First Revision No. 8979-NFPA 70-2018 [Global Input]

Moving and editing language from 706 to 480. See attachment.

Sections 706.30, 31, 32, 33, and 34 will be removed entirely. Some of the information is moved to 480 in this global FR. The rest of it needs to be deleted.

Supplemental Information

File Name	Description	Approved
Article_480_Editorial.doc	This doc shows the changes to take place in this revision. Changes are marked in comments titled "GLOBAL".	

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
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State:
Zip:
Submittal Date: Wed Jan 24 16:22:15 EST 2018

Committee Statement

Committee Statement: This revision moves various sections in Article 706 that pertain to batteries to Article 480 and deletes 706.30 through 706.34 due to the moves and redundant requirements.

Section 2.2.2.2 of the NEC Style Manual requires that where an individual article contains definition(s), they be located in the second section (XXX.2) of the article.

The definition of battery is relocated from Article 706 to Article 480. The revision also updates the definition to align with the definition of battery from NFPA 855.

This revision moves the requirements on Accessibility 480.4(D) since the section deals strictly with Batteries, and deletes identical text in 480.9. It also deletes similar text in 706.33.

Requirements on Disconnection of Series Battery Circuits were relocated from 706.30(B) to 480.7(B) since they deal strictly with batteries.

Requirements on Battery Interconnections were relocated from 706.32 to 480.12 since they deal strictly with Batteries.

The requirements for ground fault detection for battery circuits are relocated from 706.30(D) to 480.13.

Response Message:

Public Input No. 2950-NFPA 70-2017 [Section No. 480.2]

Public Input No. 2952-NFPA 70-2017 [New Section after 480.4(C)]

Public Input No. 2955-NFPA 70-2017 [New Section after 480.10]

Public Input No. 2953-NFPA 70-2017 [Section No. 480.7]

Public Input No. 2989-NFPA 70-2017 [Sections Part III., 706.30, 706.31, 706.32, 706.33, 706.34]

Article 480 Storage Batteries

480.1 Scope.

This article applies to all stationary installations of storage batteries.

Informational Note: The following standards are frequently referenced for the installation of stationary batteries:

(1) IEEE 484, *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, *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 Light Electric Rail (LER) Applications and Stationary Applications*

(9) UL Subject 2436, *Outline of Investigation for Spill Containment for Stationary Lead Acid Battery Systems*

(10) UL 1989, *Standard for Standby Batteries*

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

Battery.
~~Two or more~~A single cell, or a group of cells connected together electrically in series, in parallel, or a combination of both ~~to provide the required operating voltage and current levels~~.

Commented [TC1]: Changes made with FR-8875

Commented [TC2]: GLOBAL
PI-2950
Statement: Section 2.2.2.2 of the NEC Style Manual requires that where an individual article contains definition(s), they be located in the second section (XXX.2) of the article.

The definition of battery is relocated from Article 706 to Article 480. The revision also updates the definition to align with the definition of battery from NFPA 855.

Cell.

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

Container.

A vessel that holds the plates, electrolyte, and other elements of a single unit in a battery.

Informational Note: A container may be single-cell or multi-cell and is sometimes referred to in the industry as a “jar.”

Electrolyte.

The medium that provides the ion transport mechanism between the positive and negative electrodes of a cell.

Intercell Connector.

An electrically conductive bar or cable used to connect adjacent cells.

Intertier Connector.

An electrical conductor used to connect two cells on different tiers of the same rack or different shelves of the same rack.

Nominal Voltage (Battery or Cell).

The value assigned to a cell or battery of a given voltage class for the purpose of convenient designation. The operating voltage of the cell or battery may vary above or below this value.

Informational Note: The most common nominal cell voltages are 2 volts per cell for the lead-acid systems, 1.2 volts per cell for alkali systems, and 3.6 to 3.8 volts per cell for Li-ion systems. Nominal voltages might vary with different chemistries.

Sealed Cell or Battery.

A cell or battery that has no provision for the routine addition of water or electrolyte or for external measurement of electrolyte specific gravity and might contain pressure relief venting.

Storage Battery.

