residential applications. The 2023 language in 706.7(A) modifies the language of 110.3(B) as it applies to residential ESS, which I do not believe was the intention of CMP-13.

In addition, some residential ESS are required to have annual service and maintenance performed on the system by the manufacturer, and the 2023 NEC language in 706.7(B) implied that maintenance does not apply to residential ESS, which again is a modification of 110.3(B). The proposed language will provide correlation with UL 9540 requirements for installation instructions and will not require maintenance logs to be maintained for residential ESS which correlates with the requirements in NFPA 855.

Submitter Information Verification

Submitter Full Name: Andrew Cote

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Submittal Date:	Tue Sep 05 19:01:19 EDT 2023
Committee:	NEC-P13

2026 Public Input Form

Name: Andrew Cote Email:	2023 NEC Section Number: 706.7	Proposed NEW Section Number: 706.7

Type of Change: *(New, revision, etc.)*

Revision of existing *Code* language.

Proposed Code Language:

706.7 Commissioning and Maintenance.

(A) Commissioning. ESSs shall be commissioned upon installation in accordance with the manufacturer's instructions.

Informational Note: See NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems*, for information related to the commissioning of ESSs.

(B) Maintenance. ESSs shall be maintained in proper and safe operating condition. The required maintenance shall be in accordance with the manufacturer's requirements and industry standards. In other than one- and two-family dwelling units, a written record of the system maintenance shall be kept and shall include records of repairs and replacements necessary to maintain the system in proper and safe operating condition.

Informational Note: See NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance*, or ANSI/NETA ATS-2017, *Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems*, for information related to general electrical equipment maintenance and developing an effective electrical preventive maintenance (EPM) program.

Substantiation for Change:

The 2023 NEC language implies that a residential ESS is not required to be commissioned or maintained in a safe operating condition. I believe the intent of the 2023 NEC language was to correlate with NFPA 855 and not require commissioning plans to be submitted for AHJ approval and to not require maintenance logs to be maintained for residential systems.

The UL 9540 standard requires commissioning instructions to be provided by the manufacturer for the ESS in Section 42.1(a). This requirement applies to every listed ESS, including ones installed in residential applications. The 2023 language in 706.7(A) modifies the language of 110.3(B) as it applies to residential ESS, which I do not believe was the intention of CMP-13.

In addition, some residential ESS are required to have annual service and maintenance performed on the system by the manufacturer, and the 2023 NEC language in 706.7(B) implied that maintenance does not apply to residential ESS, which again is a modification of 110.3(B). The proposed language will provide correlation with UL 9540 requirements for installation instructions and will not require maintenance logs to be maintained for residential ESS which correlates with the requirements in NFPA 855.

Notes:

706.7 Commissioning and Maintenance.

(A) Commissioning. ESSs shall be commissioned upon installation~~. This shall not apply in one- and two-family dwellings.~~ in accordance with the manufacturer's instructions.

Informational Note: See NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems*, for information related to the commissioning of ESSs.

(B) Maintenance. ESSs shall be maintained in proper and safe operating condition. The required maintenance shall be in accordance with the manufacturer's requirements and industry standards. In other than one- and two-family dwelling units, a ~~A~~ written record of the system maintenance shall be kept and shall include records of repairs and replacements necessary to maintain the system in proper and safe operating condition. ~~This shall not apply in one- and two-family dwellings.~~

Informational Note: See NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance*, or ANSI/NETA ATS-2017, *Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems*, for information related to general electrical equipment maintenance and developing an effective electrical preventive maintenance (EPM) program.

Public Input No. 1331-NFPA 70-2023 [Section No. 706.7(B)]

(B) Maintenance.

ESSs shall be maintained in proper and safe operating condition. The required maintenance shall be in accordance with the manufacturer's requirements and industry standards. A written record of the system maintenance shall be kept and shall include records of ~~repairs~~ servicing and replacements necessary to maintain the system in proper and safe operating condition. This shall not apply in one- and two-family dwellings.

Informational Note: See NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance*, or ANSI/NETA ATS-2017, *Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems*, for information related to general electrical equipment maintenance and developing an effective electrical preventive maintenance (EPM) program.

Statement of Problem and Substantiation for Public Input

Servicing is a defined term and includes repairs. Using a defined term adds more clarity and helps avoid confusion between activities that are deemed as servicing and those that are deemed as reconditioning.

Submitter Information Verification

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Submittal Date: Sat Jul 08 11:50:47 EDT 2023
Committee: NEC-P13

Public Input No. 1375-NFPA 70-2023 [Section No. 706.7(B)]

(B) Maintenance.

ESSs shall be maintained in proper and safe operating condition. The required maintenance shall be in accordance with the manufacturer's requirements and industry standards. ~~A~~ In other than one- and two-family dwelling units, a written record of the system maintenance shall be kept and shall include records of repairs and replacements necessary to maintain the system in proper and safe operating condition. ~~This shall not apply in one- and two-family dwellings.~~

Informational Note: See NFPA 70B-~~2019~~ , *~~Recommended Practice~~ Standard for Electrical Equipment Maintenance*, or ANSI/NETA ATS-~~2017~~ , *Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems*, for information related to general electrical equipment maintenance and developing an effective electrical preventive maintenance (EPM) program.

Statement of Problem and Substantiation for Public Input

The 2023 NEC language in 706.7(B) implies that a residential ESS is not required to be maintained in a safe operating condition. This does not align with manufacturer's instructions provided as part of the product listing required in Section 706.5. The UL 9540 Standard requires maintenance instructions to be provided by the manufacturer in the installation instructions for the ESS in Section 42.1(a). This requirement applies to every listed ESS, including ones installed in residential applications.

The informational note should be revised to update the title of NFPA 70B and remove the date references in compliance with Section 90.5(C).

Submitter Information Verification

Submitter Full Name: Megan Hayes
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City:
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Submittal Date: Tue Jul 11 13:13:40 EDT 2023
Committee: NEC-P13

Public Input No. 674-NFPA 70-2023 [Section No. 706.7(B)]

~~**(B)** Maintenance.~~

~~ESSs shall be maintained in proper and safe operating condition. The required maintenance shall be in accordance with the manufacturer's requirements and industry standards. A written record of the system maintenance shall be kept and shall include records of repairs and replacements necessary to maintain the system in proper and safe operating condition. This shall not apply in one- and two-family dwellings.~~

> ~~Informational Note: See NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance* , or ANSI/NETA ATS-2017, *Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems* , for information related to general electrical equipment maintenance and developing an effective electrical preventive maintenance (EPM) program.~~

Statement of Problem and Substantiation for Public Input

The NEC applies to installations, not maintenance. If this were not so there would be no reason for the Informational Note pointing to NFPA 70B.

Submitter Information Verification

Submitter Full Name: Ryan Jackson
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Submittal Date: Thu Apr 20 13:54:29 EDT 2023
Committee: NEC-P13

Public Input No. 1256-NFPA 70-2023 [New Section after 706.9]

TITLE OF NEW CONTENT

Type your content here ...

706.10. Cybersecurity

Energy Storage Systems that are connected to a communication network and have the capability to be controlled or permit control of any portion of the premises shall comply with either of the following:

(1) The ability to control the system is limited to a direct connection through a local nonnetworked interface.

(2) The Energy Storage Sytem is connected through a networked interface complying with both of the following methods:

a. The Energy Storage System and associated software are identified as being evaluated for cybersecurity.

b. A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to cyber attacks.

The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals.

Documentation of the evaluation, assessment, identification, and certification shall be made available to those authorized to inspect, operate, and maintain the system.

Informational Note No. 1: See ANSI/ISA 62443, Cybersecurity Standards series; UL 2900, Cybersecurity Standards series; and the NIST Framework for Improving Critical Infrastructure Cybersecurity, Version 1.1, for assessment guidelines.

Informational Note No. 2: Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

(1) The ISA Security Compliance Institute (ISCI) conformity assessment program

(2) Certification of compliance by a nationally recognized test laboratory

Statement of Problem and Substantiation for Public Input

Most of the cybersecurity focus has been on IT systems. There has been very little public discussion about cybersecurity for Operational Technology (OT), but cyber attacks on OT, by both domestic and foreign actors, occur on almost a daily basis. Hackers can easily destroy unprotected equipment and shut down entire unprotected facilities. Our adversaries such as Russia, China, North Korea, and Iran, are continuously mounting cyber attacks. They understand their limits and, so far, prohibit catastrophic attacks on our financial/banking system and electrical grid. In the mean time, they attack our infrastructure, such as the southeast gas pipeline. We have the ability, and obligation, to prevent this type of damage to our infrastructure from malicious cyber attacks. This Public Input is based upon 240.6(D) and 708.7 in the 2023 NEC. Pay particular attention to the word "identified" in (2) a. "Identified" as applied to equipment, is defined 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. 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 organization concerned with product evaluation." This Public Input simply requires that an Energy Storage System either not be connected to the internet, or if it is connected to the internet, that it be identified for cybersecurity and that an assessment is provided.

Submitter Information Verification

Submitter Full Name:	Vincent Saporita
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Submittal Date:	Fri Jun 30 15:25:41 EDT 2023
Committee:	NEC-P13

Public Input No. 3020-NFPA 70-2023 [Section No. 706.9]

Part II. Circuit Requirements

706.9 Maximum Voltage.

The maximum voltage of an ESS shall be the rated ESS input and output voltage(s) indicated on the ESS nameplate(s) or system listing.

706.10 Circuit Sizing and Current.

(A) Maximum Rated Current for a Specific Circuit.

The maximum current for the specific circuit shall be calculated in accordance with 706.10(A)(1) through (A)(5).

(1) Nameplate-Rated Circuit Current.

Circuit current shall be the rated current indicated on the ESS nameplate(s) or system listing. Where the ESS has separate input (charge) and output (discharge) circuits or ratings, these shall be considered individually. Where the same terminals on the ESS are used for charging and discharging, the rated current shall be the greater of the two.

(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 ac output current rating of the inverter when the inverter is producing rated power.

(5) DC to DC Converter Output Current.

The maximum current shall be the dc-to-dc converter continuous output current rating.

(B) Conductor Ampacity.

The ampacity of the output circuit conductors of the ESS(s) connected to the wiring system serving the loads to be serviced by the system shall not be less than the greater of the nameplate(s)-rated circuit current as determined in accordance with 706.10(A)(1) or 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.

706.11 Overcurrent Protection.

(A) Circuits and Equipment.

Protection devices for ESS circuits shall be in accordance with 706.11(B) through (F). Circuits shall be protected at the source from overcurrent. A circuit conductor connected at one end to a supply with integral fault protection, where the conductor is rated for the maximum circuit current from that supply, and also connected to sources having an available maximum circuit current greater than the ampacity of the conductor, shall be protected from overcurrent at the point of connection to the higher current source.

Informational Note: Listed electronic power converter circuits powered by an ESS have integral fault protection. Where these circuits are connected to higher current sources such as a utility service, the overcurrent device is more appropriately installed at the higher current source end of the circuit conductor.

(B) Overcurrent Device Ampere Ratings.

Overcurrent protective devices, where required, shall be not less than 125 percent of the maximum currents calculated in 706.10(A).

Exception: Where the assembly, including the overcurrent protective devices, is listed for operation at 100 percent of its rating, the ampere rating of the overcurrent devices

shall be permitted to be not less than the maximum currents calculated in 706.10(B).

(C) Direct Current Rating.

Overcurrent protective devices, either fuses or circuit breakers, used in any dc portion of an ESS shall be listed for dc and shall have the appropriate voltage, current, and interrupting ratings for the application.

(D) Current Limiting.

A listed and labeled current-limiting overcurrent protective device shall be installed adjacent to the ESS for each dc output circuit.

Exception: Where current-limiting overcurrent protection is provided for the dc output circuits of a listed ESS, additional current-limiting overcurrent devices shall not be required.

(E) 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.

(F) Location.

Where circuits from the input or output terminals of energy storage components in an ESS pass through a wall, floor, or ceiling, overcurrent protection shall be provided at the energy storage component end of the circuit.

706.12 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.

(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.

(2) 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.

(3) ESS Using Interactive Inverters.

Systems using interactive inverters to control energy storage state-of-charge by diverting excess power into an alternate electric power production and distribution system, such as utility, shall comply with 706.12(B)(3)(a) and (B)(3)(b).

(1) These systems shall not be required to comply with 706.12(B)(2).

(2)

These systems shall have a second, independent means of controlling the ESS charging process for use when the alternate system is not available or when the primary charge controller fails or is disabled.

(C) Charge Controllers and DC-to-DC Converters.

Where 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, all of the following shall apply:

(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 Input

This input is only editorial, proposing a change in Section and Part location and numbering only. No changes were made to the existing language in this section.

Part IV Circuit Requirements title has been relocated above existing 706.9 and renumbered to Part II Circuit Requirements using the same Part numbers as, and in better alignment with other similar articles' structure. (per Style Manual 2.2.1.1 Parallel Numbering Within Similar Articles.)

706.09 Maximum Voltage hence moved into Part II Circuit Requirements.

706.30 Circuit Sizing and Current has been moved to new 706.10 Circuit Sizing and Current. No changes were made to the existing language in this section.

706.31 Overcurrent Protection has been moved to New 706.11 Overcurrent Protection. No changes were made to the existing language in this section.

706.33 Charge Control has been moved to New 706.12 Charge Control. No changes were made to the existing language in this section.

Submitter Information Verification

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Submittal Date:	Mon Aug 28 17:33:21 EDT 2023
Committee:	NEC-P13

Public Input No. 2547-NFPA 70-2023 [Section No. 706.15(B)]

(B) Location and Control.

The disconnecting means shall be readily accessible and shall comply with one or more of the following:

(1) Located within the ESS

(2) Located within sight and within 3 m (10 ft) from the ESS

(3) Where not located within sight of the ESS, the disconnecting means, or the enclosure providing access to the disconnecting means, shall be ~~capable of being locked~~ lockable open in accordance with 110.25

Where controls to activate the disconnecting means of an ESS are used and are not located within sight of the ESS, the disconnecting means shall be lockable in accordance with 110.25, and the location of the controls shall be marked on the disconnecting means.

For one- and two-family dwellings, an ESS shall include an emergency shutdown function to cease the export of power from the ESS to premises wiring of other systems. An initiation device(s) shall be located at a readily accessible location outside the building and shall plainly indicate whether in the "off" or "on" position. The "off" position of the device(s) shall perform the ESS emergency shutdown function.

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document when a disconnecting means is required to be lockable open elsewhere in the code. The text is revised to comply with the NEC Style Manual. The NEC Style Manual Section 3.2.5 Consistent Application of Terms, 3.2.5.3 Lockable Open. Where a requirement specifies that a disconnecting means be capable of being locked in the open position, the phrase lockable open in accordance with 110.25 shall be used.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name:	David Williams
Organization:	Delta Charter Township
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Aug 20 07:12:59 EDT 2023
Committee:	NEC-P13

Public Input No. 266-NFPA 70-2023 [Section No. 706.15(B)]

(B) Location and Control.

The disconnecting means shall be readily accessible and shall comply with one or more of the following:

(1) Located within the ESS

(2) Located ~~within sight~~ visible from and within 3 m (10 ft) from the ESS

(3) Where not located within sight of the ESS, the disconnecting means, or the enclosure providing access to the disconnecting means, shall be capable of being locked in accordance with 110.25

Where controls to activate the disconnecting means of an ESS are used and are not located within sight of the ESS, the disconnecting means shall be lockable in accordance with 110.25, and the location of the controls shall be marked on the disconnecting means.

For one- and two-family dwellings, an ESS shall include an emergency shutdown function to cease the export of power from the ESS to premises wiring of other systems. An initiation device(s) shall be located at a readily accessible location outside the building and shall plainly indicate whether in the "off" or "on" position. The "off" position of the device(s) shall perform the ESS emergency shutdown function.

Statement of Problem and Substantiation for Public Input

The use of the defined term "In Sight From (Within Sight From) (Within Sight)" and setting a distance that is different from the distance specified in the definition can be confusing. The proposed language conveys the same information without inviting confusion with 110.29 or the defined term "In Sight From (Within Sight From) (Within Sight)"

Submitter Information Verification

Submitter Full Name: Don Ganiere

Organization: none

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Zip:

Submittal Date: Wed Feb 01 16:00:49 EST 2023

Committee: NEC-P13

Public Input No. 3861-NFPA 70-2023 [Section No. 706.15(C)]

(C) Notification and Marking.

Each ESS disconnecting means shall plainly indicate whether it is in the open (off) or closed (on) position and be permanently marked as follows:

"ENERGY STORAGE SYSTEM DISCONNECT"

The disconnecting means shall be legibly marked in the field to indicate the following:

(1) Nominal ESS output voltage

(2) Available fault current derived from the ESS

(3) An arc-flash label applied in accordance with acceptable industry practice

(4) Date the calculation was performed

Exception: List items (2), (3), and (4) shall not apply to one- and two-family dwellings.

Informational Note No. 1: See NFPA *70E*-2018, *Standard for Electrical Safety in the Workplace*, for industry practices for equipment labeling. This standard provides specific criteria for developing arc-flash labels for equipment that provides nominal system voltage, incident energy levels, arc-flash boundaries, as well as minimum required levels of personal protective equipment~~, and so forth~~ .

Informational Note No. 2: ESS electronics could include inverters or other types of power conversion equipment.

For ESS disconnecting means where the line and load terminals could 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 notification(s) and marking(s) shall comply with 110.21(B).

Statement of Problem and Substantiation for Public Input

Grammatical changes to ensure correct statement of fact.

Submitter Information Verification

Submitter Full Name: William Cantor

Organization: TPI Corporation

Affiliation: IEEE IAS/PES JTCC

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Zip:
Submittal Date: Tue Sep 05 19:42:25 EDT 2023
Committee: NEC-P13

Public Input No. 3027-NFPA 70-2023 [Section No. 706.15(D)]

(D) Partitions Between Components.

Where circuits from the input or output terminals of ~~energy storage components in~~ battery that is separated from other components of an ESS pass through a wall, floor, or ceiling, a readily accessible disconnecting means shall be provided within sight of the ~~energy storage component. Fused disconnecting means or circuit breakers shall be permitted to be used.~~ battery.

Statement of Problem and Substantiation for Public Input

Since there is no definition of “energy storage component”, the language in this section is insufficient to be applied uniformly in all applications. Changing from this undefined term to the term “battery” (defined in 100) will eliminate this confusion and does not conflict with section 480.7(A).

Submitter Information Verification

Submitter Full Name:	Larry Sherwood
Organization:	Sustainable Energy Action Comm
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Aug 28 19:32:37 EDT 2023
Committee:	NEC-P13

Public Input No. 1813-NFPA 70-2023 [Section No. 706.15(E)(1)]

(1) Disconnecting Means.

A disconnecting means shall be provided for all ungrounded conductors with provisions to 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 . A disconnecting means shall be readily accessible and located within sight of the battery.

Informational Note: See 240.21(H) for information on the location of the overcurrent device for battery conductors.

Statement of Problem and Substantiation for Public Input

NFPA 70E-2024 Article 120.6, Process for Establishing and Verifying an Electrically Safe Work Condition, item (3) states "Wherever 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."

NFPA 70-2023, Article 706.15(E)(1) should be revised to require means to 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.

Relationship of OSHA and NFPA 70E: The Origin and Development section to NFPA 70E states the Committee on Electrical Safety Requirements for Employee Workplaces was formed to assist OSHA in preparing an electrical safety standard that would serve OSHA's needs and assist in complying with the requirements of Section 6(b) of the Occupational Safety and Health Act. In other words, OSHA looks to NFPA 70E to fill out the performance-based requirements included within the OSHA regulations, especially since NFPA 70E is the American National Standard on the subject and sets the bar for safe work practices.

Submitter Information Verification

Submitter Full Name:	Jeffrey Kriner
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Submittal Date:	Fri Aug 04 17:32:17 EDT 2023
Committee:	NEC-P13

Public Input No. 2548-NFPA 70-2023 [Section No. 706.15(E)(3)]

(3) Remote Activation.

Where a disconnecting means is provided with remote controls to activate the disconnecting means and the controls for the disconnecting means are not located within sight of the battery, the disconnecting means shall be ~~capable of being locked in the open position,~~ lockable open 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 Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document when a disconnecting means is required to be lockable open elsewhere in the code. The text is revised to comply with the NEC Style Manual. The NEC Style Manual Section 3.2.5 Consistent Application of Terms, 3.2.5.3 Lockable Open. Where a requirement specifies that a disconnecting means be capable of being locked in the open position, the phrase lockable open in accordance with 110.25 shall be used.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 20 07:14:09 EDT 2023
Committee: NEC-P13

Public Input No. 3029-NFPA 70-2023 [Section No. 706.15(E)(4)]

(4) Notification.

The disconnecting means shall be legibly marked in the field. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

(1) Nominal battery voltage

(2) Available fault current derived from the stationary standby battery system

Informational Note No. 1: Battery equipment suppliers can provide information about available fault current on any particular battery model.

(3) An arc-flash label in accordance with acceptable industry practice

Informational Note No. 2: See NFPA *70E*-2021, *Standard for Electrical Safety in the Workplace*, for assistance in determining the severity of potential exposure, planning safe work practices, determining arc-flash labeling, and selecting personal protective equipment.

(4) Date the calculation was performed

Exception: List items (2), (3), and (4) shall not apply to one- and two-family dwellings.

Statement of Problem and Substantiation for Public Input

This section contains duplicative requirements as is in 706.15(C) but lacks the exception that would exempt one- and two-family dwellings.

Submitter Information Verification

Submitter Full Name: Larry Sherwood

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Street Address:

City:

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Submittal Date: Mon Aug 28 19:36:41 EDT 2023

Committee: NEC-P13

Public Input No. 3030-NFPA 70-2023 [Section No. 706.16]

~~**706.16** Connection to Energy Sources.~~

~~The connection of an ESS to sources of energy shall comply with 706.16(A) through (F).~~

~~**(A)** Source Disconnect.~~

~~A disconnect that has multiple sources of power shall disconnect all energy sources when in the off position.~~

~~**(B)** Identified Interactive Equipment.~~

~~ESS that operate in parallel with other ac sources shall use inverters that are listed and identified as interactive.~~

~~**(C)** Loss of Interactive System Power.~~

~~Upon loss of a primary source of power, an ESS with a utility-interactive inverter shall comply with the requirements of 705.40 .~~

~~**(D)** Unbalanced Interconnections.~~

~~Unbalanced ac connections between an ESS and other ac electric power production sources shall be in accordance with 705.45~~

~~**(E)** Other Energy Sources.~~

~~The connection of an ESS to other energy sources shall be in accordance with 705.12 .~~

~~**(F)** Stand-Alone Operation.~~

~~Where the output of an ESS is capable of operating in stand-alone mode, the requirements of 710.15 shall apply.~~

Statement of Problem and Substantiation for Public Input

Each of these sections does not modify the requirements in the other sections identified within them and are not needed to apply this Code.

Submitter Information Verification

Submitter Full Name: Larry Sherwood

Organization: Sustainable Energy Action Comm

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Submittal Date: Mon Aug 28 19:41:19 EDT 2023

Committee: NEC-P13

Public Input No. 334-NFPA 70-2023 [Section No. 706.16(E)]

(E) Other Energy Sources.

The connection of an ESS to other energy sources shall be in accordance with either 705. 11 or 705. 12.

Statement of Problem and Substantiation for Public Input

NEC Section 230.82(6) permits energy storage systems to be connected to the supply side of the service disconnecting means. Article 705 includes the requirements necessary to make supply side connections of non-primary sources, but this Article is specific to “Power Production Sources”, and while Energy Storage Systems are non-primary sources that may operate in parallel with primary source(s), ESS are not “production sources”. Existing requirements in 706.16(E) already identify 705 as the source of requirements when connecting ESS to the load side of the service equipment. Adding a reference to Section 705.11 will identify the correct requirements to apply to ESS when connecting to the supply side of the service as permitted in 230.82(6).

Submitter Information Verification

Submitter Full Name:	LaTanya Schwalb
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Submittal Date:	Mon Feb 13 11:44:09 EST 2023
Committee:	NEC-P13

Public Input No. 3854-NFPA 70-2023 [Section No. 706.16(E)]

(E) Other Energy Sources.

The connection of an ESS to other energy sources shall be in accordance with the following:

(1) Connections to a service shall be in accordance with 705. 11

(2) Connections to a load-side source shall be in accordance with 705. 12

(3) Connections to an Energy Management System (EMS) shall be in accordance with 705 . 13 and 750.30.

Additional Proposed Changes

File Name	Description	Approved
ACote_2026_PI-3854.pdf	PI-3854: Proposed Language, Substantiation, and Markup	

Statement of Problem and Substantiation for Public Input

There is a correlation issue with the existing text in 706.16(E) and it appears that the text has been copied over for the last 2 cycles from the original requirement in 706.8 from the 2017 NEC. CMP-4 in the 2020 cycle divided the supply-side and load-side connection requirements into 3 separate Code sections, 705.11 for supply-side connections to a service, 705.12 for load-side connections, and 705.13 for connection to an EMS/PCS. As currently written in 706.16(E), it would not be NEC compliant for an ESS to be connected to a service in 705.11 or connected to an EMS in 705.13 since the current text only allows for a load-side connection for an ESS in 705.12.

Submitter Information Verification

Submitter Full Name: Andrew Cote
Organization: Generac Power Systems, Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 05 19:08:14 EDT 2023
Committee: NEC-P13

2026 Public Input Form

Name: Andrew Cote Email:	2023 NEC Section Number: 706.16(E)	Proposed NEW Section Number: 706.16(E)

Type of Change: *(New, revision, etc.)*

Revision of existing *Code* language.

Proposed Code Language:

(E) Other Energy Sources.
The connection of an ESS to other energy sources shall be in accordance with the following:

(1) Connections to a service shall be in accordance with 705.11
(2) Connections to a load-side source shall be in accordance with 705.12
(3) Connections to an Energy Management System (EMS) shall be in accordance with 705.13 and 750.30.

Substantiation for Change:

There is a correlation issue with the existing text in 706.16(E) and it appears that the text has been copied over for the last 2 cycles from the original requirement in 706.8 from the 2017 NEC. CMP-4 in the 2020 cycle divided the supply-side and load-side connection requirements into 3 separate Code sections, 705.11 for supply-side connections to a service, 705.12 for load-side connections, and 705.13 for connection to an EMS/PCS. As currently written in 706.16(E), it would not be NEC compliant for an ESS to be connected to a service in 705.11 or connected to an EMS in 705.13 since the current text only allows for a load-side connection for an ESS in 705.12.

Notes:

706.16 Connection to Energy Sources.

(E) Other Energy Sources.
The connection of an ESS to other energy sources shall be in accordance with ~~705.12~~ the following:

(1) Connections to a service shall be in accordance with 705.11
(2) Connections to a load-side source shall be in accordance with 705.12
(3) Connections to an Energy Management System (EMS) shall be in accordance with 705.13 and 750.30.

Public Input No. 2062-NFPA 70-2023 [Section No. 706.16(F)]

(F) Stand-Alone Operation.

Where the output of an ESS is capable of operating in stand-alone mode, the requirements of ~~710~~ 702 . ~~15 shall~~ 4 shall apply.

Statement of Problem and Substantiation for Public Input

This public input is being submitted on behalf of the Minnesota Department of Labor and Industry. Currently, the Department's inspection staff includes 14-office/field staff, 12-state field inspectors, 2-virtual inspectors and 50 plus contract electrical inspectors that complete over 170,000 electrical inspections annually.

An ESS that is capable of operating in stand-alone mode would not be considered a stand-alone system as covered by the scope of 710 as these systems are not connected to the utility or other electric power production and distribution network. The reference should be changed so that the ESS system is sized for the entire load of the building, similar to an automatic transfer system as required by 702.4(B)(a), or the ESS system should be listed as an Energy Management System (EMS) that is capable of managing the connected load as allowed in 702.4(B)(b).

Submitter Information Verification

Submitter Full Name: Dean Hunter

Organization: Minnesota Department of Labor

Street Address:

City:

State:

Zip:

Submittal Date: Fri Aug 11 13:52:51 EDT 2023

Committee: NEC-P13

Public Input No. 1376-NFPA 70-2023 [Section No. 706.20]

~~**706.20** General.~~

~~**(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. Ventilation of an ESS shall be permitted to be provided in accordance with the manufacturer's recommendations and listing for the system.~~

> ~~Informational Note No. 1: See NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems* , for technology-specific guidance. Not all ESS technologies require ventilation.~~

> ~~Informational Note No. 2: See IEEE 1635-2018/ASHRAE Guideline 21-2018, *Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications* , as a source for design of ventilation of batteries.~~

~~**(B)** Dwelling Units.~~

~~An ESS for one- and two-family dwelling units shall not exceed 100 volts dc between conductors or to ground.~~

~~*Exception: Where live parts are not accessible during routine ESS maintenance, a maximum ESS voltage of 600 volts dc shall be permitted.*~~

~~**(C)** Spaces About ESS Components.~~

~~**(1)** General.~~

~~Working spaces for ESS shall comply with 110.26 and 110.34 .~~

~~**(2)** Space Between Components.~~

~~ESSs shall be permitted to have space between components in accordance with the manufacturer's instructions and listing.~~

> ~~Informational Note: Additional space may be needed to accommodate ESS hoisting equipment, tray removal, or spill containment.~~

Statement of Problem and Substantiation for Public Input

The requirements in Section 706.5 require listing for all energy storage systems. The installation instructions are required to provide specific details on the spacing of ESS components and any required ventilation. The working space requirements in Section 110.26 and 110.34 are required for all installations and should not be repeated in this section. The dwelling unit voltage limits and exception should be removed as the product standard addresses exposure to live parts in the product listing evaluation.

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: NEMA
Street Address:
City:
State:
Zip:

Submittal Date:	Tue Jul 11 13:23:57 EDT 2023
Committee:	NEC-P13

Public Input No. 2500-NFPA 70-2023 [Section No. 706.20(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 mixture. Ventilation of an ESS shall be permitted to be provided in accordance with the manufacturer's recommendations and listing for the system.~~

> ~~Informational Note No. 1: See NFPA 855-2020, *Standard for the Installation of Stationary Energy Storage Systems* , for technology-specific guidance. Not all ESS technologies require ventilation.~~
>
> ~~Informational Note No. 2: See IEEE 1635-2018/ASHRAE Guideline 21-2018, *Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications* , as a source for design of ventilation of batteries.~~

Statement of Problem and Substantiation for Public Input

Now that we have a product standard and the NEC requires the equipment to be listed, this section should be deleted. If the CMP disagrees, please, at a minumum, change the last sentence to mandatory text (shall) instead of permissive (shall be permitted). I'm guessing the intent of this is not to modify 110.3(B) and make it optional.

Submitter Information Verification

Submitter Full Name:	Ryan Jackson
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City:	
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Submittal Date:	Fri Aug 18 12:44:58 EDT 2023
Committee:	NEC-P13

Public Input No. 2914-NFPA 70-2023 [Section No. 706.20(B)]

(B) Dwelling Units.

An ESS for one- and two-family dwelling units shall not exceed ~~100 volts~~ 120 volts nominal dc between conductors or to ground.

Exception: Where live parts are not accessible during routine ESS maintenance, a maximum ESS voltage of 600 volts dc shall be permitted.

Statement of Problem and Substantiation for Public Input

Edison DC systems 110 - 120 Volts nominal distributed power to dwelling units for a century without documented issues due to voltage, 210.6 allows 120V DC circuits in a dwelling. There is no technical reason for a lower limit on this voltage.

Submitter Information Verification

Submitter Full Name: Stephen Schmiechen
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Submittal Date: Sun Aug 27 15:25:40 EDT 2023
Committee: NEC-P13

Public Input No. 675-NFPA 70-2023 [Section No. 706.20(C)]

~~**(C)** Spaces About ESS Components.~~

~~**(1)** General.~~

~~Working spaces for ESS shall comply with 110.26 and 110.34 .~~

~~**(2)** Space Between Components.~~

~~ESSs shall be permitted to have space between components in accordance with the manufacturer's instructions and listing.~~

> ~~Informational Note: Additional space may be needed to accommodate ESS hoisting equipment, tray removal, or spill containment.~~

Statement of Problem and Substantiation for Public Input

This is already covered by 90.3 and violates 4.1 of the Style Manual.

Submitter Information Verification

Submitter Full Name:	Ryan Jackson
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Submittal Date:	Thu Apr 20 13:56:16 EDT 2023
Committee:	NEC-P13

Public Input No. 265-NFPA 70-2023 [Section No. 706.20(C)(1)]

~~**(1)** General.~~

~~Working spaces for ESS shall comply with 110.26 and 110.34 .~~

Statement of Problem and Substantiation for Public Input

There is no need to reference the rule in 110.26 as 90.3 says that the rules in Chapters 1 through 4 apply generally throughout the code.

Submitter Information Verification

Submitter Full Name:	Don Ganiere
Organization:	none
Street Address:	
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Submittal Date:	Wed Feb 01 15:24:01 EST 2023
Committee:	NEC-P13

Public Input No. 3031-NFPA 70-2023 [Section No. 706.20(C)(1)]

~~**(1)** General.~~

~~Working spaces for ESS shall comply with 110.26 and 110.34 .~~

Statement of Problem and Substantiation for Public Input

The language in this section is not needed to apply this Code since it only contains pointers.

The 2023 NEC Style Manual 4.1.1 states that the general requirements contained in Chapters 1 through 4 shall not be repeated in other articles. Since the working space requirements are located within Sections 110.26 and 110.34, they are considered as general requirements so the structure in 90.3 should be maintained. As a general requirement, they inherently apply to an ESS installation. Section 706.20(C)(1) does not modify the general working space requirements and therefore appears to conflict with the current NEC Style Manual.

Submitter Information Verification

Submitter Full Name: Larry Sherwood

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Submittal Date: Mon Aug 28 19:42:36 EDT 2023

Committee: NEC-P13

Public Input No. 1377-NFPA 70-2023 [Section No. 706.21]

~~**706.21** Directory (Identification of Power Sources).~~

~~ESS shall be indicated by markings or labels that shall be in accordance with 110.21(B) .~~

~~**(A)** Facilities with Utility Services and ESS.~~

~~Plaques or directories shall be installed in accordance with 705.10 .~~

~~**(B)** Facilities with Stand-Alone Systems.~~

~~Plaques or directories shall be installed in accordance with 710.10 .~~

Statement of Problem and Substantiation for Public Input

The requirements for a power source directory in Section 706.21 are redundant to the requirements in other parts of the code and should be removed.

Submitter Information Verification

Submitter Full Name:	Megan Hayes
Organization:	NEMA
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Jul 11 13:25:43 EDT 2023
Committee:	NEC-P13

Public Input No. 4177-NFPA 70-2023 [Section No. 706.30(A)(3)]

(3) Inverter Input Circuit Current.

The maximum current shall be the rated continuous ~~inverter~~ input current ~~rating when~~ of the inverter. Where the rated current is not provided, the maximum current shall be the calculated continuous inverter input current when the inverter is producing rated power at the lowest input voltage.

Statement of Problem and Substantiation for Public Input

The manufacturer-specified rated continuous input current, where available, should be used to maintain system safety and size components and conductors for actual operating values.
As currently written, the Section requires calculating maximum current based on the lowest operating voltage and rated power as specified by the equipment manufacturer, instead of using a manufacturer rated value, if provided. A calculated value in some cases will be lower than the rated current which could be a safety concern.

The Solar and Storage Industry Forum (SSIF) is a coalition of individuals and organizations convened by the Solar Energy Industry Association (SEIA) to organize, support, and mentor renewable energy industry professionals in codes and standards development. Our objective is to submit industry consensus-based recommendations for changes to the National Electrical Code. We believe that this effort improves the Code-making process by consolidating multiple industry member's points of view into fewer, common proposals.
SSIF members are dedicated to continually improving the installation safety of PV and storage systems in the U.S. A list of members can be found here:
https://www.seia.org/industry-forum

Submitter Information Verification

Submitter Full Name: Evelyn Butler
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Submittal Date: Wed Sep 06 19:34:33 EDT 2023
Committee: NEC-P13

Public Input No. 4250-NFPA 70-2023 [Section No. 706.30(A) [Excluding any Sub-Sections]]

The maximum current for the specific circuit shall be calculated in accordance with 706.30(A)(1) through (A)(5). Calculations shall be permitted to be rounded to the nearest whole ampere, with decimal fractions smaller than 0.5 dropped.

Statement of Problem and Substantiation for Public Input

This language is based on an existing allowance in 220.5(B), which applies to ampere calculations for branch-circuits, feeders, and services. It extends this allowance for rounding to the nearest whole ampere (and dropping decimal fractions smaller than 0.5) to calculations in Articles 690, 705, and 706, making it clear that this allowance is valid for circuits that are defined and named differently than those covered in Article 220.

Currently, there is no standard approach or method outside of inferring that the 220.5(B) applies elsewhere; furthermore, significant digits don't work for current and voltage calculations because of small decimal temperature coefficients. While it may be preferable and more advantageous for this allowance to be in Section 90.9 so as to apply Code-wide, it could instead be addressed in Articles 690, 705, and 706 as proposed here.

The Solar and Storage Industry Forum (SSIF) is a coalition of individuals and organizations convened by the Solar Energy Industry Association (SEIA) to organize, support, and mentor renewable energy industry professionals in codes and standards development. Our objective is to submit industry consensus-based recommendations for changes to the National Electrical Code. We believe that this effort improves the Code-making process by consolidating multiple industry member's points of view into fewer, common proposals.
SSIF members are dedicated to continually improving the installation safety of PV and storage systems in the U.S. A list of members can be found here:
https://www.seia.org/industry-forum

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4246-NFPA 70-2023 [New Section after 690.6]	matching language
Public Input No. 4248-NFPA 70-2023 [Section No. 705.28(A)]	matching language
Public Input No. 4252-NFPA 70-2023 [New Section after 690.4(G)]	

Submitter Information Verification

Submitter Full Name: Evelyn Butler
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Submittal Date: Thu Sep 07 07:43:55 EDT 2023
Committee: NEC-P13

Public Input No. 3032-NFPA 70-2023 [Section No. 706.31(A)]

(A) Circuits and Equipment.

Protection devices for ESS circuits shall be in accordance with 706.31(B) through (F). Circuits shall be protected at the source from overcurrent. A circuit conductor connected at one end to a supply with integral fault protection, where the conductor is rated for the maximum circuit current from that supply, and also connected to sources having an available maximum circuit current greater than the ampacity of the conductor, shall be protected from overcurrent at the point of connection to the higher current source.

~~Informational Note: Listed electronic power converter circuits powered by an ESS have integral fault protection. Where these circuits are connected to higher current sources such as a utility service, the overcurrent device is more appropriately installed at the higher current source end of the circuit conductor.~~

Statement of Problem and Substantiation for Public Input

This IN is not needed to apply this Code and its statements may not be true in all applications.

Submitter Information Verification

Submitter Full Name: Larry Sherwood
Organization: Sustainable Energy Action Comm
Street Address:
City:
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Zip:
Submittal Date: Mon Aug 28 19:44:07 EDT 2023
Committee: NEC-P13

Public Input No. 4145-NFPA 70-2023 [Section No. 706.31(D)]

~~**(D)** Current Limiting.~~

~~A listed and labeled current-limiting overcurrent protective device shall be installed adjacent to the ESS for each dc output circuit.~~

~~*Exception: Where current-limiting overcurrent protection is provided for the dc output circuits of a listed ESS, additional current-limiting overcurrent devices shall not be required.*~~

Statement of Problem and Substantiation for Public Input

This section calls for a current limiting DC fuse. This solution is not available and nor is there a standard and understanding of what a "current limiting" dc overcurrent device is. This public input will remove the section and eliminate the confusion that this requirement brings to applications.

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
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Zip:

Submittal Date: Wed Sep 06 18:42:34 EDT 2023
Committee: NEC-P13

Public Input No. 4016-NFPA 70-2023 [Section No. 706.41]

706.41 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~~ <u>each entry door to the system</u> .

Statement of Problem and Substantiation for Public Input

As currently written, for containerized walk-in systems signage is only visible when inside the system. Having signage outside allows first responders to know what they are dealing with prior to entering the ESS. Some fire codes require signage adjacent to each entry door.

Submitter Information Verification

Submitter Full Name: Steve Edley
Organization: Zinc8 Energy
Affiliation: Zinc8 Energy
Street Address:
City:
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Zip:
Submittal Date: Wed Sep 06 14:04:58 EDT 2023
Committee: NEC-P13

Public Input No. 4019-NFPA 70-2023 [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 Input

Secondary containment is addressed by UL 1973, UL 9540, the fire codes and NFPA 855. This topic is not addressed for other battery technologies in Article 480 or 706. Proposal is to delete 706.42.

Submitter Information Verification

Submitter Full Name: Steve Edley
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Affiliation: Zinc8 Energy
Street Address:
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Submittal Date: Wed Sep 06 14:10:15 EDT 2023
Committee: NEC-P13

Public Input No. 4023-NFPA 70-2023 [Section No. 706.43]

~~**706.43** Flow Controls.~~

~~Controls shall be provided to safely shut down the system in the event of electrolyte blockage.~~

Statement of Problem and Substantiation for Public Input

Propose deleting 706.43 entirely. 706.5 Requires Listing and electrolyte blockage testing is a product listing requirement in UL 1973 Sec C5.3. The AHJ is no position to test or evaluate this type of failure. These tests are conducted in a specialized lab and could be dangerous to attempt in the field with unqualified individuals.

Submitter Information Verification

Submitter Full Name:	Steve Edley
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Submittal Date:	Wed Sep 06 14:16:44 EDT 2023
Committee:	NEC-P13

Public Input No. 4025-NFPA 70-2023 [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 Input

Propose deleting 706.44 entirely. 706.5 Requires Listing and this is a product listing requirement in UL 1973 Sec C2. Testing includes extended duration high temperature electrolyte immersion conditioning followed by specialized tensile strength tests. The AHJ is no position to evaluate or test these materials. These tests are conducted in a specialized lab and could be dangerous to attempt in the field with unqualified individuals.

Submitter Information Verification

Submitter Full Name: Steve Edley

Organization: Zinc8 Energy

Affiliation: Zinc8 Energy

Street Address:

City:

State:

Zip:

Submittal Date: Wed Sep 06 14:19:17 EDT 2023

Committee: NEC-P13

Public Input No. 1607-NFPA 70-2023 [Section No. 706.50]

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*. The systems shall comply with Parts I, II, III, and IV of this article.