A battery comprised of one or more rechargeable cells of the lead-acid, nickel-cadmium, or other rechargeable electrochemical types.

Terminal.

That part of a cell, container, or battery to which an external connection is made (commonly identified as post, pillar, pole, or terminal post).

480.3 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.

Informational Note: The battery manufacturer's installation and instruction manual can be used for guidance for acceptable materials.

(B) Intercell and Intertier Conductors and Connections.

The ampacity of field-assembled intercell and intertier connectors and conductors shall be of such cross-sectional area that the temperature rise under maximum load conditions and at maximum ambient temperature shall not exceed the safe operating temperature of the conductor insulation or of the material of the conductor supports.

Informational Note: Conductors sized to prevent a voltage drop exceeding 3 percent of maximum anticipated load, and where the maximum total voltage drop to the furthest point of connection does not exceed 5 percent, may not be appropriate for all battery applications. IEEE 1375-2003, *Guide for the Protection of Stationary Battery Systems,* provides guidance for overcurrent protection and associated cable sizing.

(C) Battery Terminals.

Electrical connections to the battery, and the cable(s) between cells on separate levels or racks, shall not put mechanical strain on the battery terminals. Terminal plates shall be used where practicable.

Informational Note: Conductors are commonly pre-formed to eliminate stress on battery terminations. Fine stranded cables may also eliminate the stress on battery terminations. See the manufacturer's instructions for guidance.

(D) Accessibility.

The terminals of all cells or multi-cell 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 inspections of the internal components.

Commented [TC3]: GLOBAL
PI-2952
Statement: This revision moves the requirements on Accessibility 480.4(D) since the section deals strictly with Batteries, and deletes identical text in 480.9. It also deletes similar text in 706.33.

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 battery system with a voltage over 60 volts dc. A disconnecting means shall be readily accessible and located within sight of the battery system.

For one-family and two-family dwellings, a disconnecting means or its remote control shall be located at a readily accessible location outside the building for use by first responders.

Commented [TC4]: Changes made per FR-8089

Informational Note: See 240.21(H) for information on the location of the overcurrent device for battery conductors.

(B) Disconnection of Series Battery Circuits.

Battery circuits ~~subject to field servicing, where~~ exceeding 240 volts 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 nominal for maintenance by qualified persons. Non–load-break bolted or plug-in disconnects shall be permitted.

Commented [TC5]: GLOBAL
PI-2953
Statement: Requirements on Disconnection of Series Battery Circuits were relocated from 706.30(B) to 480.7(B) since they deal strictly with batteries.

(C) Remote Actuation.

Commented [TC6]: Changes made per FR-8089

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 battery system, the disconnecting means shall be

capable of being locked in the open position, in accordance with 110.25, and the location of the controls shall be field marked on the disconnecting means.

(D) Busway.

Where a DC busway system is installed, the disconnecting means shall be permitted to be incorporated into the busway.

(E) 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 battery system

(3) An arc flash label applied in accordance with acceptable industry practice.

(4) Date the calculation was performed

(4)

Informational Note No. 1: Battery equipment suppliers can provide information about available fault current on any particular battery model.
Informational Note No. 2: *NFPA 70E*-2015, *Standard for Electrical Safety in the Workplace*, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment.

480.7(F) Identification of Power Sources. Battery systems shall be indicated by 480.7(F)(1) and (2).

(1) Facilities with Utility Services and Battery Systems. Plaques or directories shall be installed in accordance with 705.10 and 712.10(A).
Exception: This requirement does not apply where a disconnect in 480.7(A) is not required.

Commented [TC7]: Changes made per FR-8089

Commented [TC8]: Changes made per FR-8089

(2) Facilities with Stand-Alone Systems. A permanent plaque or directory shall be installed outside a building or structure supplied by a stand-alone system located at each service equipment location or at an approved readily visible location. The plaque or directory shall denote the location of each power source disconnecting means on or in the premises or be grouped with other plaques or directories for other on-site sources.

Exception: This requirement does not apply where a disconnect in 480.7(A) is not required.

Commented [TC9]: Changes made per FR-8089

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.