Additional Proposed Changes

File Name	Description	Approved
TIA_1597_70_20_14.pdf	NEC TIA 20-14 Log 1597	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 20-14 (Log 1597) issued by the Standards Council on December 8, 2021 and per the NFPA Regs., needs to be reconsidered by the Code-Making Panel for the next edition of the Document.

Substantiation: The reference to Part III of Article 705 is incorrect as there is no Part III in that Article. However, the previous parts of Article 706 apply to these other types of Energy Storage Systems (ESS).

Emergency Nature: The NFPA Standard contains an error or an omission that was overlooked during the regular revision process.

This revision is necessary as the current reference in Section 706.50 is pointing to a non-existent part of Article 705, which could lead to confusion for users of the NEC. Instead, this Section should be pointing to the previous parts of Article 706, which do apply to other types of ESS.

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Submittal Date: Thu Jul 27 11:18:25 EDT 2023

Committee: NEC-P13

Tentative Interim Amendment

NFPA® 70®

National Electrical Code®

2020 Edition

Reference: Section 706.50
TIA 20-14
(SC 21-12-11 / TIA Log #1597)

Pursuant to Section 5 of the NFPA *Regulations Governing the Development of NFPA Standards*, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 70®, *National Electrical Code®*, 2020 edition. The TIA was processed by the Code-Making Panel 13, and the NEC Correlating Committee, and was issued by the Standards Council on December 8, 2021, with an effective date of December 28, 2021.

1. Revise Section 706.50 to read as follows:

> **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~~ The systems shall comply with ~~the applicable provisions of Part III of Article 705~~ Parts I, II, and III of this article.

Issue Date: December 8, 2021

Effective Date: December 28, 2021

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo)

Public Input No. 3822-NFPA 70-2023 [Section No. 706.51]

706.51 Flywheel ESS (FESS).

Flywheel ESS (FESS) using flywheels as the storage mechanism shall also comply with all of the following:

(1) FESS shall not be used for one- or two-family dwelling ~~units.~~

~~Informational Note No. 1: FESS are intended for high-power shorter term applications. They contain parts that rotate under high speed with hazardous kinetic energy and include parts such as magnetic bearings that require ongoing monitoring and maintenance and, therefore, are not suitable for residential-type applications.~~

(2) ~~FESS shall be provided with bearing monitoring and controls that can identify bearing wear or damage to avoid catastrophic failure.~~

~~Informational Note No. 2: The bearing monitoring controls should be evaluated as part of the listing evaluation.~~

(3) ~~FESS shall be provided with a containment means to contain moving parts that could break from the system upon catastrophic failure.~~

~~Informational Note No. 3: The containment means should be evaluated as part of the listing evaluation.~~

~~The~~

(4) units unless the installation is designed by a registered design professional, is approved by the AHJ, and is maintained by a trained service provider when regular maintenance is required.

(5) The spin-down time of the FESS shall be provided in the maintenance documentation.

Statement of Problem and Substantiation for Public Input

The clause 706.51 (1) is very limiting and could unnecessarily stifle technological and commercial development. No other technology in this standard is subject to this limitation. It is not clear why FESS should be disallowed from such installations provided they are designed and operated in a safe manner. It is understood that the existing building codes may not account for ESS installations and that there are concerns about homeowners performing required regular maintenance. Revise the wording to address conditions under which the installation could be allowed.

With respect to the informational note attached to this clause, flywheel energy storage is being used in a wide variety of applications including longer term applications. Some specific longer term applications include EV charging, frequency regulation, and UPS systems. It can be argued that any type of significant energy storage can be hazardous if used incorrectly. All energy storage systems require some level of maintenance and monitoring. It is not fair to single out FESS as being more hazardous than other forms of energy storage.

Clauses 706.51 (2 and 3) as addressed in these sections are design requirements that are already included as part of UL 9540. Section 706.5 states that ESS shall be listed and UL 9540 is the appropriate listing standard. These clauses should be removed in favor of the requirements in UL

9540.

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Public Input No. 2619-NFPA 70-2023 [Section No. 708.2]

708. ~~2~~ 3 Reconditioned Equipment.

Reconditioned transfer switches shall not ~~be permitted~~ be installed .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to comply with the NEC Style Manual Section 2.2.1 regarding reconditioned equipment.
2.2.1 Parallel Numbering Required. Technical committees shall use the following section numbers for the same purposes within articles. This requirement shall not apply to Articles 90, 100, and 110. If the article does not contain listing or reconditioning requirements, the subdivisions shall not be included in the article.
Required Parallel Numbering Format
XXX.1 Scope.
XXX.2 Listing Requirements.
XXX.3 Reconditioned Equipment.
XXX.3(A) Permitted to be Installed.
XXX.3(B) Not Permitted to be Installed.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Public Input No. 3870-NFPA 70-2023 [Section No. 708.4(B)]

(B) Identification of Hazards.

Hazards to be considered at a minimum shall include, but shall not be limited to, the following:

(1) Naturally occurring hazards (geological, meteorological, and biological)

(2) Human-caused events (accidental and intentional)

(3) Hazards that prohibit community internet access.

Statement of Problem and Substantiation for Public Input

The ability of an emergency response entity serving a designated critical operations area depends upon reaching the affected population through the internet; cell-phones specifically. Merchant utilities upload outage maps and information about when power will be restored, for example. Communities served by a regional emergency management organization are more resilient to loss of power; much less resilient when members of the community cannot communicate through the internet. The original inspiration for Article 708 came from Hurricane Katrina in 2005 -- well before the iPhone became the central fixture in every day life as it is now.

I recognize that this proposal means a scope extension not just for this article but a scope extension of the National Electrical Code itself. Broadband service providers will need to invest more outside the classical scope of the NEC (building premise wiring) to supplement the portable base stations (Cell on Wheels). Our nation's finest electrical minds need to contribute more to communication security since loss of power is a more frequent hazard than electrical fires. See related proposal in Article 800.

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Public Input No. 1575-NFPA 70-2023 [Section No. 708.6(D)]

(D) Written Record.

A written record shall be kept of such tests and maintenance <u>and made available to those authorized to design, install, inspect, maintain and operate the system</u> .

Statement of Problem and Substantiation for Public Input

The added language is the same already used in other portions of the code and provides consistency and clarity that this record does not only have to exist somewhere, it must also be easily available to those that may need it.

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Public Input No. 2296-NFPA 70-2023 [Section No. 708.6(D)]

(D) Written Record.

A written record shall be kept of such tests and maintenance <u>and made available to those authorized to design, install, inspect, maintain, and operate the system</u> .

Statement of Problem and Substantiation for Public Input

The proposed new language is the same already used in other portions of the Code. Including it at this location provides consistency and clarity this this record does not only have to exist somewhere, but must
also be readily available to those that may need it.

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Public Input No. 1241-NFPA 70-2023 [Section No. 708.7]

708.7 Cybersecurity.

COPS that are connected to a communication network and have the capability to permit control of any portion of the premises ~~COPS~~ shall comply with either of the following:

(1) The ability to control the system is limited to a direct connection through a local nonnetworked interface.

(2) ~~It~~ The system is connected through a networked interface complying with ~~one~~ both of the following methods:

(3) The system and associated software are identified as being evaluated for cybersecurity.

(4) A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to cyberattacks.

The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals.

Documentation of the evaluation, assessment, identification, and certification shall be made available to those authorized to inspect, operate, and maintain the system.

Informational Note No. 1: See ANSI/ISA 62443, Cybersecurity Standards series; UL 2900, Cybersecurity Standards series; or the NIST Framework for Improving Critical infrastructure Cybersecurity, Version 1.1, for assessment requirements.

Informational Note No. 2: Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

(1) The ISA Security Compliance Institute (ISCI) conformity assessment program

(2) Certification of compliance by a nationally recognized test laboratory

(3) ~~Manufacturer certification for the specific type and brand of system provided~~

(4)

Statement of Problem and Substantiation for Public Input

Existing requirements have no teeth. They allow for the installation to be vulnerable to cyber hacking by simply performing an assessment. That assessment, unfortunately, could actually show the system to be vulnerable to cyber attack. The major change of this Public Input removes that possible vulnerability. It requires a "networked" circuit breaker and associated hardware to be both "identified" for cybersecurity and for an "assessment" to be completed.

Why is it so important to require actual cyber security protection? Because, if the system is not protected, a hacker could easily destroy equipment or shut down the entire facility. A cyber security assessment showing an unprotected system that sits in the plant engineer's desk drawer will not prevent equipment from being destroyed or an unplanned blackout of the entire facility.

The second occurrence of "COPS" is removed from the first sentence for grammar improvement.

"Manufacturer certification" is removed because it is not needed as nationally recognized testing laboratories are available for "commissioning certification" and "identification" of the network connected equipment.

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Public Input No. 3434-NFPA 70-2023 [Section No. 708.7]

708.7 Cybersecurity.

COPS that are connected to a communication network and have the capability to permit control of any portion of the premises COPS shall comply with either of the following:

(1) The ability to control the system is limited to a direct connection through a local nonnetworked interface.

(2) It is connected through a networked interface complying with one of the following methods:

  (3) The system and associated software are identified as being evaluated for cybersecurity.

  (4) A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to cyberattacks.

The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals.

Documentation of the evaluation, assessment, and certification shall be made available to those authorized to inspect, operate, and maintain the system.

Informational Note No. 1: See ANSI/ISA 62443, Cybersecurity Standards series; UL 2900, Cybersecurity Standards series; or the NIST Framework for Improving Critical infrastructure Cybersecurity, Version 1.1, for assessment requirements.

Informational Note No. 2: Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

(1) The ISA Security Compliance Institute (ISCI) conformity assessment program

(2) Certification of compliance by a nationally recognized test laboratory

(3) Manufacturer certification for the specific type and brand of system provided

Informational Note No. 3: See NEMA *CY 10000 Cybersecurity Implementation Guidance for Connected Electrical Infrastructure* , for recommendations on how to meet this requirement.

Statement of Problem and Substantiation for Public Input

The cybersecurity requirements for Critical Operations Power Systems do not currently provide recommendations on how to conduct a risk assessment or certification of these systems for cybersecurity. The NEMA document provides the user with guidance on how to meet these requirements and others.

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Public Input No. 4136-NFPA 70-2023 [Section No. 708.7]

708.7 Cybersecurity.

COPS that are connected to a communication network and have the capability to permit control of any portion of the premises COPS shall comply with either of the following:

(1) The ability to control the system is limited to a direct connection through a local nonnetworked interface.

(2) It is connected through a networked interface complying with one of the following methods:

(3) The system and associated software are identified as being evaluated for cybersecurity.

(4) A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to cyberattacks.

~~The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals.~~

(1)

a. Documentation of the evaluation, assessment, and certification shall be made available to those authorized to inspect, operate, and maintain the system.

Informational Note No. 1: See ANSI/ISA 62443, Cybersecurity Standards series; UL 2900, Cybersecurity Standards series; or the NIST Framework for Improving Critical infrastructure Cybersecurity, Version 1.1, for assessment requirements.

Informational Note No. 2: Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

(1) The ISA Security Compliance Institute (ISCI) conformity assessment program

(2) Certification of compliance by a nationally recognized test laboratory

(3) Manufacturer certification for the specific type and brand of system provided

Informational Note No. 3: Cybersecurity is a specialized field requiring constant, vigilant attention to security vulnerabilities that could arise due to software defects, system configuration changes, or user interactions. Installation of devices that can be secured is an important first step but not sufficient to guarantee a secure system.

Statement of Problem and Substantiation for Public Input

In the 2023 NEC cycle, the task group considered several PCs that sought to make the changes presented in this PI and agreed to the set of changes shown. However, because the panel voted to remove the whole section, the CAM could only reinstate the first draft text. This text has several deficiencies, and this PI brings the section into alignment with 240.6(D).

The deficiencies are:
The requirement "Documentation of the evaluation, assessment, and certification shall be made available to those authorized to inspect, operate, and maintain the system." should follow 708.7 (2) (B) "A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to

cyberattacks." as it only applies when that method of compliance is used. Note Terra may not show this accurately, but that is the intent of this PI.

The requirement "The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals." is actually harmful to cybersecurity. Configuration changes to respond to threats, changes in employee status, published vulnerabilities, and a litany of other conditions are required very frequently, and in some larger connected systems, these changes could occur daily. The NEC should not disincentivize maintaining cybersecurity by imposing the financial burden of a repeat assessment due to a configuration change. Proper cybersecurity hygiene requires a continuous process by which your level of cybersecurity is reevaluated and maintained, and a 5-year interval is woefully deficient. It is also questionable how this would be enforced as the question of access for inspection was not answered when this requirement was adopted.

In closing, I encourage for the purpose of consistency through the code that 708.7 align itself with 240.6(C) by adopting this PI.

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Committee:	NEC-P13

Public Input No. 4461-NFPA 70-2023 [Section No. 708.7]

708.7 Cybersecurity.

Where required by governing laws, codes, or standards, COPS that are connected to a communication network and have the capability to permit control of any portion of the premises COPS shall

~~comply with either of the following:~~

(1) ~~The ability to control the system is limited to a direct connection through a local nonnetworked interface.~~

(2) ~~It is connected through a networked interface complying with one of the following methods:~~

(3) ~~The system and associated software are identified as being evaluated for cybersecurity.~~

(4) ~~A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to cyberattacks.~~

~~The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals.~~

~~Documentation of the evaluation, assessment, and certification shall be made available to those authorized to inspect, operate, and maintain the system.~~

~~Informational Note No. 1: See ANSI/ISA 62443, Cybersecurity Standards series; UL 2900, Cybersecurity Standards series; or the NIST Framework for Improving Critical infrastructure Cybersecurity, Version 1.1, for assessment requirements.~~

~~Informational Note No. 2: Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:~~

(1) ~~The ISA Security Compliance Institute (ISCI) conformity assessment program~~

(2) ~~Certification of compliance by a nationally recognized test laboratory~~

(3) ~~Manufacturer certification for the specific type and brand of system provided~~

address Cybersecurity in the Electrical Maintenance Plan defined in NFPA 70B.

No minimum cybersecurity level shall be required for systems that meet both of the following conditions:

(1) No network connectable equipment

(2) No uploadable software configuration

Statement of Problem and Substantiation for Public Input

NFPA 72 has leapt ahead of the NEC in definition of Cybersecurity requirements and best practices. NFPA 72 has the benefit of being a combined maintenance and installation standard, but the NEC does not have this luxury. All meaningful requirements around Cybersecurity are best addressed, and in many cases, only addressable as a maintenance issue as threats arise long after final inspection of a building. To this end, I will submit public inputs to NFPA 70B in the current cycle to establish a Cybersecurity chapter in line with NFPA 72's 2025 edition.

In support of this, I have proposed in this PI a change to the criteria exempting a device from cybersecurity evaluation to be in line with NFPA 72 and industry best practice. A "local nonnetworked interface" is still prone to cyber attack through malicious software updates applied by personnel physically present at the site, possibly without their knowledge due to breaks in the chain of trust around software update distribution systems. The NFPA 72 language addresses this vulnerability.

I have also proposed elimination of the installation-time requirement for listing or evaluation. The listing and evaluation status of equipment must be reevaluated over time at regular intervals, as described in NFPA 72's 2025 Second Draft. The NEC lacks the purview to enforce this effectively, but NFPA 70B does. Further, with NFPA 70B being elevated from recommendation to standard, it becomes more widely enforceable to address this critical issue.

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Public Input No. 1686-NFPA 70-2023 [New Section after 708.8]

708.9 Qualified Persons.

Critical Operations Power Systems (COPS) and equipment covered by this Article shall be installed by Qualified Persons.

Informational Note: See definition of *Qualified Person* in Article 100.

Statement of Problem and Substantiation for Public Input

Critical Operations Power systems are becoming more complicated and, in most cases, requiring far more training and experience. These systems are often part of essential electrical systems and critical operations power systems requiring a greater degree of training and experience, in design, planning, installation, and programing in many instances. These systems and others require trained qualified personnel and contractors. Qualified contractors, electricians and technicians are a crucial element of safety, related to these installations and systems.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1708-NFPA 70-2023 [New Section after 800.3]	
Public Input No. 1706-NFPA 70-2023 [New Section after 770.3]	
Public Input No. 1701-NFPA 70-2023 [New Section after 760.3]	
Public Input No. 1698-NFPA 70-2023 [New Section after 726.3]	
Public Input No. 1695-NFPA 70-2023 [New Section after 725.3]	
Public Input No. 1694-NFPA 70-2023 [New Section after 724.3]	
Public Input No. 1690-NFPA 70-2023 [New Section after 722.3]	
Public Input No. 1684-NFPA 70-2023 [New Section after 701.7]	
Public Input No. 1672-NFPA 70-2023 [New Section after 700.8]	
Public Input No. 4394-NFPA 70-2023 [New Section after 625.6]	
Public Input No. 1629-NFPA 70-2023 [New Section after 393.6]	
Public Input No. 1557-NFPA 70-2023 [Section No. 90.2(A)]	
Public Input No. 1557-NFPA 70-2023 [Section No. 90.2(A)]	
Public Input No. 1629-NFPA 70-2023 [New Section after 393.6]	
Public Input No. 1672-NFPA 70-2023 [New Section after 700.8]	
Public Input No. 1684-NFPA 70-2023 [New Section after 701.7]	
Public Input No. 1690-NFPA 70-2023 [New Section after 722.3]	
Public Input No. 1694-NFPA 70-2023 [New Section after 724.3]	
Public Input No. 1695-NFPA 70-2023 [New Section after 725.3]	
Public Input No. 1698-NFPA 70-2023 [New Section after 726.3]	
Public Input No. 1701-NFPA 70-2023 [New Section after 760.3]	
Public Input No. 1706-NFPA 70-2023 [New Section after 770.3]	
Public Input No. 1708-NFPA 70-2023 [New Section after 800.3]	
Public Input No. 4394-NFPA 70-2023 [New Section after 625.6]	

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Public Input No. 1032-NFPA 70-2023 [Section No. 708.10(A)]

(A) Identification.

(1) Boxes and Enclosures.

In a building or at a structure where a critical operations power system and any other type of power system are present, all boxes and enclosures (including transfer switches, generators, and power panels) for critical operations power system circuits shall be permanently marked in BLUE so they will be readily identified as a component of the critical operations power system.

(2) Receptacle Identification.

In a building in which COPS are present with other types of power systems described in other sections in this article, the cover plates for the receptacles or the receptacles themselves supplied from the COPS shall ~~have a distinctive color~~ Blue in color or marking so as to be readily identifiable. Nonlocking-type, 125-volt, 15- and 20-ampere receptacles supplied from the COPS shall have an illuminated face or an indicator light to indicate that there is power to the receptacle.

Exception: If the COPS supplies power to a DCOA that is a stand-alone building, receptacle cover plates or the receptacles themselves shall not be required to have distinctive marking.

Statement of Problem and Substantiation for Public Input

Article 708 (COP) wiring must be color coded in blue so other non-related electrical can not be connect to the 708 system.
Having this in the NEC will allow code update changes every 3 years to address this color requirement.

Submitter Information Verification

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Committee: NEC-P13

Public Input No. 3794-NFPA 70-2023 [Section No. 708.10(C)(1)]

(1) Protection Against Physical Damage.

The wiring of the COPS system shall be protected against physical damage. Only the following wiring methods shall be permitted:

(1) Rigid metal conduit, intermediate metal conduit, Type MI, or non-interlocked Type ~~MI~~ MC cable.

(2) Where encased in not less than 50 mm (2 in.) of concrete, any of the following wiring methods shall be permitted:

 (3) Schedule 40 or Schedule 80 rigid polyvinyl chloride conduit (PVC)

 (4) Reinforced thermosetting resin conduit (RTRC)

 (5) Electrical metallic tubing (EMT)

 (6) Flexible nonmetallic or jacketed metallic raceways

 (7) Jacketed metallic cable assemblies listed for installation in concrete

(8) Where provisions must be made for flexibility at equipment connection, one or more of the following shall also be permitted:

 (9) Flexible metal fittings

 (10) Flexible metal conduit with listed fittings

 (11) Liquidtight flexible metal conduit with listed fittings

Statement of Problem and Substantiation for Public Input

Type MC cables are listed by passing UL 1569 requirements, which require crush resistance and impact testing for all cables: 1000 lbf minimum on 14 AWG conductors, and 2000 lbf minimum on 2 AWG conductors; impact is tested by dropping a 10 lb steel block on 14 AWG conductors and 50 lbs. steel block on 2 AWG conductor.

Additionally, non-interlocked Type MC cable is not subject to separation of the interlocking armor sections.

For MI cable, there is only an optional crush test on the UL standard that supports type MI cable (UL 504) for the jacketed version. There is only an optional impact test in UL 504 for impact at -40C temperature. Additionally, the UL 504 crushing requirement is only 1000 lbf and it does not specify conductor size, it is optional and only applicable to jacketed cables. The UL 504 requirement for impact test is also optional and only available for the jacketed cables, lacking impact weight criteria.

Based on equitable and impartial standards requirements, Type MC cables are subject to a higher level of crush and impact testing than MI cable, which is already allowed in this application. Therefore, it is proposed that Type MC cables be permitted in this application.

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Submittal Date:	Tue Sep 05 16:35:42 EDT 2023
Committee:	NEC-P13

Public Input No. 3716-NFPA 70-2023 [Section No. 708.10(C)(2)]

(2) Fire Protection for Feeders.

Feeders shall meet one of the following conditions:

(1) The cable or raceway is protected by a listed electrical circuit protective system with a minimum 2-hour fire rating.

Informational Note No. 1: See UL 1724, *Fire Tests for Electrical Circuit Protective Systems*, for one method of defining an electrical circuit protective system, by establishing a rating when tested. UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain a minimum 2-hour fire resistive rating.

(2) The cable or raceway is a listed fire-resistive cable system with a minimum 2-hour fire rating.

Informational Note No. 2: See UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*, for testing requirements for fire-resistive cables.

Informational Note No. 3: The listing organization provides information for fire-resistive cable systems on proper installation requirements to maintain the fire rating.

(3) The cable or raceway is protected by a listed fire-rated assembly that has a minimum fire rating of 2 hours.

(4) The cable or raceway is encased in a minimum of ~~50 mm (2 in.) of concrete~~ <u>127 mm (5 inches) of concrete and 200 °C (392 °F) rated conductors are used [limited to the ampacity of 194 °F (90 °C)] with properly rated conduit</u> .

Statement of Problem and Substantiation for Public Input

The NFPA Research Foundation published a report titled 'Fire Resistance of Concrete for Electrical Conductors' in December 2018 to provide insight to the National Electrical Code regarding concrete encasement meant to protect electrical conductors from the effects of fire.

Simply allowing concrete encasement for 2-hour fire protection as its currently written does not appear to hold the same level of scrutiny as those required for the remaining protection options as explained below:

1) The criteria to select concrete for thermal protection are either:
a. End-point heat transmission acceptance criterion of ASTM E119 limiting the temperature rise of the non-exposed concrete surface to an average of 250 F considering all measuring points or a maximum of 325 F at any single point.
b. End-point integrity acceptance criterion of ASTM E119 that prohibits the passage of flame or gases hot enough to ignite cotton waste within the selected test period.

2) Assuming that the NEC permits concrete encasement to provide 2-hour fire protection based on the end-point heat transmission acceptance criterion of item 1) a. above, as temperature of the unexposed surface could be used to relate to the ambient temperature that the conductors will be exposed to:
a. 250 °F (121.1 °C) average and 325 °F single point (162.8 °C) are higher than the rating of many conductor types listed in the NEC, and these are just the rise in temperature above the initial ambient temperature. NFPA 70 Article 310.14 (3) states that "No conductor shall be used in such a manner that its operating temperature exceeds that designated for the type of insulated conductor involved."

b. Besides the high ambient temperature inside concrete encasement in the event of a fire, the conductors will also heat up from the internal heat generated by resistance during power transmission and they will not be able to dissipate this heat into the surrounding ambient. In a fire event, the temperature of the conductors could become higher than the temperatures found in the concrete encased environment, due to the sum of these effects.

c. Most NEC conductor types would be outside their rated temperature if used in these conditions, thus infringing NFPA 70 Article 310.14 (3).

3) Concrete thickness required to provide 2-hour protection based on end-point heat transmission is up to 5” depending on the type of aggregate used. The ‘Fire Resistance of Concrete for Electrical Conductors’ cites several sources of information where this data can be found. Of notice is ACI 216.1-07 entitled ‘Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies’ by the American Concrete Institute, where tables and graphs clearly demonstrate how concrete thicknesses vary from 3.6 inches to 5 inches to provide 2-hours of protection where the temperature rise. Using only 2 inches of concrete would cause an increase of 250 °F above the initial temperature in less than 1-hour for most concrete types, based on figure 2.3 of the ACU document mentioned above. The only 2-inches thick concrete type that is able to limit the temperature rise of 250 °F above ambient for 1-hour is insulating concrete, and again, only for 1-hour.

In light of the presented concerns, it is evident that relying on 2 inches of concrete or even increasing to 5 inches, may not adequately ensure the thermal protection required to safeguard conductors during a 2-hour fire. Such an approach risks exposing conductors to temperatures far beyond their ratings and contravenes NEC safety standards.

Another proposal has been made to modify Article 230.6, where service conductors encased in 2-inches thick concrete are considered to be outside of the building. The proposed modification will clarify that that 2-inches of concrete grants mechanical protection only; fire-resistance is unrelated to this mechanical only consideration as seen in the arguments presented here that 2-inches of concrete may not provide adequate thermal protection to maintain the conductors’ insulation temperature within their rated range.

Therefore, it is important that concrete encasement be reevaluated as an option for providing 2-hour fire protection for conductors. This proposal underscores the need for a more comprehensive and safety-conscious approach to address this critical issue within the electrical code.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3688-NFPA 70-2023 [Section No. 695.6(A)(2)]	same topic

Submitter Information Verification

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Committee:	NEC-P13

Public Input No. 3433-NFPA 70-2023 [Section No. 708.20(D)]

(D) Surge Protection ~~Devices~~ .

Surge ~~protection~~ -protective devices (SPDs) shall be provided at all ~~facility distribution voltage levels~~ sources of power supplying COPS .

Statement of Problem and Substantiation for Public Input

This public input makes editorial revisions to the section to add clarity and enforceability. The title of section is changed to “surge protection” and “surge protection device” is replaced with “surge-protective device (SPDs)” as this is the defined and correct name of the surge protection method required by this rule. There is some confusion in the field as to what constitutes “all facility distribution voltage levels” so this language is replaced with “all sources of power supplying COPS” to align the rule with the title of section 708.20 and to ensure surge protection is being provided to protect COPS from all sources of power regardless of the source or supply voltage.

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Committee: NEC-P13

Public Input No. 2943-NFPA 70-2023 [Section No. 708.20(H)]

(H) Fuel Cell System.

Installation of a fuel cell system shall meet the requirements of Article 692, Parts II through VI ~~of Article 692~~ .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Submitter Information Verification

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Submittal Date: Mon Aug 28 12:33:32 EDT 2023
Committee: NEC-P13

Public Input No. 1332-NFPA 70-2023 [Section No. 708.22(A)]

(A) Capacity and Rating.

A COPS shall have capacity and rating for all loads to be operated simultaneously for continuous operation with variable load for an unlimited number of hours, except for required maintenance of the power source. A portable, temporary, or redundant alternate power source shall be available for use whenever the COPS power source is out of service for maintenance or ~~repair~~ servicing .

Statement of Problem and Substantiation for Public Input

Servicing is a defined term and includes repairs. Using a defined term adds more clarity and helps avoid confusion between activities that are deemed as servicing and those that are deemed as reconditioning.

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Submittal Date: Sat Jul 08 11:51:50 EDT 2023

Committee: NEC-P13

Public Input No. 3290-NFPA 70-2023 [Section No. 708.24]

708.24 Transfer Equipment.

(A) General.

Transfer equipment, including automatic transfer switches, shall be automatic, listed, and identified for emergency use. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and critical operations 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 Parts I and II of Article 705.

(B)

Bypass Isolation Maintenance of Transfer Switches.

The COPS system shall include a bypass isolation transfer switch to facilitate maintenance as required in 708.6(C) without jeopardizing continuity of power. If the bypass isolation transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair. ~~**Means shall be permitted to bypass and isolate the transfer equipment.**~~

~~**If**~~

If bypass

~~**isolation transfer**~~

~~**(D)** Redundant Transfer Equipment.~~

~~**If COPS loads are supplied by a single feeder, the COPS shall include redundant transfer equipment or a bypass isolation transfer switch to facilitate maintenance as required in 708.6(C)**~~

isolation transfer switches are used, inadvertent parallel operation shall be avoided.

~~**(C)** Automatic Transfer Switches.~~

~~**If used with sources that are not inherently synchronized, automatic transfer switches shall comply with the following:**~~

~~**(1) Automatic transfer switches shall be listed for emergency use.**~~

~~**(2) Automatic transfer switches shall be electrically operated and mechanically held.**~~

Exception No. 1:

The requirement for a bypass isolation transfer switch shall not apply where any of the following conditions exist:

(1) ***All processes that rely on the COPS source are capable of being disabled during maintenance or repair activities without jeopardizing the COPS.***

(2) ***Other temporary means are available to be substituted for the COPS system.***

(3) ***A written emergency plan that includes mitigation actions and responsibilities for qualified persons to address the recognized site hazards for the duration of the maintenance or repair activities shall be developed and implemented. The emergency plan shall be made available to the authority having jurisdiction.***

Exception No. 2:

Redundant transfer switches may be used in lieu of a bypass isolation transfer switch when all of the following conditions exist:

(1) ***The redundant transfer switches are provided with interlocking to prevent inadvertent parallel operation.***

(1) ***Means are provided to completely isolate each transfer switch to facilitate maintenance of the transfer switch without jeopardizing continuity of power.***

(1) ***If the redundant transfer***

~~**equipment or bypass isolation transfer**~~

(1) ***switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair.***

(

~~**E)**~~

C) Automatic Transfer Switches.

If used with sources that are not inherently synchronized, automatic transfer switches shall comply with the following:

(1) Automatic transfer switches shall be listed for emergency use.

(2) Automatic transfer switches shall be electrically operated and mechanically held.

(D) Use.

Transfer equipment shall supply only COPS loads.

(

~~**F**~~

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.

Additional Proposed Changes

File Name	Description	Approved
2023-08-30_proposed_PI_for_708.24_submitted_to_Terraview.docx	I have uploaded a copy of my word document just in case the Terraview version is too difficult to understand	

Statement of Problem and Substantiation for Public Input

Rationale:

Proper maintenance of transfer equipment in emergency systems is critical. The revisions to 708.24(D) in the 2023 NEC was intended to make provisions for safe maintenance without jeopardizing continuity of power, but only applies when the emergency loads are supplied by a single feeder.

There may be cases where the emergency loads are separated, with some loads supplied by one feeder, and other loads supplied by a second feeder. As currently written 708.24(D) does applies only to COPS loads supplied by a single feeder. In reality, every emergency transfer switch must be maintained, and the provisions for safe maintenance apply regardless of how many feeders are used in an emergency system. This PI ensures this by requiring a bypass isolation transfer switch for all transfer equipment, regardless of the number of feeders in the emergency system. This is accomplished by combining 708.24(B) and 708.24(D). While 708.24(B) is currently a permissive statement, there is no situation where a bypass isolation transfer switch is not required unless provided with redundant transfer switches as discussed below.

The allowance for redundant transfer switches was added during the second draft of 2023 Code cycle, but is missing some critical information. The use of redundant transfer switches alone does not facilitate the safe maintenance of the emergency power system, as there is no way to connect two transfer switches together that would allow safe maintenance of one transfer switch while the other is supplying power to the load. Using only redundant transfer switches, the switch being serviced can not be completely isolated from whichever source is providing power to the load. This is true whether the switches are connected in series or in parallel.

Furthermore, using redundant transfer switches without interlocking between the transfer switches could result in inadvertent paralleling of the normal and emergency sources. Rather than remove the allowance for redundant transfer switches, this PI allows the use of redundant switches an alternative to the bypass isolation transfer switch, and includes the requirements needed to facilitate safe maintenance when a bypass isolation transfer switch is not used.

The proposed combination of 708.24(B) and 708.24(D) results in text that correlates with proposed revisions to 700.5, with the exception that item (2) of Exception number 1 (regarding fire protection systems) has not been included in 708.24(B).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3289-NFPA 70-2023 [Section No. 701.5(B)]	similar revisions regarding bypass/isolation and redundant transfer switches

Submitter Information Verification

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Committee:	NEC-P13

708.24 Transfer Equipment.

(A) General.

Transfer equipment, including automatic transfer switches, shall be automatic, listed, and identified for emergency use. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and critical operations 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 Parts I and II of Article **705**.

(B) ~~Bypass Isolation~~ Maintenance of Transfer Switches.
The COPS system shall include a bypass isolation transfer switch to facilitate maintenance as required in 708.6(C) without jeopardizing continuity of power. If the bypass isolation transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair. ~~Means shall be permitted to bypass and isolate the transfer equipment.~~ If bypass isolation transfer switches are used, inadvertent parallel operation shall be avoided.

Exception No. 1:
The requirement for a bypass isolation transfer switch shall not apply where any of the following conditions exist:

(1) *All processes that rely on the COPS source are capable of being disabled during maintenance or repair activities without jeopardizing the COPS.*
(2) *Other temporary means are available to be substituted for the COPS system.*
(3) *A written emergency plan that includes mitigation actions and responsibilities for qualified persons to address the recognized site hazards for the duration of the maintenance or repair activities shall be developed and implemented. The emergency plan shall be made available to the authority having jurisdiction.*

Exception No. 2:
Redundant transfer switches may be used in lieu of a bypass isolation transfer switch when all of the following conditions exist:

(1) *The redundant transfer switches are provided with interlocking to prevent inadvertent parallel operation.*

(2) *Means are provided to completely isolate each transfer switch to facilitate maintenance of the transfer switch without jeopardizing continuity of power.*

(3) *If the redundant transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair.*

(C) Automatic Transfer Switches.
If used with sources that are not inherently synchronized, automatic transfer switches shall comply with the following:

- (1) Automatic transfer switches shall be listed for emergency use.
- (2) Automatic transfer switches shall be electrically operated and mechanically held.

~~**(D) Redundant Transfer Equipment.**~~
~~If COPS loads are supplied by a single feeder, the COPS shall include redundant transfer equipment or a bypass isolation transfer switch to facilitate maintenance as required in **708.6(C)** without jeopardizing continuity of power. If the redundant transfer equipment or bypass isolation transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair.~~

(~~E~~D) Use.
Transfer equipment shall supply only COPS loads.

(~~F~~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.

Rationale:

Proper maintenance of transfer equipment in emergency systems is critical. The revisions to 708.24(D) in the 2023 NEC was intended to make provisions for safe maintenance without jeopardizing continuity of power, but only applies when the emergency loads are supplied by a single feeder.

There may be cases where the emergency loads are separated, with some loads supplied by one feeder, and other loads supplied by a second feeder. As currently written 708.24(D) does applies only to COPS loads supplied by a single feeder. In reality, every emergency transfer switch must be maintained, and the provisions for safe maintenance apply regardless of how many feeders are used in an emergency system. This PI ensures this by requiring a bypass isolation transfer switch for all transfer equipment, regardless of the number of feeders in the emergency system. This is accomplished by combining 708.24(B) and 708.24(D). While 708.24(B) is currently a permissive statement, there is no situation where a bypass isolation transfer switch is not required unless provided with redundant transfer switches as discussed below.

The allowance for redundant transfer switches was added during the second draft of 2023 Code cycle, but is missing some critical information. The use of redundant transfer switches alone does not facilitate the safe maintenance of the emergency power system, as there is no way to connect two transfer switches together that would allow safe maintenance of one transfer switch while the other is supplying power to the load. Using only redundant transfer switches, the switch being serviced can not be completely isolated from whichever source is providing power to the load. This is true whether the switches are connected in series or in parallel.

Furthermore, using redundant transfer switches without interlocking between the transfer switches could result in inadvertent paralleling of the normal and emergency sources. Rather than remove the allowance for redundant transfer switches, this PI allows the use of redundant switches an alternative to the bypass isolation transfer switch, and includes the requirements needed to facilitate safe maintenance when a bypass isolation transfer switch is not used.

The proposed combination of 708.24(B) and 708.24(D) results in text that correlates with proposed revisions to 700.5, with the exception that item (2) of Exception number 1 (regarding fire protection systems) has not been included in 708.24(B).

Public Input No. 2944-NFPA 70-2023 [Section No. 708.24(A)]

(A) General.

Transfer equipment, including automatic transfer switches, shall be automatic, listed, and identified for emergency use. Transfer equipment shall be designed and installed to prevent the inadvertent interconnection of normal and critical operations 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 <u>Article 705,</u> Parts I and II ~~of Article 705~~ .

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document. The text is revised to to comply with the NEC Style Manual Section 4.1.4, regarding the use of Parts.
4.1.4 References to an Entire Article. References shall not be made to an entire article, except for the Article 100 or where referenced to provide the necessary context. References to specific parts within articles shall be permitted. References to all parts of an article shall not be permitted. The article number shall precede the part number.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

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Committee: NEC-P13

Public Input No. 1333-NFPA 70-2023 [Section No. 708.24(D)]

(D) Redundant Transfer Equipment.

If COPS loads are supplied by a single feeder, the COPS shall include redundant transfer equipment or a bypass isolation transfer switch to facilitate maintenance as required in 708.6(C) without jeopardizing continuity of power. If the redundant transfer equipment or bypass isolation transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or ~~repair~~ servicing .

Statement of Problem and Substantiation for Public Input

Servicing is a defined term and includes repairs. Using a defined term adds more clarity and helps avoid confusion between activities that are deemed as servicing and those that are deemed as reconditioning.

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Committee: NEC-P13

Public Input No. 3436-NFPA 70-2023 [Section No. 708.24(D)]

(D) Redundant Transfer Equipment.

If COPS loads are supplied by a single feeder, the COPS shall include redundant transfer equipment or a bypass isolation transfer switch to facilitate maintenance as required in 708.6(C) without jeopardizing continuity of power. If the redundant transfer equipment or bypass isolation transfer switch is manual (or nonautomatic), then it shall be actively supervised by a qualified person when the primary (automatic) transfer equipment is disabled for maintenance or repair. Where redundant transfer equipment is used, inadvertent parallel operation shall be prevented.

Statement of Problem and Substantiation for Public Input

As currently worded in the Code, redundant transfer equipment could be as simple as two transfer switches connected in parallel. The Code does not require any additional isolation devices between the two to prevent inadvertent parallel operation. Parallel operation could result in damage to one or both sources and loss of power to the emergency loads. The proposed additional sentence requires that appropriate additional equipment be provided to prevent inadvertent parallel operation.

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Committee:	NEC-P13

Public Input No. 3775-NFPA 70-2023 [Section No. 708.52(A)]

(A) Applicability.

The requirements of 708.52 shall apply to critical operations (including multiple occupancy buildings) with critical operation areas.

(1) For fused disconnects, where the available fault current is 10,000 amperes or greater, the ground-fault protection provisions of Section 210.13, 215.10, 230.95, and 240.13 shall not apply if the fuses have a clearing time of 0.07 seconds or less at the lower of the calculated minimum available arcing current or 38% of the available fault current, or if the disconnect switch complies with Section 240.67(B)(1), 240.67(B)(3), or 240.67(B)(4) and is set to operate at the lower of the calculated minimum arcing current or 38% of the available fault current.

(2) For circuit breakers, where the available fault current is 10,000 amperes or greater, the ground-fault protection provisions of Section 210.13, 215.10, 230.95, and 240.13shall not apply if the circuit breaker complies with Section 240.87(B)(2), 240.87(B)(4), 240.87(B)(5), or 240.87(B)(6), and is set to operate at the lower of the calculated minimum arcing current or 38% of the available fault current.

Additional Proposed Changes

File Name	Description	Approved
PC_312_CMP_13.pdf	NEC_PC312	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as “Reject but Hold” in Public Comment No. 312 of the (A2022) Second Draft Report for NFPA 70 and per the Regs. at 4.4.8.3.1.

This Public Comment utilizes the concepts raised in Public Inputs 693, 694, 695, and 696 to provide an alternate to the GFPE requirements required elsewhere in this Code. (Because the concepts were raised
in the Public Input stage, they are not considered “new material”). When these alternate methods are utilized, it provides the consulting engineer with significantly more design options to meet the selective coordination requirements of 708.54. This becomes especially important now, because it appears that GFPE will be required at 800 amperes and above, rather than 1000 amperes and above, making selective
coordination even more challenging for the consulting engineer.

The following is the substantiation provided for the Public Comments to add exceptions to 210.13, 215.10,
230.95, and 240.13. It provides the technical background necessary to implement the changes to 708.52.

"A sincere “Thank You” goes to Code Making Panels 2 and 10 for discovering the flaw with Public Inputs
693, 694, 695, and 696. The Panels stated: “Substantiation was not provided to support the equivalency
of alternate technologies. As an example, it is possible that alternate systems could be set such that they
might provide arc energy reduction, but not operate during a lower level ground fault where traditional GFPE will provide protection.” To rectify this flaw, this Public Comment has added the requirement that the methods to reduce clearing time operate at the lower of the calculated minimum arcing current or 38%

of the available fault current. While an arcing fault from phase to ground is almost certainly going to escalate into a three phase arcing fault, it is possible that the arcing fault could remain as a phase to ground arcing fault. When this occurs, it has been shown, in numerous IEEE papers, that the minimum phase to ground arcing fault, on a 480/277 volt, solidly grounded system, must be at least 38% of the available fault current in order to sustain the arc. With this requirement added in, it is assured that the method to reduce clearing time will function to clear the circuit.
In addition to this requirement, and to add even more conservatism, this Public Comment has added a minimum available fault current of 10,000 amperes to the proposed requirement. Based on a 32mm spacing, 480 volts, and HCB configuration, IEEE 1584-2018 calculates the minimum arcing current to be
6.09 kA for an available (bolted) fault current of 10,000 amperes. The minimum arcing current of 6.09 KA
is 5 times the maximum 1200 ampere setting and 2 times the 3000 ampere value used with the one second maximum delay. (NEC 230.95(A) allows for a maximum setting of 1200 amperes and a maximum
time delay of 1 second at 3000 amperes or greater.) The 6.09 KA current for 60 cycles produces an expected equipment damage level of 36,540 KW-Cycles (6.09KA X 100 arcing volts X 60 cycles). In contrast, this Public Comment would provide a worst case, expected equipment damage level of only 4,263 KW-Cycles. Yes, that is correct, the proposed exception would allow less than 12% of the damage
level allowed by the existing 230.95(A) requirements.

The following paragraphs provide a detailed comparison of expected equipment damage levels allowed by
230.95(A), proposed exceptions for fusible switches (240.67), and proposed exceptions for circuit breakers (240.87).
Expected Equipment Damage from 230.95(A)
For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 10kA, the IEEE
1584-2018 arcing current is 7.07kA with a minimum arcing current of 6.09kA. Using the maximum 230.95(A) opening time of 60 cycles, the expected equipment damage is 36,540 kW-cycles.
For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 25kA, the IEEE
1584-2018 arcing current is 17.64kA with a minimum arcing current of 15.21kA. Using the maximum 230.95(A) opening time of 60 cycles, the expected equipment damage is 91,260 kW-cycles.
For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 50kA, the IEEE
1584-2018 arcing current is 30.14kA with a minimum arcing current of 25.98kA. Using the maximum 230.95(A) opening time of 60 cycles, the expected equipment damage is 155,880 kW-cycles.
Expected Equipment Damage from Proposed Exceptions for Fusible Switches (240.67)
For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 10kA, the IEEE
1584-2018 arcing current is 7.07kA with a minimum arcing current of 6.09kA. Assuming an opening time
of 4 cycles for 240.67(B), the expected equipment damage is 2,436 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) or (B)(3), the expected equipment damage is 4,263 kW-cycles.
Assuming an opening time of 1/2 cycle for 240.67(B)(4), the expected equipment damage is 305 kWcycles.
Worst case damage (4,263 kW-cycles) is less than 12% of the damage allowed by 230.95(A) (36,540 kW-cycles).

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 25kA, the IEEE
1584-2018 arcing current is 17.64kA with a minimum arcing current of 15.21kA. Assuming an opening time of 4 cycles for 240.67(B), the expected equipment damage is 6,084 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) or (B)(3), the expected equipment damage is 10,647 kW-cycles.
Assuming an opening time of 1/2 cycle for 240.67(B)(4), the expected equipment damage is 761 kWcycles.
Worst case damage (10,647 kW-cycles) is less than 12% of the damage allowed by 230.95(A) (91,260 kW-cycles).

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 50kA, the IEEE
1584-2018 arcing current is 30.14kA with a minimum arcing current of 25.98kA. Assuming an opening time of 4 cycles for 240.67(B), the expected equipment damage is 10,392 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) or (B)(3), the expected equipment damage is 18,186 kW-cycles.
Assuming an opening time of 1/2 cycle for 240.67(B)(4), the expected equipment damage is 1,299 kWcycles.
Worst case damage (18,186 kW-cycles) is less than 12% of the damage allowed by 230.95(A) (155,880 kW-cycles)
Expected Equipment Damage from Proposed Exceptions for Circuit Breakers (240.87)
For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 10kA, the IEEE
1584-2018 arcing current is 7.07kA with a minimum arcing current of 6.09kA. Assuming an opening time
of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the expected equipment damage is 2,436 kW-cycles.
Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the expected equipment damage is 1,827 kW-cycles. Worst case damage (2,426 KW-Cycles) is less than 7% of the damage allowed by 230.95(A) (36,540 kW-cycles).

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 25kA, the IEEE
1584-2018 arcing current is 17.64kA with a minimum arcing current of 15.21kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the expected equipment damage is 6,084 kW-cycles.
Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the expected equipment damage is 4,563 kW-cycles. Worst case damage (6,084 kW-Cycles) is less than 7% of the damage allowed by 230.95(A) (91,260 kW-cycles).

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 50kA, the IEEE
1584-2018 arcing current is 30.14kA with a minimum arcing current of 25.98kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the expected equipment damage is 10,392 kW-cycles.
Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the expected equipment damage is 7,794 kW-cycles. Worst case damage (10,392 KW-Cycles) is less than 7% of the damage allowed by 230.95(A) (155,880 kW-cycles).
Other Change from Public Input Stage
The other change that is made from the original Public Input is that the text lists the methods that can be
used rather than the methods that cannot be used.
Background from Public Input Stage
A requirement (230.95) for ground fault protection of equipment (GFPE) was added to the 1971 NEC® because 480/277 volt, solidly grounded wye services, protected by 1000 ampere and larger overcurrent
protective devices, were burning down due to arcing faults. 208/120 volt services and those services protected by smaller overcurrent protective devices were not burning down, so they weren't included in the new requirement. Over many Code cycles, GFPE requirements were also added for branch circuits (210.13), feeders (215.10), and equipment (240.13). In all cases, the intent was to limit damage to the switchboard, switchgear, panelboard or equipment, not the downstream conductors or busway.
The electrical industry has evolved considerably since those early GFPE requirements were introduced.
IEEE 1584 now predicts the magnitude of the arcing current along with the incident energy to which a worker could be exposed while working on energized equipment. It has become clearly evident that the
level of protection necessary to protect an employee is orders of magnitude greater than that required to
protect equipment.

Energy reducing maintenance switches (240.67(B)(2) and 240.87(B)(3)) are excluded because energyreducing

maintenance switches are typically turned off when a worker is not working on energized equipment, whereas ground fault protection is constantly protecting the equipment, whether or not a worker is working on the energized equipment.
The Approved Equivalent Means (240.67(B)(5) and 240.87(B)(7)) are excluded because the opening times for these methods are unknown at this time.
Key Benefit
One very key benefit of this Public Comment is that when these alternate methods are utilized, it provides
the consulting engineer with significantly more design options to meet the selective coordination requirements of 700.32, 701.32, and 708.54. This becomes especially important now, because it appears
that GFPE will be required at 800 amperes and above, rather than 1000 amperes and above, making selective coordination even more challenging for the consulting engineer.
Conclusion
This Public Comment takes advantage of the arc-energy reduction requirements found in 240.67 and 240.87. It provides an exception for GFPE requirements whenever specific 240.67 and 240.87 methods to
reduce clearing time are utilized. The methods to reduce clearing time will limit the arcing fault damage to
the equipment to a level that is considerably less than currently allowed by the requirements found in 230.95(A)."

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Committee:	NEC-P13

Public Comment No. 312-NFPA 70-2021 [Section No. 708.52(A)]

(A) Applicability.

The requirements of 708.52 shall apply to critical operations (including multiple occupancy buildings) with critical operation areas.

(1) For fused disconnects, where the available fault current is 10,000 amperes or greater, the ground-fault protection provisions of Section 210.13, 215.10, 230.95, and 240.13 shall not apply if the fuses have a clearing time of 0.07 seconds or less at the lower of the calculated minimum available arcing current or 38% of the available fault current, or if the disconnect switch complies with Section 240.67(B)(1), 240.67(B)(3), or 240.67(B)(4) and is set to operate at the lower of the calculated minimum arcing current or 38% of the available fault current.

(2) For circuit breakers, where the available fault current is 10,000 amperes or greater, the ground-fault protection provisions of Section 210.13, 215.10, 230.95, and 240.13shall not apply if the circuit breaker complies with Section 240.87(B)(2), 240.87(B)(4), 240.87(B)(5), or 240.87(B)(6), and is set to operate at the lower of the calculated minimum arcing current or 38% of the available fault current.

Statement of Problem and Substantiation for Public Comment

This Public Comment utilizes the concepts raised in Public Inputs 693, 694, 695, and 696 to provide an alternate to the GFPE requirements required elsewhere in this Code. (Because the concepts were raised in the Public Input stage, they are not considered “new material”). When these alternate methods are utilized, it provides the consulting engineer with significantly more design options to meet the selective coordination requirements of 708.54. This becomes especially important now, because it appears that GFPE will be required at 800 amperes and above, rather than 1000 amperes and above, making selective coordination even more challenging for the consulting engineer.

The following is the substantiation provided for the Public Comments to add exceptions to 210.13, 215.10, 230.95, and 240.13. It provides the technical background necessary to implement the changes to 708.52.

"A sincere “Thank You” goes to Code Making Panels 2 and 10 for discovering the flaw with Public Inputs 693, 694, 695, and 696. The Panels stated: “Substantiation was not provided to support the equivalency of alternate technologies. As an example, it is possible that alternate systems could be set such that they might provide arc energy reduction, but not operate during a lower level ground fault where traditional GFPE will provide protection.” To rectify this flaw, this Public Comment has added the requirement that the methods to reduce clearing time operate at the lower of the calculated minimum arcing current or 38% of the available fault current. While an arcing fault from phase to ground is almost certainly going to escalate into a three phase arcing fault, it is possible that the arcing fault could remain as a phase to ground arcing fault. When this occurs, it has been shown, in numerous IEEE papers, that the minimum phase to ground arcing fault, on a 480/277 volt, solidly grounded system, must be at least 38% of the available fault current in order to sustain the arc. With this requirement added in, it is assured that the method to reduce clearing time will function to clear the circuit.
In addition to this requirement, and to add even more conservatism, this Public Comment has added a minimum available fault current of 10,000 amperes to the proposed requirement. Based on a 32mm spacing, 480 volts, and HCB configuration, IEEE 1584-2018 calculates the minimum arcing current to be 6.09 kA for an available (bolted) fault current of 10,000 amperes. The minimum arcing current of 6.09 KA is 5 times the maximum 1200 ampere setting and 2 times the 3000 ampere value used with the one second maximum delay. (NEC 230.95(A) allows for a maximum setting of 1200 amperes and a maximum time delay of 1 second at 3000 amperes or greater.) The 6.09 KA current for 60 cycles produces an expected equipment damage level of 36,540 KW-Cycles (6.09KA X 100 arcing volts X 60 cycles). In contrast, this Public Comment would provide a worst case, expected equipment damage level of only 4,263 KW-Cycles. Yes, that is correct, the proposed exception would allow less than 12% of the damage level allowed by the existing 230.95(A) requirements.

The following paragraphs provide a detailed comparison of expected equipment damage levels allowed by 230.95(A), proposed exceptions for fusible switches (240.67), and proposed exceptions for circuit breakers (240.87).

Expected Equipment Damage from 230.95(A)

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 10kA, the IEEE 1584-2018 arcing current is 7.07kA with a minimum arcing current of 6.09kA. Using the maximum 230.95(A) opening time of 60 cycles, the expected equipment damage is 36,540 kW-cycles.

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 25kA, the IEEE 1584-2018 arcing current is 17.64kA with a minimum arcing current of 15.21kA. Using the maximum 230.95(A) opening time of 60 cycles, the expected equipment damage is 91,260 kW-cycles.

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 50kA, the IEEE 1584-2018 arcing current is 30.14kA with a minimum arcing current of 25.98kA. Using the maximum 230.95(A) opening time of 60 cycles, the expected equipment damage is 155,880 kW-cycles.

Expected Equipment Damage from Proposed Exceptions for Fusible Switches (240.67)

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 10kA, the IEEE 1584-2018 arcing current is 7.07kA with a minimum arcing current of 6.09kA. Assuming an opening time of 4 cycles for 240.67(B), the expected equipment damage is 2,436 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) or (B)(3), the expected equipment damage is 4,263 kW-cycles. Assuming an opening time of 1/2 cycle for 240.67(B)(4), the expected equipment damage is 305 kW-cycles. Worst case damage (4,263 kW-cycles) is less than 12% of the damage allowed by 230.95(A) (36,540 kW-cycles).

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 25kA, the IEEE 1584-2018 arcing current is 17.64kA with a minimum arcing current of 15.21kA. Assuming an opening time of 4 cycles for 240.67(B), the expected equipment damage is 6,084 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) or (B)(3), the expected equipment damage is 10,647 kW-cycles. Assuming an opening time of 1/2 cycle for 240.67(B)(4), the expected equipment damage is 761 kW-cycles. Worst case damage (10,647 kW-cycles) is less than 12% of the damage allowed by 230.95(A) (91,260 kW-cycles).

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 50kA, the IEEE 1584-2018 arcing current is 30.14kA with a minimum arcing current of 25.98kA. Assuming an opening time of 4 cycles for 240.67(B), the expected equipment damage is 10,392 kW-cycles. Assuming an opening time of 7 cycles for 240.67(B)(1) or (B)(3), the expected equipment damage is 18,186 kW-cycles. Assuming an opening time of 1/2 cycle for 240.67(B)(4), the expected equipment damage is 1,299 kW-cycles. Worst case damage (18,186 kW-cycles) is less than 12% of the damage allowed by 230.95(A) (155,880 kW-cycles)

Expected Equipment Damage from Proposed Exceptions for Circuit Breakers (240.87)

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 10kA, the IEEE 1584-2018 arcing current is 7.07kA with a minimum arcing current of 6.09kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the expected equipment damage is 2,436 kW-cycles. Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the expected equipment damage is 1,827 kW-cycles. Worst case damage (2,426 KW-Cycles) is less than 7% of the damage allowed by 230.95(A) (36,540 kW-cycles).

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 25kA, the IEEE 1584-2018 arcing current is 17.64kA with a minimum arcing current of 15.21kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the expected equipment damage is 6,084 kW-cycles. Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the expected equipment damage is 4,563 kW-cycles. Worst case damage (6,084 kW-Cycles) is less than 7% of the damage allowed by 230.95(A) (91,260 kW-cycles).

For a 32mm spacing, 480 volts, and HCB configuration, and an available fault current of 50kA, the IEEE 1584-2018 arcing current is 30.14kA with a minimum arcing current of 25.98kA. Assuming an opening time of 4 cycles for 240.87(B)(1), (B)(2), or (B)(4), the expected equipment damage is 10,392 kW-cycles. Assuming an opening time of 3 cycles for 240.87(B)(5) or (B)(6), the expected equipment damage is 7,794 kW-cycles. Worst case damage (10,392 KW-Cycles) is less than 7% of the damage allowed by 230.95(A) (155,880 kW-cycles).

Other Change from Public Input Stage

The other change that is made from the original Public Input is that the text lists the methods that can be used rather than the methods that cannot be used.

Background from Public Input Stage

A requirement (230.95) for ground fault protection of equipment (GFPE) was added to the 1971 NEC® because 480/277 volt, solidly grounded wye services, protected by 1000 ampere and larger overcurrent protective devices, were burning down due to arcing faults. 208/120 volt services and those services protected by smaller overcurrent protective devices were not burning down, so they weren't included in the new requirement. Over many Code cycles, GFPE requirements were also added for branch circuits (210.13), feeders (215.10), and equipment (240.13). In all cases, the intent was to limit damage to the switchboard, switchgear, panelboard or equipment, not the downstream conductors or busway.

The electrical industry has evolved considerably since those early GFPE requirements were introduced. IEEE 1584 now predicts the magnitude of the arcing current along with the incident energy to which a worker could be exposed while working on energized equipment. It has become clearly evident that the level of protection necessary to protect an employee is orders of magnitude greater than that required to protect equipment.

Energy reducing maintenance switches (240.67(B)(2) and 240.87(B)(3)) are excluded because energy-reducing maintenance switches are typically turned off when a worker is not working on energized equipment, whereas ground fault protection is constantly protecting the equipment, whether or not a worker is working on the energized equipment.

The Approved Equivalent Means (240.67(B)(5) and 240.87(B)(7)) are excluded because the opening times for these methods are unknown at this time.

Key Benefit

One very key benefit of this Public Comment is that when these alternate methods are utilized, it provides the consulting engineer with significantly more design options to meet the selective coordination requirements of 700.32, 701.32, and 708.54. This becomes especially important now, because it appears that GFPE will be required at 800 amperes and above, rather than 1000 amperes and above, making selective coordination even more challenging for the consulting engineer.

Conclusion

This Public Comment takes advantage of the arc-energy reduction requirements found in 240.67 and 240.87. It provides an exception for GFPE requirements whenever specific 240.67 and 240.87 methods to reduce clearing time are utilized. The methods to reduce clearing time will limit the arcing fault damage to the equipment to a level that is considerably less than currently allowed by the requirements found in 230.95(A)."

Related Item

• PI 693 • PI 694 • PI 695 • PI 696

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Committee: NEC-P13

Committee Statement

Committee Action: Rejected but held

Resolution: This would be new material submitted to Panel 13 at the Second Draft stage. Before adding it to Article 708, Panel 13 would like to see how it is handled by Panel 2 and Panel 10 to coordinate the actions. The Panel requests that the submitter provide access to the research documentation that was referenced in the substantiation.

Public Input No. 4513-NFPA 70-2023 [Section No. 708.54(A)]

(A) General.

Critical operations power system(s) overcurrent protective devices (OCPDs) shall be selectively coordinated with all supply-side and load-side ~~OCPDs.~~ OCPDs for the period of time that a fault's duration extends beyond 0.1 second .

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.

Statement of Problem and Substantiation for Public Input

In 2012, NFPA 99 the Technical Committee on Electrical System realized this issue and stated that 4.4.2.1.2.1 Selective Coordination – Overcurrent devices serving the essential electrical systems shall be selectively coordinated down to 0.1 second. This then became part of the National Electrical Code in Article 517.31(G) stating that "Coordination. Overcurrent protective devices serving the essential electrical system shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second."
Health care is a critical system that deemed this to be a safer way to proceed with their electrical systems.

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Public Input No. 4054-NFPA 70-2023 [Section No. 708.54(B)]

(B) Replacements.

Where critical operations power system(s) OCPDs <u>or normal system OCPDs that supply critical operations power system load(s)</u> are replaced, they shall be reevaluated to ensure selective coordination <u>of the critical operations power system(s)</u> is maintained with all supply-side and load-side OCPDs.

Statement of Problem and Substantiation for Public Input

Selective coordination is vital to ensure the reliability of critical operations power systems (COPS), which are important to life and public safety. The NEC, in including 708.54(B) and (C), has established that it is important that selective coordination be maintained throughout the life of the system. Selective coordination is achieved and verified based on the specific OCPDs and their ratings and settings at the time of installation. Since selective coordination applies to all supply-side and load-side OCPDs, the OCPDs in the normal system that supply the COPS are included in this evaluation. Therefore, if one of the OCPDs in the normal system supplying the COPS is replaced, it will directly affect whether the system remains selectively coordinated. The Code language, as written, does not address this potential problem. Therefore, to close this gap in the language, and maintain selective coordination through the life of the system, selective coordination should also be re-evaluated after OCPDs supplying the COPS are replaced.

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Committee: NEC-P13

Public Input No. 4059-NFPA 70-2023 [Section No. 708.54(C)]

(C) Modifications.

If modifications, additions, or deletions to the critical operations power system(s) or the normal system supplying the critical operations power system load(s) occur, selective coordination of the critical operations power system(s) OCPDs with all supply-side and load-side OCPDs shall be reevaluated.

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.

Informational Note: See Informational Note Figure 708.54(C) for an example of how critical operations power system OCPDs selectively coordinate with all supply-side OCPDs.

OCPD D selectively coordinates with OCPDs C, F, E, B, and A.

OCPD C selectively coordinates with OCPDs F, E, B, and A.

OCPD F selectively coordinates with OCPD E.

OCPD B is not required to selectively coordinate with OCPD A because OCPD B is not a critical operations power system OCPD.

Figure Informational Note Figure 708.54(C) Critical Operations Power System Selective Coordination.

Statement of Problem and Substantiation for Public Input

The NEC, in including 700.54(B) and (C), has established that it is important that selective coordination be maintained throughout the life of the critical operations power system.
Selective coordination is achieved and verified based on the equipment and the available fault current at the time of installation. Modifications to the normal system supplying the COPS including transformers or conductor lengths, may result in changes to the available fault currents throughout the COPS, which directly affects whether the system remains selectively coordinated. The Code language, as written, does not address this potential problem. Therefore, to close this gap in the language, and maintain selective coordination through the life of the system, selective coordination should be re-evaluated after changes are made to the normal system supplying the COPS. This is consistent with similar requirements that exist in 110.24(B).

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Public Input No. 4291-NFPA 70-2023 [Article 750]

Article 750 Energy Management Systems

Part I. General

750.1 Scope.

This article applies to the installation and operation of energy management systems.

Informational Note: Performance provisions in other codes may establish prescriptive requirements ~~that may further restrict~~ in addition to the requirements contained in this article.

750.

~~6~~

2 Listing Requirements .

Energy management equipment and systems shall be

~~one of the following:~~

- ~~Listed as a complete energy management system~~
- ~~Listed as a kit for field installation in switch or overcurrent device enclosures~~

~~Listed individual components assembled as a system~~

listed as follows:

(1) Energy management equipment utilized to switch loads shall be listed.

(2) Energy management systems with overload control (EMS-OC) for loads, sources, or both, shall be listed for the purpose and marked "EMS-OC".

Informational Note: Evaluations of energy management systems with overload control (EMS-OC) are different than evaluations of energy management equipment. See UL 916, Energy Management Equipment, for more information on listed energy management equipment, and UL 3141, Energy Management Systems for Overload Control, for information on listed EMS-OC.

750.20 Alternate Power Sources.

An energy management system shall not override any control necessary to ensure continuity of an alternate power source for the following:

(1) Fire pumps

(2) Health care facilities

(3) Emergency systems

(4) Legally required standby systems

(5) Critical operations power systems

750.30 Load Management.

Energy management systems shall be permitted to monitor and control electrical loads and sources in accordance with 750.30(A) through (C).

(A) Load Shedding Controls.

An energy management system shall not override the load shedding controls put in place to ensure the minimum electrical capacity for the following:

(1) Fire pumps

(2) Emergency systems

(3) Legally required standby systems

(4) Critical operations power systems

(B) Disconnection of Power.

An energy management system shall not cause disconnection of power to the following:

(1) Elevators, escalators, moving walks, or stairway lift chairs

(2) Positive mechanical ventilation for hazardous (classified) locations

(3) Ventilation used to exhaust hazardous gas or reclassify an area

(4) Circuits supplying emergency lighting

(5) Essential electrical systems in health care facilities

(C) Capacity of Branch Circuit, Feeder, or Service.

An energy management system shall not cause a branch circuit, feeder, or service to be overloaded.

~~If an EMS is used to limit the current on a conductor, 750.30(C)(1) through (C)(4) shall apply:~~

~~**(1)** Current Setpoint.~~

~~A single value equal to the maximum ampere setpoint of the EMS shall be permitted for one or more of the following:~~

~~(1) For calculating the connected load per 220.70~~

~~(2) For the maximum source current permitted by EMS control~~

~~**(2)** System Malfunction.~~

~~The EMS shall use monitoring and controls to automatically cease current flow upon malfunction of the EMS.~~

~~(3)~~

Part II. EMS with Overload Control (EMS-OC).

750.100 General.

Part II contains additional requirements for energy management systems which provide controls to prevent the overloading of conductors and equipment.

750.120 Conductors and Equipment.

(A) Monitoring and Controls.

The EMS-OC shall include monitoring and automatic control equipment to prevent overload of conductors and equipment.

(B) Documentation.

A list of the EMS-OC monitoring and control equipment and associated settings which perform the overload control functions shall be documented and readily available.

Informational Note: Listed EMS-OC may include specific hardware and software components that are detailed in the listing information.

(C) Malfunction.

The EMS-OC shall transition to a state that prevents overload in response to a failure or malfunction.

Informational Note: Examples of failure or malfunction are operating conditions where the control system is not able to achieve or maintain the desired setpoint value. Equipment failure, delayed response, or the loss of control or feedback elements are common causes of system malfunction.

750.140 Current Setpoint.

(A) Current Setpoint.

The EMS-OC shall be capable of being set to a current setpoint for each controlled conductor, controlled source, or controlled load.

Informational Note: Current setpoints may be used for calculating the connected load(s) and or source(s). See 220.70 for application of an EMS-OC used in load calculations.

(B) Settings.

Adjustable settings shall be permitted if access to the settings is

~~accomplished Located behind~~

limited by at least one of the following:

- ~~Located behind removable and sealable covers over the adjustment means~~
- ~~Located behind a cover or door that requires the use of a tool to open~~

1. Located behing locked doors accessible only to qualified personnel

- ~~Password protected with password accessible only to qualified personnel~~

2. Software that has password protected access to the adjusting means accessible to qualified personnel only

~~(4)~~

3. Hardware such as dip switches located behind locked doors or areas requiring a tool for accress

Exception: Adjustable trip circuit breakers with restricited access, as allowed in 240.6(C) or 240.6(D), shall be permitted.

(C) Marking.

The equipment that supplies the branch circuit, feeder, or service shall be field marked with the following information:

- ~~Maximum current setting~~

1. Current setpoint(s)

2. Date of calculation

~~and setting~~

, implemented settings, and identification of qualified personnel determining the settings

3. Identification of loads and sources

~~associated with the current limiting feature~~

managed by the EMS overload control

4. The following or equivalent wording: "The

~~setting for the EMS current limiting feature shall not be bypassed~~

current setpoint(s) shall only be changed by a qualified person "

The markings shall meet the requirements in 110.21(B) and shall be located such that they are clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

750.

~~50~~

160 Directory.

Where

~~an energy management system is employed to control electrical power through the use of a remote means~~

the EMS-OC is not located within sight of the overcurrent device(s) , a directory identifying the

~~controlled~~

control device(s) and circuit(s) shall be posted on the enclosure of the

~~controller~~

control device(s) , disconnect, or branch-circuit overcurrent protective device.

Additional Proposed Changes

File Name	Description	Approved
Article_750_Final.docx		
750_rationale.docx		

Statement of Problem and Substantiation for Public Input

This public input is part of a series of changes submitted on behalf of a task group appointed by the NEC Correlating Committee. This task group was appointed to clarify the requirements for energy management systems that include controls to prevent the overload of conductors and equipment. The members of the task group are Derrick Atkins, Greg Ball, Doug Burket, Mark Cook, Jason Fisher, Matthew Grover, Rebekah Hren, Pete Jackson, Robert Jordan, Robert Osborne, Charles Picard, Laura Stevens, Tim Windey, Timothy Zgonena.

In the 2023 NEC Cycle the requirements for EMS were consolidated from across the code into Article 750. Since this action was taken in the second draft stage, the article structure, technical changes, and revisions to clarify the requirements which apply to systems which comply with 220.70 could not be completed. This public input seeks to structure the article into two parts where the general requirements that apply to all systems are located in Part I and the additional requirements which apply to EMS with overload control in Part II.

The informational note in Section 750.1 was revised to clarify that requirements in other codes may be additions instead of restrictions.

The listing requirements are moved to 750.2 in accordance with the NEC Style Manual with clarifications to the list items. Energy management equipment may be used in general systems covered in Part I or as a component within a Part II system. The listing requirement is added to ensure the device is suitable for the application. Part II EMS which include overload control require a system listing for this purpose and marked accordingly to differentiate from EMS without overload control. A companion public input to align Section 220.70 was submitted. The informational note is added to provide users with the product standards which may be referenced for further details on these products and systems.

Section 750.20 Alternate Power Sources is retained without modification.

Section 750.30 (A) and 750.30(B) are retained without modification.

Section 750.30(C) retained the first sentence with the remainder being moved and clarified in the new Part II.

Section 750.50 is moved into Part II, Section 750.160 with revisions applicable to EMS which include overload control. The phrase “through the use of a remote means” is removed to include the requirement for any installation where the EMS is not within sight of the overcurrent devices. The directory requirement for Part I EMS systems was removed since it is unnecessary for systems which do not provide overload control.

Part II is titled EMS with Overload Control (EMS-OC) to provide specific requirements for these systems.

Section 750.120(A) requires that EMS with overload control include monitoring and automatic control to prevent overloading of conductors and equipment.

Section 750.120(B) adds documentation requirements to ensure the equipment information and settings associated with the EMS are readily available.

Section 750.120(C) is based on the existing requirement in 750.30(C)(2) System Malfunction. The revision addresses systems that can prevent overloading without a complete cessation of current flow. An informational note was added which provides common causes and examples of system malfunction.

Section 750.140(A) Current Setpoint is based on existing Section 750.30(C)(1) but was revised for clarity. The term “maximum” was removed since the system design will be based on a defined setpoint which must comply with the restricted setting access requirements. The existing 750.30(C)(1)(1) was moved into an informational note to eliminate redundancy in requirements.

Section 750.140(B) Settings is based on existing Section 750.30(C)(3). The requirements are reorganized and consolidated for clarity. Access to hardware settings is also included to address systems with this capability. An exception was added to permit the existing restricted access requirements in 240.6(C) and 240.6(D) for circuit breakers.

Section 750.140(C) Marking is based on existing Section 750.30(C)(4) but is revised to align with other revisions to the article and provide additional clarity. The identification of qualified personnel determining the settings was added to address complex systems requiring expertise in EMS-OC systems.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4302-NFPA 70-2023 [Section No. 220.70]	

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Committee:	NEC-P13

Article 750 Energy Management Systems

Part I. General

750.1 Scope.

This article applies to the installation and operation of energy management systems.

Informational Note: Performance provisions in other codes may establish prescriptive requirements ~~that may further restrict~~ in addition to the requirements contained in this article.

750.2 Listing Requirements.

Energy management equipment and systems shall be listed as follows:

(1) Energy management equipment utilized to switch loads shall be listed.
(2) Energy management systems with overload control (EMS-OC) for loads, sources, or both, shall be listed for the purpose and marked “EMS-OC”.

Informational Note: Evaluations of energy management systems with overload control (EMS-OC) are different than evaluations of energy management equipment. See UL 916, Energy Management Equipment, for information on listed energy management equipment, and UL 3141, Energy Management Systems for Overload Control, for information on listed EMS-OC.

~~750.6 Listing.~~

~~Energy management systems shall be one of the following:~~

~~(1)Listed as a complete energy management system~~
~~(2)Listed as a kit for field installation in switch or overcurrent device enclosures~~
~~(3)Listed individual components assembled as a system~~

750.20 Alternate Power Sources.

An energy management system shall not override any control necessary to ensure continuity of an alternate power source for the following:

(1) Fire pumps
(2) Health care facilities
(3) Emergency systems
(4) Legally required standby systems
(5) Critical operations power systems

750.30 Load Management.

Energy management systems shall be permitted to monitor and control electrical loads and sources in accordance with 750.30(A) through (C).

(A) Load Shedding Controls.

An energy management system shall not override the load shedding controls put in place to ensure the minimum electrical capacity for the following:

(1) Fire pumps
(2) Emergency systems
(3) Legally required standby systems
(4) Critical operations power systems

(B) Disconnection of Power.

An energy management system shall not cause disconnection of power to the following:

(1) Elevators, escalators, moving walks, or stairway lift chairs

(2) Positive mechanical ventilation for hazardous (classified) locations
(3) Ventilation used to exhaust hazardous gas or reclassify an area
(4) Circuits supplying emergency lighting
(5) Essential electrical systems in health care facilities

(C) Capacity of Branch Circuit, Feeder, or Service.

An energy management system shall not cause a branch circuit, feeder, or service to be overloaded ~~at any time~~. ~~If an EMS is used to limit the current on a conductor, 750.30(C)(1) through (C)(4) shall apply:~~

~~**(1) Current Setpoint.**~~

~~A single value equal to the maximum ampere setpoint of the EMS shall be permitted for one or more of the following:~~

~~(1)For calculating the connected load per 220.70~~
~~(2)For the maximum source current permitted by EMS control~~

~~**(2) System Malfunction.**~~

~~The EMS shall use monitoring and controls to automatically cease current flow upon malfunction of the EMS.~~

~~**(3) Settings.**~~

~~Adjustable settings shall be permitted if access to the settings is accomplished by at least one of the following:~~

~~(1)Located behind removable and sealable covers over the adjustment means~~
~~(2)Located behind a cover or door that requires the use of a tool to open~~

(3) ~~Located behind locked doors accessible only to qualified personnel~~
(4) ~~Password protected with password accessible only to qualified personnel~~
(5) ~~Software that has password protected access to the adjusting means accessible to qualified personnel only~~

~~(4) Marking.~~

~~The equipment that supplies the branch circuit, feeder, or service shall be field marked with the following information:~~

(1) ~~Maximum current setting~~
(2) ~~Date of calculation and setting~~
(3) ~~Identification of loads and sources associated with the current limiting feature~~
(4) ~~The following or equivalent wording: "The setting for the EMS current limiting feature shall not be bypassed"~~

~~The markings shall meet the requirements in 110.21(B) and shall be located such that they are clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.~~

~~750.50 Directory~~

~~Where an energy management system is employed to control electrical power through the use of a remote means, a directory identifying the controlled device(s) and circuit(s) shall be posted on the enclosure of the controller, disconnect, or branch-circuit overcurrent device~~

Part II. EMS with Overload Control (EMS-OC).

750.100 General

Part II contains additional requirements for energy management systems which provide controls to prevent the overloading of conductors and equipment.

750.120 Conductors and Equipment.

(A) Monitoring and Controls.

The EMS-OC shall include monitoring and automatic control equipment to prevent overload of conductors and equipment.

(B) Documentation.

A list of the EMS-OC monitoring and control equipment and associated settings which perform the overload control functions shall be documented and readily available.

Informational Note: Listed EMS-OC may include specific hardware and software components that are detailed in the listing information.

(C) Malfunction.

The EMS-OC shall transition to a state that prevents overload in response to failure or malfunction.

Informational Note: Examples of failure or malfunction are operating conditions where the control system is not able to achieve or maintain the desired setpoint value. Equipment failure, delayed response, or the loss of control or feedback elements are common causes of system malfunction.

750.140 Current Setpoint

(A) Current Setpoint.

The EMS-OC shall be capable of being set to a current setpoint for each controlled conductor, controlled source, or controlled load.

Informational Note: Current setpoints may be used for calculating the connected load(s) and or source(s). See 220.70 for application of an EMS-OC setpoint used in load calculations.

(B) Settings.

Adjustable settings shall be permitted if access to the settings is limited by at least one of the following:

1. Located behind locked doors accessible only to qualified personnel
2. Software that has password protected access to the adjusting means accessible to qualified personnel only
3. Hardware such as dip switches located behind locked doors or areas requiring a tool for access

Exception: Adjustable trip circuit breakers with restricted access, as allowed in 240.6(C) or 240.6(D), shall be permitted.

(C) Marking.

The equipment that supplies the branch circuit, feeder, or service shall be field marked with the following information:

(1) Current setpoint(s)

(2) Date of calculation, implemented settings, and identification of qualified personnel determining the settings

(3) Identification of loads and sources managed by the EMS overload control

(4) The following or equivalent wording: “The current setpoint(s) shall only be changed by a qualified person”

The markings shall meet the requirements in 110.21(B) and shall be located such that they are clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

750.160 Directory.

Where the EMS-OC is not located within sight of the overcurrent device(s), a directory identifying the control device(s) and circuit(s) shall be posted on the enclosure of the control device(s), disconnect, or branch-circuit overcurrent device.

Substantiation:
This public input is part of a series of changes submitted on behalf of a task group appointed by the NEC Correlating Committee. This task group was appointed to clarify the requirements for energy management systems that include controls to prevent the overload of conductors and equipment. The members of the task group are Derrick Atkins, Greg Ball, Doug Burket, Mark Cook, Jason Fisher, Matthew Grover, Rebekah Hren, Pete Jackson, Robert Jordan, Robert Osborne, Charles Picard, Laura Stevens, Tim Windey, Timothy Zgonena.

In the 2023 NEC Cycle the requirements for EMS were consolidated from across the code into Article 750. Since this action was taken in the second draft stage, the article structure, technical changes, and revisions to clarify the requirements which apply to systems which comply with 220.70 could not be completed. This public input seeks to structure the article into two parts where the general requirements that apply to all systems are located in Part I and the additional requirements which apply to EMS with overload control in Part II. The informational note in Section 750.1 was revised to clarify that requirements in other codes may be additions instead of restrictions.

The listing requirements are moved to 750.2 in accordance with the NEC Style Manual with clarifications to the list items. Energy management equipment may be used in general systems covered in Part I or as a component within a Part II system. The listing requirement is added to ensure the device is suitable for the application. Part II EMS which include overload control require a system listing for this purpose and marked accordingly to differentiate from EMS without overload control. A companion public input to align Section 220.70 was submitted. The informational note is added to provide users with the product standards which may be referenced for further details on these products and systems.

Section 750.20 Alternate Power Sources is retained without modification.

Section 750.30 (A) and 750.30(B) are retained without modification.

Section 750.30(C) retained the first sentence with the remainder being moved and clarified in the new Part II. The phrase “at any time” was removed to align with the use of a current setpoint within the EMS controls.

Section 750.50 is moved into Part II, Section 750.160 with revisions applicable to EMS which include overload control. The phrase “through the use of a remote means” is removed to include the requirement for any installation where the EMS is not within sight of the overcurrent devices. The directory requirement for Part I EMS systems was removed since it is unnecessary for systems which do not provide overload control.

Part II is titled EMS with Overload Control (EMS-OC) to provide specific requirements for these systems.

Section 750.120(A) requires that EMS with overload control include monitoring and automatic control to prevent overloading of conductors and equipment.

Section 750.120(B) adds documentation requirements to ensure the equipment information and settings associated with the EMS are readily available.

Section 750.120(C) is based on the existing requirement in 750.30(C)(2) System Malfunction. The revision addresses systems that can prevent overloading without a complete cessation of current flow. An informational note was added which provides common causes and examples of system malfunction.

Section 750.140(A) Current Setpoint is based on existing Section 750.30(C)(1) but was revised for clarity. The term “maximum” was removed since the system design will be based on a defined setpoint which must comply with the restricted setting access requirements. The existing 750.30(C)(1)(1) was moved into an informational note to eliminate redundancy in requirements.

Section 750.140(B) Settings is based on existing Section 750.30(C)(3). The requirements are reorganized and consolidated for clarity. Access to hardware settings is also included to address systems with this capability. An exception was added to permit the existing restricted access requirements in 240.6(C) and 240.6(D) for circuit breakers.

Section 750.140(C) Marking is based on existing Section 750.30(C)(4) but is revised to align with other revisions to the article and provide additional clarity. The identification of qualified personnel determining the settings was added to address complex systems requiring expertise in EMS-OC systems.

Public Input No. 2856-NFPA 70-2023 [New Section after 750.1]

750.2 Listing Requirements.

Energy management systems shall be one of the following:

(1) Listed as a complete energy management system

(2) Listed as a kit for field installation in switch or overcurrent device enclosures

(3) Listed individual components assembled as a system

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document when general listing requirements are covered within an article. The NEC Style Manual Section 2.2.1 Parallel Numbering Required, states that technical committees shall use the following section numbers for the same purposes within articles. The listing requirements are to be located in the .2 section.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2857-NFPA 70-2023 [Section No. 750.6]	Deleted and relocated to the .2 section.
Public Input No. 2857-NFPA 70-2023 [Section No. 750.6]	

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Public Input No. 1811-NFPA 70-2023 [Section No. 750.6]

750.6 Listing.

Energy management systems shall be one of the following:

(1) Listed as a complete energy management system

(2) Listed as a kit for field installation in switch ~~or~~ , control device, or overcurrent device enclosures

(3) Listed ~~individual components~~ equipment assembled as a system

Statement of Problem and Substantiation for Public Input

Per NEC Style Manual 4.2.1, 4.2.2.1, and 4.2.2.1.1, if Article 750 requires listing, Annex A Table A.1(a) shall identify the number and title of the related product safety standard. See also NEC Supplemental Operating Procedures, and Regs. FYI, UL tends to use IEC/UL 60730-1 or UL 916, but see UL PAZY.GuideInfo, PAZX, or ODCF2 to confirm. Presumably the intent of the three variants are intended to align with the three categories noted. A kit could be installed in a switch, overcurrent, relay, contactor, or control cabinet, but adding "control" should be adequate. Components don't generally have a listing, but equipment does, and we suspect that is what was intended. Equipment is a defined term and used in the UL standards and Annex A. The 2023 NEC Style Manual was adopted by the NEC Correlating Committee in Apr 2023 and is the required editorial sytle.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1752-NFPA 70-2023 [Section No. 625.1]	Article 625 listed product standards in informational notes, but shouldn't have.
Public Input No. 1754-NFPA 70-2023 [Section No. 625.6]	Listing requirement linked to incomplete list of product standards, and extra product standards it shouldn't list in both Tables A.1(a) and A.1(b).

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Public Input No. 2857-NFPA 70-2023 [Section No. 750.6]

~~**750.6** Listing.~~

~~Energy management systems shall be one of the following:~~

(1) ~~Listed as a complete energy management system~~

(2) ~~Listed as a kit for field installation in switch or overcurrent device enclosures~~

(3) ~~Listed individual components assembled as a system~~

Statement of Problem and Substantiation for Public Input

This Public Input is being submitted on behalf of the NEC Correlating Committee Usability Task Group in order to provide correlation throughout the document when general listing requirements are covered within an article. The NEC Style Manual Section 2.2.1 Parallel Numbering Required, states that technical committees shall use the following section numbers for the same purposes within articles. The listing requirements are to be located in the .2 section.
The Usability Task Group members are: Derrick Atkins, David Hittinger, Richard Holub, Dean Hunter, Chad Kennedy and David Williams.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2856-NFPA 70-2023 [New Section after 750.1]	Deleted and relocated to the .2 section.
Public Input No. 2856-NFPA 70-2023 [New Section after 750.1]	

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Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]

750.6 Listing.

Energy management systems shall be one of the following:

(1) Listed as a complete energy management system

(2) Listed as a kit for field installation in switch or overcurrent device enclosures

(3) Listed individual components assembled as a system

(4) <u>Listed as Power Circuit Management (PCM) if required by this Code to be Power Circuit Management.</u>

Statement of Problem and Substantiation for Public Input

Activities, such as the electrification of the transportation sector and replacement of gas-fired appliance with all electric appliances, coupled with widespread adoption of on-site storage and generation, will place significant new demands on the premises wiring systems covered by the NEC. These activities are complicated by the need to facilitate this shift in energy generation, storage, and use, with an existing (and aging) infrastructure.

An emerging trend is to leverage the technology offered by "Energy Management Systems" to manage these complex electrical systems in a way that prevents overloading of the premises wiring system. These types of systems require functional reliability in order to prevent overloading of the premises wiring, as well as utility owned assets serving the facility. Energy management systems (EMS) historically have not been evaluated for functional reliability to address electrical overload.

While other PI's may address this need for a more robust "Energy Management System", this must co-exist with the realization that there is still a place for the traditional Energy Management devices that are not being relied upon for these functions and should not be mandated to meet functional safety requirements.

Recognizing that these existing products will continue to exist in the marketplace, a new term is needed to differentiate between the historic EMS application of energy optimization for appliance control versus electrical overload and/or grid interconnection applications where safety is paramount. With this in mind, this PI focuses on introducing the term Power Circuit Management (PCM) where functional reliability has been applied.

This PI utilizes the new term that is proposed in a Related PI (refer to "Related PI's") to mark the distinction between "Energy Management" and "PCM". As described above, the requirement for this section should reflect the more robust requirements for "PCM".

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling "q".]	Related due to addition of new PCM definition / term
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	Related due to addition of new PCM definition / term
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	Related due to addition of new PCM definition / term
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	Related due to addition of new PCM definition / term

Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	Related due to addition of new PCM definition / term
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	Related due to addition of new PCM definition / term
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	Related due to addition of new PCM definition / term
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	Related due to addition of new PCM definition / term
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	Related due to addition of new PCM definition / term
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling “q”.]	
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	
Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]	
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	

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Public Input No. 4335-NFPA 70-2023 [Section No. 750.30]

750.30 Load Management.

~~Energy management systems~~ Power Circuit Management (PCM) shall be permitted to monitor and control electrical loads and sources in accordance with 750.30(A) through (C).

(A) Load Shedding Controls.

~~An energy management system~~ PCM shall not override the load shedding controls put in place to ensure the minimum electrical capacity for the following:

(1) Fire pumps

(2) Emergency systems

(3) Legally required standby systems

(4) Critical operations power systems

(B) Disconnection of Power.

~~An energy management system~~ PCM shall not cause disconnection of power to the following:

(1) Elevators, escalators, moving walks, or stairway lift chairs

(2) Positive mechanical ventilation for hazardous (classified) locations

(3) Ventilation used to exhaust hazardous gas or reclassify an area

(4) Circuits supplying emergency lighting

(5) Essential electrical systems in health care facilities

(C) Capacity of Branch Circuit, Feeder, or Service.

~~An energy management system~~ PCM shall not cause a branch circuit, feeder, or service to be overloaded. If ~~an EMS~~ PCM is used to limit the current on a conductor, 750.30(C)(1) through (C)(4) shall apply:

(1) Current Setpoint.

A single value equal to the maximum ampere setpoint of ~~the EMS~~ PCM shall be permitted for one or more of the following:

(1) For calculating the connected load per 220.70

(2) For the maximum source current permitted by ~~EMS~~ PCM control

(2) System Malfunction.

~~The EMS~~ PCM shall use monitoring and controls to automatically cease current flow upon malfunction of the ~~EMS~~ PCM .

(3) Settings.

Adjustable settings shall be permitted if access to the settings is accomplished by at least one of the following:

(1) Located behind removable and sealable covers over the adjustment means

(2) Located behind a cover or door that requires the use of a tool to open

(3) Located behind locked doors accessible only to qualified personnel

(4) Password protected with password accessible only to qualified personnel

(5) Software that has password protected access to the adjusting means accessible to qualified personnel only

(4) Marking.

The equipment that supplies the branch circuit, feeder, or service shall be field marked with the following information:

(1) Maximum current setting

(2) Date of calculation and setting

(3) Identification of loads and sources associated with the current limiting feature

(4) The following or equivalent wording: "The setting for the ~~EMS~~ PCM current limiting feature shall not be bypassed"

The markings shall meet the requirements in 110.21(B) and shall be located such that they are clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

Statement of Problem and Substantiation for Public Input

Activities, such as the electrification of the transportation sector and replacement of gas-fired appliance with all electric appliances, coupled with widespread adoption of on-site storage and generation, will place significant new demands on the premises wiring systems covered by the NEC. These activities are complicated by the need to facilitate this shift in energy generation, storage, and use, with an existing (and aging) infrastructure.

An emerging trend is to leverage the technology offered by “Energy Management Systems” to manage these complex electrical systems in a way that prevents overloading of the premises wiring system. These types of systems require functional reliability in order to prevent overloading of the premises wiring, as well as utility owned assets serving the facility. Energy management systems (EMS) historically have not been evaluated for functional reliability to address electrical overload.

While other PI’s may address this need for a more robust “Energy Management System”, this must co-exist with the realization that there is still a place for the traditional Energy Management devices that are not being relied upon for these functions and should not be mandated to meet functional safety requirements.

Recognizing that these existing products will continue to exist in the marketplace, a new term is needed to differentiate between the historic EMS application of energy optimization for appliance control versus electrical overload and/or grid interconnection applications where safety is paramount. With this in mind, this PI focuses on introducing the term Power Circuit Management (PCM) where functional reliability has been applied.

This PI utilizes the new term that is proposed in a Related PI (refer to “Related PI’s”) to mark the distinction between “Energy Management” and “PCM”. As described above, the requirement for this section should reflect the more robust requirements for “PCM”.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling “q”.]	Related due to addition of new PCM definition / term
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	Related due to addition of new PCM definition / term
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	Related due to addition of new PCM definition / term
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	Related due to addition of new PCM definition / term
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	Related due to addition of new PCM definition / term
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	Related due to addition of new PCM definition / term
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	Related due to addition of new PCM definition / term
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	Related due to addition of new PCM definition / term
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	Related due to addition of new PCM definition / term
Public Input No. 4331-NFPA 70-2023 [New Definition after Definition: Powder Filling “q”.]	
Public Input No. 4332-NFPA 70-2023 [Definition: Energy Management System (EMS).]	
Public Input No. 4357-NFPA 70-2023 [Section No. 220.70]	
Public Input No. 4360-NFPA 70-2023 [Section No. 625.42(A)]	
Public Input No. 4362-NFPA 70-2023 [Section No. 700.4(B)]	
Public Input No. 4364-NFPA 70-2023 [Section No. 701.4(C)]	
Public Input No. 4366-NFPA 70-2023 [Section No. 702.4(A)(2)]	
Public Input No. 4367-NFPA 70-2023 [Section No. 705.13]	
Public Input No. 4372-NFPA 70-2023 [Section No. 750.6]	

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Public Input No. 1828-NFPA 70-2023 [Section No. 750.30(C)(1)]

(1) ~~Current Setpoint.~~

~~A single value equal to the maximum ampere setpoint of the~~

Load or Source Capacity.

The load limit or source capacity limit of an EMS shall be permitted for one or more of the following:

(1) For calculating ~~the connected load~~ the load connected to a feeder or service per 220.70

(2) For

~~the maximum source current permitted by EMS control~~

(3) calculating the load connected to a branch per 220 Part II

(4) For calculating the source capacity per 702.4 or 705.13

Statement of Problem and Substantiation for Public Input

Section 220.70 is in Part III of Article 220, which only applies to feeders and service load calculations, it is Part II that covers branch circuits (per the title of Article 220 and Subdivision 750.30(C)). Since EMS cover sources, and they aren't necessarily only using current (Ampere) setpoints, subdivision (C) was revised to reflect the concept of source capacity to align with 702.4, and 705.13, which can hopefully be revised to use the same terminology. Loads, and power source capacities, are usually rated in Watts or VA, and while AC EVSE are usually limited in Amperes, to align with breaker ratings, load and source management are not limited to using Ampere ratings. See section 220.57 which is problematic given that it assumes 240 V, AC, and 30 A, yet even AC EVSE are often used on 208 V systems, available at lower amperages such as 16 A, 20 A, or 24 A to suit 20 A, 25 A, or 30 A branches, and 625.42 explicitly allows for adjustable settings where the lower ratings are common (along with 15 A and 22.5 A output, being 50% or 75% of 30 A). Also the term "current" is inherently confusing in terms of whether it is meant to be temporal (at present time) or the Ampere rating, so unless the intent is to be unclear, it's best used carefully.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1757-NFPA 70-2023 [Section No. 625.42]	Similar terminology alignment issues.

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Public Input No. 4496-NFPA 70-2023 [New Section after 750.30(C)(2)]

Phase Balancing

When EV EMS calculations incorporate phase balancing to ascertain the maximum permissible current per phase within single-phase and split-phase EVSE installations, on-site physical control mechanisms must be present to monitor and control the load per phase such that the permissible phase imbalance is never exceeded.

Statement of Problem and Substantiation for Public Input

Phase balancing for EVSEs in load management configuration: The NEC addresses phase balancing several areas, but not for Electric Vehicles operating under the control of an energy management system. In the context of Electric Vehicle Supply Equipment (EVSE) installations, particularly those employing split-phase and single-phase chargers concurrently with EV EMS systems, phase balancing monitoring and control is essential. Independent operation of multiple EVSEs creates inherent variability in loads across distinct phases, requiring a dedicated physical control system to ensure sustained phase equilibrium. This system is necessary for continuous monitoring and regulation of electrical loads on a per-phase basis, ensuring prescribed phase imbalance limits are maintained. Active harmonization of load distribution amongst phases both safeguards electrical equipment and contributes to electrical safety and the reliability of EVSE applications.

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Public Input No. 1936-NFPA 70-2023 [Section No. 750.30(C)(2)]

(2) System Malfunction.

The EMS shall use monitoring and controls to automatically cease ~~current~~ , or otherwise limit to a safe level, power flow upon malfunction of the EMS.

Statement of Problem and Substantiation for Public Input

The most common failure in EMS is a loss of communication between pieces of local or remote equipment, and it is only necessary that the system go to a risk-addressed or safe state, such as a pre-set default minimum current or power setting that will not overload the circuit. Often this will be a product standard issue, but since interconnection of kits or assembled equipment will occur, it's possible there will be situations covered by this clause as part of an installation.
Energy is measured in W or VA, not necessarily just A, so it's best if the concept be generalized. Similarly if EMS are to include sources, then the requirements should be generalized accordingly.

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Public Input No. 4277-NFPA 70-2023 [Section No. 750.30(C)(2)]

(2) System Malfunction.

The EMS shall use monitoring and controls to automatically cease current flow ~~upon~~ of loads or sources during any malfunction of the EMS that could impact its current-limiting ability . A subset of loads, sources, or a combination thereof controlled by the EMS may remain connected, provided their maximum combined operation is unable to exceed the maximum ampere setpoint of the EMS.

Statement of Problem and Substantiation for Public Input

Without product safety standard backing, the ambiguity in the conditional statement "upon malfunction of the EMS" could result in a hazardous load management EMS that is designed with insufficient fault-protective systems. Similarly, because the existing wording is not clear on what conditions should be evaluated, AHJs lack sufficient guidance for inspecting a load management EMS, potentially resulting in either blind trust in equipment manufacturer's claims or ineffectual attempts to simulate all possible modes of EMS failure. Consider an EMS equipped with a real-time clock to provide timestamps for digital energy usage monitoring. Loss of this function only impacts informational reporting without affecting the ability of the EMS to limit load on a conductor, meaning this malfunction could safely be indicated to the user without disconnecting controlled load. However, an EMS manufacturer may misleadingly point to error-detection systems that respond to such tangential errors as evidence for 750.30(C) compliance. Therefore, the clarification of malfunction type is suggested to focus attention on safety rather than any form of device error. And although the intent of "upon" in the original wording is reasonably clear, "during malfunction" is suggested as a more explicit requirement that fault-protective behavior shall continue until the malfunction is remediated.

For two reasons, the unqualified requirement to "cease current flow" may also result in hazardous installations. First, there could be excessive impact to building residents caused by ceasing all current rather than reducing it to a level that cannot cause an overload condition, driving them to ignore the 750.30(C)(4) notice and seek a means of bypassing the system to regain use of their loads or sources. Second, excessive operation of electromechanical load controls causes degradation of the equipment. Consider an EMS that monitors a subpanel feeder and limits current to a maximum ampere setpoint of 80 A. This EMS controls one 30 A load and two 40 A loads supplied by the subpanel. An additional 30 A load is supplied by the subpanel but not controlled by the EMS. The EMS could safely be configured to disconnect only two of the three controlled loads if an error state occurs, thus reducing the likelihood of end user bypass and potentially extending the functional lifespan of the EMS.

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Public Input No. 4487-NFPA 70-2023 [Section No. 750.30(C)(2)]

(2) System Malfunction.

The EMS shall utilize monitoring and controls to automatically allow for a non-zero value equal to or less than the EMS set point when physical control means are present upon malfunction of the EMS. This may include utilizing fallback values stored in non-volatile memory in the EVSEs or other physical switching devices as applicable. If no physical control means are present, t he EMS shall use monitoring and controls to automatically cease current flow upon malfunction of the EMS.

Statement of Problem and Substantiation for Public Input

The current NEC provision for EMS system malfunction does not reflect the capability in electric vehicle use cases of both EVSEs and the Open ChargePoint Protocol's "TxDefaultProfile" charging profile to set non-zero values to which EVSEs will default in the absence of any external charging command. These values can be individually set for each EVSE, and allow EVSEs to continue to charge their EVs while aggregate levels automatically remain below site limits. Storing this setting onsite, for example in the non-volatile memory of EVSE itself , ensures that the EVSE retains the default charging limits if the EVSE loses communications and the EV EMS and/or the EVSE loses then regains power. "TxDefaultProfile" is included in OCPP version 1.6 and later.

Example of OCPP JSON file for implementation of TxDefaultProfile for an AC charger. If the EVSE does not reply, the EMS assumes the EVSE is charging at 100%.


```
"action": "SetChargingProfile",
  "connector_id": null,
  "request": {
   "connector_id": 0,
   "cs_charging_profiles": {
    "chargingSchedule": {
     "chargingSchedulePeriod": [
      {
       "startPeriod": 0,
       "limit": 32
      }
     ],
     "chargingRateUnit": "A",
     "startSchedule": "2023-09-06T19:39:08Z"
    },
    "stackLevel": 0,
    "chargingProfileKind": "Absolute",
    "chargingProfileId": 0,
    "chargingProfilePurpose": "TxDefaultProfile"
   }
  },
```


Reply:


```
"_source": {
  "config_schema_version": "0.0.0",
  "connector_id": null,
  "@version": "1",
  "@timestamp": "2023-09-05T23:27:02.159Z",
  "action": "SetChargingProfile",
```

```
    "config_payload_version": "x00x00x0-xxxx-x0x0-0000-xx00x0xx0xxx",
    "schema_version": "0.0.0",
    "charger_id": "1111111111",
    "request": {
      "cs_charging_profiles": {
        "chargingSchedule": {
          "chargingRateUnit": "A",
          "chargingSchedulePeriod": [
            {
              "startPeriod": 0,
              "limit": 32
            }
          ],
          "startSchedule": "2023-09-05T23:27:01Z"
        },
        "chargingProfileKind": "Absolute",
        "chargingProfilePurpose": "TxDefaultProfile",
        "stackLevel": 0,
        "chargingProfileId": 0
      },
      "connector_id": 0
    },
    "datetime": "2023-09-05T23:27:02Z",
    "rabbitmq_headers": {},
    "source": "csms",
    "_logstash_from": "logstash.exchange-from-lc.ocpp",
    "response": {
      "status": "Accepted"
    },
    "site_id": "0x000000-00xx-00x0-0x0x-0x0x000x0000",
    "error": ""
  },
  "fields": {
    "datetime": [
      "2023-09-05T23:27:02.000Z"
    ],
    "@timestamp": [
      "2023-09-05T23:27:02.159Z"
    ]
  },
```


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Public Input No. 1939-NFPA 70-2023 [Section No. 750.30(C)(3)]

(3) Settings.

Adjustable settings shall be permitted if access to the settings is accomplished by at least one of the following:

(1) Located behind ~~removable and sealable~~ covers ~~over the adjustment means~~
~~Located behind a cover or door that requires~~

(2) <u>or doors that are sealable, lockable, or require</u> <u>the use of a tool to open</u>

(3) ~~Located behind locked doors accessible only to qualified personnel~~

(4) ~~Password protected with password accessible only to qualified personnel~~
~~Software that has password protected access to the adjusting means accessible to qualified personnel only~~

(5) ~~.~~

(6) ~~Password protected with separate role-based authorization for the adjustment~~

Statement of Problem and Substantiation for Public Input

While I understand the existing false equivalents are a consequence of the prior correlating task group consolidation of several occurences, they should now be simplified since a door and cover are similar; a lock, seal or tool are arguably similar; and a password if intended to be similar should have a similar level of differentiation to other restricted access means. Apologies for the messy formatting, the system refuses to consolidate the text down to two subdivisions.

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Public Input No. 4293-NFPA 70-2023 [Section No. 750.30(C)(3)]

(3) Settings.

~~Adjustable settings~~ (a) Settings that prevent overload of a conductor shall be permitted to be adjustable if access to the settings is accomplished by at least one of the following:

(1) Located behind removable and sealable covers over the adjustment means

(2) Located behind a cover or door that requires the use of a tool to open

(3) Located behind locked doors accessible only to qualified personnel

(4) Password protected with password accessible only to qualified personnel

(5) Software that has password protected access to the adjusting means accessible to qualified personnel only

(b) Unrestricted access to adjustable settings shall be permitted if adjusting those settings could not lead to overloading a conductor.

Statement of Problem and Substantiation for Public Input

Problem Statement
Settings such as load prioritization and load limits should be user-adjustable so long as they remain within the limits set by the qualified person in order to prevent any conductor from becoming overloaded.

Substantiation
Energy management systems often include certain settings that do not impact safety as they are unrelated to limiting current on a conductor. System owners may want to adjust settings governing load-shedding priority, notification options, or display preferences. Such adjustments will not lead to overloaded conductors. Current-limiting maximum ampere setpoints are the only settings that should require restricted access as those are the only settings that impact an energy management system's ability to prevent overloading of a conductor.

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Public Input No. 2000-NFPA 70-2023 [Section No. 750.30(C)(4)]

(4) Marking.

The equipment that supplies or connects the branch circuit, feeder, or service shall be field marked with the following information:

(1) Maximum ~~current setting~~ energy setting

(2) Date of ~~calculation and setting~~ energy limit setting and contact information

(3) Identification of loads ~~and~~ or sources associated with the ~~current~~ energy limiting feature

(4) The following or equivalent wording: "~~The setting for the EMS current limiting feature shall~~ This circuit is controlled by an EMS and its setting shall only be adjusted by qualified personnel and shall not be bypassed"

The markings shall meet the requirements in 110.21(B) and shall be located such that they are clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

Statement of Problem and Substantiation for Public Input

The existing wording, while understood to be a consequence of the consolidation of EMS into one section by a task group formed by the Correlating Committee, confuses due to the terminology: Does current mean "at the present time" or Amperes? Why does it then refer to date, and setting again? If it is energy (W or VA) then why does it refer to current (A) limiting only?. Why is this only in the Load Management section? Will there be a Source Management section that will be different? In paralleled interactive systems the sources can be managed unrelated to the load.

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Public Input No. 1829-NFPA 70-2023 [Section No. 750.30(C) [Excluding any Sub-Sections]]

An energy management system shall not cause a branch circuit, feeder, or service to be overloaded. If an EMS is used to limit the ~~current~~ load or sources on a ~~conductor,~~ circuit 750.30(C)(1) through (C)(4) shall apply:

Statement of Problem and Substantiation for Public Input

While it's true that the vast majority of EMS regulate based on current, and are managing loads, more generically they are managing energy / power, and since they can be managing sources, it's best if the terminology is kept generic.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1757-NFPA 70-2023 [Section No. 625.42]	Has similar assumptions that only current and loads are involved, but with EVPE and BiDi power and sources need to be considered also.

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Public Input No. 1258-NFPA 70-2023 [New Section after 750.50]

TITLE OF NEW CONTENT

Type your content here ...

750.55. Cybersecurity

Energy Management Systems that are connected to a communication network and have the capability to be controlled or permit control of any portion of the premises shall comply with either of the following:

(1) The ability to control the system is limited to a direct connection through a local nonnetworked interface.

(2) The Energy Management Sytem is connected through a networked interface complying with both of the following methods:

a. The Energy Management System and associated software are identified as being evaluated for cybersecurity.

b. A cybersecurity assessment is conducted on the connected system to determine vulnerabilities to cyber attacks.

The cybersecurity assessment shall be conducted when the system configuration changes and at not more than 5-year intervals.

Documentation of the evaluation, assessment, identification, and certification shall be made available to those authorized to inspect, operate, and maintain the system.

Informational Note No. 1: See ANSI/ISA 62443, Cybersecurity Standards series; UL 2900, Cybersecurity Standards series; and the NIST Framework for Improving Critical Infrastructure Cybersecurity, Version 1.1, for assessment guidelines.

Informational Note No. 2: Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

(1) The ISA Security Compliance Institute (ISCI) conformity assessment program

(2) Certification of compliance by a nationally recognized test laboratory

Statement of Problem and Substantiation for Public Input

Most of the cybersecurity focus has been on IT systems. There has been very little public discussion about cybersecurity for Operational Technology (OT), but cyber attacks on OT, by both domestic and foreign actors, occur on almost a daily basis. Hackers can easily destroy unprotected equipment and shut down entire unprotected facilities. Our adversaries such as Russia, China, North Korea, and Iran, are continuously mounting cyber attacks. They understand their limits and, so far, prohibit catastrophic attacks on our financial/banking system and electrical grid. In the mean time, they attack our infrastructure, such as the southeast gas pipeline. We have the ability, and obligation, to prevent this type of damage to our infrastructure from malicious cyber attacks. This Public Input is based upon 240.6(D) and 708.7 in the 2023 NEC. Pay particular attention to the word "identified" in (2) a. "Identified" as applied to equipment, is defined 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. 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 organization concerned with product evaluation." This Public Input simply requires that an Energy Management System either not be connected to the internet, or if it is connected to the internet, that it be identified for cybersecurity and that an assessment is provided.

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Public Input No. 2002-NFPA 70-2023 [Section No. 750.50]

750.50 Directory.

Where an energy management system is employed to control electrical power through the use of a remote means, a directory identifying the related equipment, controlled device(s) and circuit(s) shall be posted on the enclosure of the controller, disconnect, or branch-circuit ~~overcurrent~~ , feeder, or service, overcurrent device.

Statement of Problem and Substantiation for Public Input

Since multiple pieces of equipment (CTs at a service, feeder, and branch, corresponding transducer(s) to convert and communicate the signals, controller(s), controlled device(s)) can be involved in EMS systems, it is valuable to indicated when several pieces of equipment are involved, and since loads and sources, and branches, feeders, and services, can be controlled, it is not limited to branch overcurrents but also feeders and services, panels, etc.

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Public Input No. 3005-NFPA 70-2023 [Part I.]

Part I. Availability and Reliability for Critical Operations Power Systems.

Critical operations power systems may support facilities with a variety of objectives that are vital to public safety. Often these objectives are of such critical importance that system downtime is costly in terms of economic losses, loss of security, or loss of mission. For those reasons, the availability of the critical operations power system, the percentage of time that the system is in service, is important to those facilities. Given a specified level of availability, the reliability and maintainability requirements are then derived based on that availability requirement.

Availability. Availability is defined as the percentage of time that a system is available to perform its function(s). Availability is measured in a variety of ways, including the following:

[F.1]

where:

MTBF = mean time between failures

MTTF = mean time to failure

MTTR = mean time to repair

See Table F.1 for an example of how to establish required availability for critical operation power systems:

Table F.1 Availability for Critical Operation Power Systems

Availability	**Hours of Downtime**
0.9	876
0.99	87.6
0.999	8.76
0.9999	0.876
0.99999	0.0876
0.999999	0.00876
0.9999999	0.000876

Note: Based on a year of 8760 hours.

Availability of a system in actual operations is determined by the following:

(1) The frequency of occurrence of failures. Failures may prevent the system from performing its function or may cause a degraded effect on system operation. Frequency of failures is directly related to the system's level of reliability.

(2) The time required to restore operations following a system failure or the time required to perform maintenance to prevent a failure. These times are determined in part by the system's level of maintainability.

(3) The logistics provided to support maintenance of the system. The number and availability of spares, maintenance personnel, and other logistics resources (refueling, etc.) combined with the system's level of maintainability determine the total downtime following a system failure.

Reliability. Reliability is concerned with the probability and frequency of failures (or lack of failures). A commonly used measure of reliability for repairable systems is *MTBF*. The equivalent measure for nonrepairable items is *MTTF*. Reliability is more accurately expressed as a probability over a given duration of time, cycles, or other parameter. For example, the reliability of a power plant might be stated as 95 percent probability of no failure over a 1000-hour operating period while generating a certain level of power. Reliability is usually defined in two ways (the electrical power industry has historically not used these definitions):

(1) The duration or probability of failure-free performance under stated conditions

(2) The probability that an item can perform its intended function for a specified interval under stated conditions [For nonredundant items, this is equivalent to the preceding definition (1). For redundant items, this is equivalent to the definition of mission reliability.]

Maintainability. Maintainability is a measure of how quickly and economically failures can be prevented through preventive maintenance, or system operation can be restored following failure through corrective maintenance. A commonly used measure of maintainability in terms of corrective maintenance is the mean time to repair (*MTTR*). Maintainability is not the same thing as maintenance. It is a design parameter, while maintenance consists of actions to correct or prevent a failure event.

Improving Availability. The appropriate methods to use for improving availability depend on whether the facility is being designed or is already in use. For both cases, a reliability/availability analysis should be performed to determine the availability of the old system or proposed new system in order to ascertain the hours of downtime (see the preceding table). The AHJ or government agency should dictate how much downtime is acceptable.

Existing facilities: For a facility that is being operated, two basic methods are available for improving availability when the current level of availability is unacceptable: (1) Selectively adding redundant units (e.g., generators, chillers, fuel supply) to eliminate sources of single-point failure, and (2) optimizing maintenance using a reliability-centered maintenance (RCM) approach to minimize downtime. (Refer to NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance*.) A combination of the previous two methods can also be implemented. A third very expensive method is to redesign subsystems or to replace components and subsystems with higher reliability items. *(Refer to NFPA 70B.)*

New facilities: The opportunity for high availability and reliability is greatest when designing a new facility. By applying an effective reliability strategy, designing for maintainability, and ensuring that manufacturing and commissioning do not negatively affect the inherent levels of reliability and maintainability, a highly available facility will result. The approach should be as follows:

(1) *Develop and determine a reliability strategy* (establish goals, develop a system model, design for reliability, conduct reliability development testing, conduct reliability acceptance testing, design system delivery, maintain design reliability, maintain design reliability in operation). The reliability strategy should include an understanding of related auxiliary systems that support the COPS objective:

a) Public alert and warning systems,

b) Radio and satellite communications,

c) Broadband for GIS mappingm videoconferencing and social media monitoring

d) All other related crisis communication technologies

(2) *Develop a reliability program.* This is the application of the reliability strategy to a specific system, process, or function. Each step in the preceding strategy requires the selection and use of specific methods and tools. For example, various tools can be used to develop requirements or evaluate potential failures. To derive requirements, analytical models can be used, for example, quality function development (a technique for deriving more detailed, lower-level requirements from one level to another, beginning with mission requirements, i.e., customer needs). This model was developed as part of the total quality management movement. Parametric models can also be used to derive design values of reliability from operational values and vice versa. Analytical methods include but are not limited to things such as thermal analysis, durability analysis, and predictions. Finally, one should evaluate possible failures. A failure modes and effects criticality analysis (FMECA) and fault tree analysis (FTA) are two methods for evaluating possible failures. The mission facility engineer should determine which method to use or whether to use both.

(3) *Identify reliability requirements.* The entire effort for designing for reliability begins with identifying the mission critical facility's reliability requirements. These requirements are stated in a variety of ways, depending on the customer and the specific system. For a mission-critical facility, it would be the mission success probability.

Informational Note: For information regarding power system reliability, see IEEE 3006.5-2014, *Recommended Practice for the Use of Probability Methods for Conducting* *a Reliability Analysis of Industrial and Commercial Power Systems*.

Statement of Problem and Substantiation for Public Input

Since Hurricane Katrina in 2015, an inspiration for the original appearance of Article 708 Critical Operations Power Systems, communication hardware, firmware and software has evolved substantially. This proposal is intended to provide more specifics that will support the resilience of critical operations power systems. Two of the original authors of Article 708 and this Annex are participating in this update: Robert G. Arno and Neal Dowling.

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Public Input No. 370-NFPA 70-2023 [Part I.]

Part I. Availability and Reliability for Critical Operations Power Systems.

Critical operations power systems may support facilities with a variety of objectives that are vital to public safety. Often these objectives are of such critical importance that system downtime is costly in terms of economic losses, loss of security, or loss of mission. For those reasons, the availability of the critical operations power system, the percentage of time that the system is in service, is important to those facilities. Given a specified level of availability, the reliability and maintainability requirements are then derived based on that availability requirement.

Availability. Availability is defined as the percentage of time that a system is available to perform its function(s). Availability is measured in a variety of ways, including the following:

Availability

= MTBF / (MTBF + MTTR) **[F.1]**

where:

MTBF = mean time between failures

MTTF = mean time to failure

MTTR = mean time to repair

The term *MTTF* is used instead of *MTBF* depending on whether the item is repairable or not.

See Table F.1 for an example of how to establish required availability for critical operation power systems:

Table F.1 Availability for Critical Operation Power Systems

Availability	**Hours of Downtime**
0.9	876
0.99	87.6
0.999	8.76
0.9999	0.876
0.99999	0.0876
0.999999	0.00876
0.9999999	0.000876

Note: Based on a year of 8760 hours.

Availability of a system in actual operations is determined by the following:

(1) The frequency of occurrence of failures. Failures may prevent the system from performing its function or may cause a degraded effect on system operation. Frequency of failures is directly related to the system's level of reliability.

(2) The time required to restore operations following a system failure or the time required to perform maintenance to prevent a failure. These times are determined in part by the system's level of maintainability.

(3) The logistics provided to support maintenance of the system. The number and availability of spares, maintenance personnel, and other logistics resources (refueling, etc.) combined with the system's level of maintainability determine the total downtime following a system failure.

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(1) The duration or probability of failure-free performance under stated conditions

(2) The probability that an item can perform its intended function for a specified interval under stated conditions [For nonredundant items, this is equivalent to the preceding definition (1). For redundant items, this is equivalent to the definition of mission reliability.]

Maintainability. Maintainability is a measure of how quickly and economically failures can be prevented through preventive maintenance, or system operation can be restored following failure through corrective maintenance. A commonly used measure of maintainability in terms of corrective maintenance is the mean time to repair (*MTTR*). Maintainability is not the same thing as maintenance. It is a design parameter, while maintenance consists of actions to correct or prevent a failure event.

Improving Availability. The appropriate methods to use for improving availability depend on whether the facility is being designed or is already in use. For both cases, a reliability/availability analysis should be performed to determine the availability of the old system or proposed new system in order to ascertain the hours of downtime (see the preceding table). The AHJ or government agency should dictate how much downtime is acceptable.

Existing facilities: For a facility that is being operated, two basic methods are available for improving availability when the current level of availability is unacceptable: (1) Selectively adding redundant units (e.g., generators, chillers, fuel supply) to eliminate sources of single-point failure, and (2) optimizing maintenance using a reliability-centered maintenance (RCM) approach to minimize downtime. (Refer to NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance*.) A combination of the previous two methods can also be implemented. A third very expensive method is to redesign subsystems or to replace components and subsystems with higher reliability items. *(Refer to NFPA 70B.)*

New facilities: The opportunity for high availability and reliability is greatest when designing a new facility. By applying an effective reliability strategy, designing for maintainability, and ensuring that manufacturing and commissioning do not negatively affect the inherent levels of reliability and maintainability, a highly available facility will result. The approach should be as follows:

(1) *Develop and determine a reliability strategy* (establish goals, develop a system model, design for reliability, conduct reliability development testing, conduct reliability acceptance testing, design system delivery, maintain design reliability, maintain design reliability in operation).

(2) *Develop a reliability program.* This is the application of the reliability strategy to a specific system, process, or function. Each step in the preceding strategy requires the selection and use of specific methods and tools. For example, various tools can be used to develop requirements or evaluate potential failures. To derive requirements, analytical models can be used, for example, quality function development (a technique for deriving more detailed, lower-level requirements from one level to another, beginning with mission requirements, i.e., customer needs). This model was developed as part of the total quality management movement. Parametric models can also be used to derive design values of reliability from operational values and vice versa. Analytical methods include but are not limited to things such as thermal analysis, durability analysis, and predictions. Finally, one should evaluate possible failures. A failure modes and effects criticality analysis (FMECA) and fault tree analysis (FTA) are two methods for evaluating possible failures. The mission facility engineer should determine which method to use or whether to use both.

(3) *Identify reliability requirements.* The entire effort for designing for reliability begins with identifying the mission critical facility's reliability requirements. These requirements are stated in a variety of ways, depending on the customer and the specific system. For a mission-critical facility, it would be the mission success probability.

Informational Note: For information regarding power system reliability, see IEEE 3006.5-2014, *Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems*.

Statement of Problem and Substantiation for Public Input

The current formula for Availability is incorrect. Availability = MTBF / MTBF + MTTR

See Army Corp TM 5-698-5 Table 5, or RAC Operational Availability Handbook, among others, for the correct formula

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Public Input No. 4119-NFPA 70-2023 [Part I.]

Part I. Availability and Reliability for Critical Operations Power Systems.

Critical operations power systems may support facilities with a variety of objectives that are vital to public safety. Often these objectives are of such critical importance that system downtime is costly in terms of economic losses, loss of security, or loss of mission. For those reasons, the availability of the critical operations power system, the percentage of time that the system is in service, is important to those facilities. Given a specified level of availability, the reliability and maintainability requirements are then derived based on that availability requirement.

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See Table F.1 for an example of how to establish required availability for critical operation power systems:

Table F.1 Availability for Critical Operation Power Systems

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0.99999	0.0876
0.999999	0.00876
0.9999999	0.000876

Note: Based on a year of 8760 hours.

Availability of a system in actual operations is determined by the following:

(1) The frequency of occurrence of failures. Failures may prevent the system from performing its function or may cause a degraded effect on system operation. Frequency of failures is directly related to the system's level of reliability.

(2) The time required to restore operations following a system failure or the time required to perform maintenance to prevent a failure. These times are determined in part by the system's level of maintainability.

(3) The logistics provided to support maintenance of the system. The number and availability of spares, maintenance personnel, and other logistics resources (refueling, etc.) combined with the system's level of maintainability determine the total downtime following a system failure.

Reliability. Reliability is concerned with the probability and frequency of failures (or lack of failures). A commonly used measure of reliability for repairable systems is *MTBF*. The equivalent measure for nonrepairable items is *MTTF*. Reliability is more accurately expressed as a probability over a given duration of time, cycles, or other parameter. For example, the reliability of a power plant might be stated as 95 percent probability of no failure over a 1000-hour operating period while generating a certain level of power. Reliability is usually defined in two ways (the electrical power industry has historically not used these definitions):

(1) The duration or probability of failure-free performance under stated conditions

(2) The probability that an item can perform its intended function for a specified interval under stated conditions [For nonredundant items, this is equivalent to the preceding definition (1). For redundant items, this is equivalent to the definition of mission reliability.]

Resiliency. Resiliency is a combination of Availability, Reliability and Maintainability.

Maintainability. Maintainability is a measure of how quickly and economically failures can be prevented through preventive maintenance, or system operation can be restored following failure through corrective maintenance. A commonly used measure of maintainability in terms of corrective maintenance is the mean time to repair (*MTTR*). Maintainability is not the same thing as maintenance. It is a design parameter, while maintenance consists of actions to correct or prevent a failure event.

Improving Availability. The appropriate methods to use for improving availability depend on whether the facility is being designed or is already in use. For both cases, a reliability/availability analysis should be performed to determine the availability of the old system or proposed new system in order to ascertain the hours of downtime (see the preceding table). The AHJ or government agency should dictate how much downtime is acceptable.

Existing facilities: For a facility that is being operated, two basic methods are available for improving availability when the current level of availability is unacceptable: (1) Selectively adding redundant units (e.g., generators, chillers, fuel supply) to eliminate sources of single-point failure, and (2) optimizing maintenance using a reliability-centered maintenance (RCM) approach to minimize downtime. (Refer to NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance*.) A combination of the previous two methods can also be implemented. A third very expensive method is to redesign subsystems or to replace components and subsystems with higher reliability items. *(Refer to NFPA 70B.)*

New facilities: The opportunity for high availability and reliability is greatest when designing a new facility. By applying an effective reliability strategy, designing for maintainability, and ensuring that manufacturing and commissioning do not negatively affect the inherent levels of reliability and maintainability, a highly available facility will result. The approach should be as follows:

(1) *Develop and determine a reliability strategy* (establish goals, develop a system model, design for reliability, conduct reliability development testing, conduct reliability acceptance testing, design system delivery, maintain design reliability, maintain design reliability in operation).

(2) *Develop a reliability program.* This is the application of the reliability strategy to a specific system, process, or function. Each step in the preceding strategy requires the selection and use of specific methods and tools. For example, various tools can be used to develop requirements or evaluate potential failures. To derive requirements, analytical models can be used, for example, quality function development (a technique for deriving more detailed, lower-level requirements from one level to another, beginning with mission requirements, i.e., customer needs). This model was developed as part of the total quality management movement. Parametric models can also be used to derive design values of reliability from operational values and vice versa. Analytical methods include but are not limited to things such as thermal analysis, durability analysis, and predictions. Finally, one should evaluate possible failures. A failure modes and effects criticality analysis (FMECA) and fault tree analysis (FTA) are two methods for evaluating possible failures. The mission facility engineer should determine which method to use or whether to use both.

(3) *Identify reliability requirements.* The entire effort for designing for reliability begins with identifying the mission critical facility's reliability requirements. These requirements are stated in a variety of ways, depending on the customer and the specific system. For a mission-critical facility, it would be the mission success probability.

Informational Note: For information regarding power system reliability, see IEEE 3006.5-2014, *Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems*.

Statement of Problem and Substantiation for Public Input

Most of the content in this section is derived from findings by the United States Army Corps of Engineers Power Reliability Enhancement Program when Article 708 first appeared in the NEC. That program identified Facility Energy System Resiliency and Reliability, or Unified Facilities Criteria (UFC) prescribed by MIL-STD 3007. It provides criteria for planning, design, construction, sustainment, restoration and modernization of military departments, defense agencies, and DoD Field Activities in accordance with with USD (AT&L) Memorandum dated 29 May 2002. UFC is used for all DoD projects and work for other customers where appropriate.

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Public Input No. 4126-NFPA 70-2023 [Part I.]

Part I. Availability and Reliability for Critical Operations Power Systems.

Critical operations power systems may support facilities with a variety of objectives that are vital to public safety. Often these objectives are of such critical importance that system downtime is costly in terms of economic losses, loss of security, or loss of mission. For those reasons, the availability of the critical operations power system, the percentage of time that the system is in service, is important to those facilities. Given a specified level of availability, the reliability and maintainability requirements are then derived based on that availability requirement.

Availability. Availability is defined as the percentage of time that a system is available to perform its function(s). Availability is measured in a variety of ways, including the following:

[F.1]

where:

MTBF = mean time between failures

MTTF = mean time to failure

MTTR = mean time to repair

See Table F.1 for an example of how to establish required availability for critical operation power systems:

Table F.1 Availability for Critical Operation Power Systems

Availability	Hours of Downtime
0.9	876
0.99	87.6
0.999	8.76
0.9999	0.876
0.99999	0.0876
0.999999	0.00876
0.9999999	0.000876

Note: Based on a year of 8760 hours.

Availability of a system in actual operations is determined by the following:

(1) The frequency of occurrence of failures. Failures may prevent the system from performing its function or may cause a degraded effect on system operation. Frequency of failures is directly related to the system's level of reliability.

(2) The time required to restore operations following a system failure or the time required to perform maintenance to prevent a failure. These times are determined in part by the system's level of maintainability.

(3) The logistics provided to support maintenance of the system. The number and availability of spares, maintenance personnel, and other logistics resources (refueling, etc.) combined with the system's level of maintainability determine the total downtime following a system failure.

Reliability. Reliability is concerned with the probability and frequency of failures (or lack of failures). A commonly used measure of reliability for repairable systems is *MTBF*. The equivalent measure for nonrepairable items is *MTTF*. Reliability is more accurately expressed as a probability over a given duration of time, cycles, or other parameter. For example, the reliability of a power plant might be stated as 95 percent probability of no failure over a 1000-hour operating period while generating a certain level of power. Reliability is usually defined in two ways (the electrical power industry has historically not used these definitions):

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Maintainability. Maintainability is a measure of how quickly and economically failures can be prevented through preventive maintenance, or system operation can be restored following failure through corrective maintenance. A commonly used measure of maintainability in terms of corrective maintenance is the mean time to repair (*MTTR*). Maintainability is not the same thing as maintenance. It is a design parameter, while maintenance consists of actions to correct or prevent a failure event.

Improving Availability. The appropriate methods to use for improving availability depend on whether the facility is being designed or is already in use. For both cases, a reliability/availability analysis should be performed to determine the availability of the old system or proposed new system in order to ascertain the hours of downtime (see the preceding table). The AHJ or government agency should dictate how much downtime is acceptable.

<u>Concurrent Maintenance. Action that supports the mission when partially functional; either as a planned or forced outage.</u>

Existing facilities: For a facility that is being operated, two basic methods are available for improving availability when the current level of availability is unacceptable: (1) Selectively adding redundant units (e.g., generators, chillers, fuel supply) to eliminate sources of single-point failure, and (2) optimizing maintenance using a reliability-centered maintenance (RCM) approach to minimize downtime. (Refer to NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance*.) A combination of the previous two methods can also be implemented. A third very expensive method is to redesign subsystems or to replace components and subsystems with higher reliability items. *(Refer to NFPA 70B.)*

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Informational Note: For information regarding power system reliability, see IEEE 3006.5-2014, *Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems*.

Statement of Problem and Substantiation for Public Input

Most of the content in this section is derived from findings by the United States Army Corps of Engineers Power Reliability Enhancement Program when Article 708 first appeared in the NEC. That program identified Facility Energy System Resiliency and Reliability, or Unified Facilities Criteria (UFC) prescribed by MIL-STD 3007. It provides criteria for planning, design, construction, sustainment, restoration and modernization of military departments, defense agencies, and DoD Field Activities in accordance with with USD (AT&L) Memorandum dated 29 May 2002. UFC is used for all DoD projects and work for other customers where appropriate.

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Public Input No. 4034-NFPA 70-2023 [Part V.]

~~Part V~~ 480 .14. Flow Battery ESSs

~~Part V~~ applies to ESSs composed of or containing flow batteries.

Informational Note: Due to the unique design features and difference in operating characteristics of flow batteries as compared with that of storage batteries such as lead acid or lithium ion batteries, the requirements for flow batteries have been included herein (Article 706, Part V).

Statement of Problem and Substantiation for Public Input

Article 706 Part V addresses the battery technology and does not cover Energy Storage Systems aspects for flow batteries. This entire section should be moved to Article 480.

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