~~The terminals of all cells or multi-cell units shall be readily accessible for readings, inspection, and cleaning where required by the equipment design. One side of transparent battery containers shall be readily accessible for inspection of the internal components.~~

Commented [TC10]: GLOBAL
Moved to 480.4 as shown above.

480.10 Battery Locations.

Battery locations shall conform to 480.10(A), (B), and (C).

(A) Ventilation.

Provisions appropriate to the battery technology shall be made for sufficient diffusion and ventilation of gases from the battery, if present, to prevent the accumulation of an explosive mixture.

Informational Note No. 1: See NFPA 1-2015, *Fire Code*, Chapter 52, for ventilation considerations for specific battery chemistries.
Informational Note No. 2: Some battery technologies do not require ventilation.

Informational Note No. 3: For additional information on the ventilation of stationary battery systems, see *IEEE Std 1635-2012/ASHRAE Guideline 21-2012 Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications*.

(B) Live Parts.

Guarding of live parts shall comply with 110.27.

(C) Spaces About Battery Systems.

Spaces about battery systems shall comply with 110.26. Working space shall be measured from the edge of the battery cabinet, racks, or trays.

For battery racks, there shall be a minimum clearance of 25 mm (1 in.) between a cell container and any wall or structure on the side not requiring access for maintenance. Battery stands shall be permitted to contact adjacent walls or structures, provided that the battery shelf has a free air space for not less than 90 percent of its length.

Informational Note: Additional space is often needed to accommodate battery hoisting equipment, tray removal, or spill containment.

(D) Top Terminal Batteries.

Where top terminal batteries are installed on tiered racks or on shelves of battery cabinets, working space in accordance with the battery manufacturer's instructions shall be provided between the highest point on a cell and the row, shelf, or ceiling above that point.

Informational Note: IEEE 1187-2013, *IEEE Recommended Practice for Installation Design and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications*, provides guidance for top clearance of valve-regulated lead-acid batteries, which are commonly used in battery cabinets.

(E) Egress.

A personnel door(s) intended for entrance to, and egress from, rooms designated as battery rooms shall open in the direction of egress and shall be equipped with listed panic hardware.

(F) Piping in Battery Rooms.

Gas piping shall not be permitted in dedicated battery rooms.

(G) Illumination.

Illumination shall be provided for working spaces containing battery systems. The lighting outlets shall not be controlled by automatic means only. Additional lighting outlets shall not be required where the

work space is illuminated by an adjacent light source. The location of luminaires shall not:

(1) Expose personnel to energized battery components while performing maintenance on the luminaires in the battery space; or

(2) Create a hazard to the battery upon failure of the luminaire.

480.11 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.

~~706.32~~ 480.12 Battery Interconnections.

Flexible cables, as identified in Article 400, in sizes 2/0 AWG and larger shall be permitted within the battery enclosure from battery terminals to a nearby junction box where they shall be connected to an approved wiring method. Flexible battery cables shall also be permitted between batteries and cells within the battery enclosure. Such cables shall be listed and identified for the environmental conditions~~as moisture resistant~~. Flexible, fine-stranded cables shall only be used with terminals, lugs, devices, or connectors in accordance with 110.14.

480.13 ~~Storage Systems of More Than 100 Volts.~~Ground-Fault Detection

Battery circuits ~~On ESS~~ exceeding 100 volts between the conductors or to ground~~, the battery circuits~~ shall be permitted to operate with ungrounded conductors, provided a ground-fault detector and indicator is installed to monitor for ground faults ~~within the storage system~~.

Commented [TC11]: GLOBAL
PI-2955
Statement: Requirements on Battery Interconnections were relocated from 706.32 to 480.12 since they deal strictly with Batteries.

Commented [TC12]: GLOBAL
Statement: The requirements for ground fault detection for battery circuits are relocated from 706.30(D).

First Revision No. 8980-NFPA 70-2018 [Global Input]

Replace the references to UL 2196 with the following new title.

"ANSI/UL 2196. Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables, **2017 edition"**

For CMP-13, found in these locations: 695.6(A)(2)(d)(2) Informational Note, 695.14(F) Informational Note, 700.10(D)(2)(3) Informational Note, and 708.10(C)(2)(2) Informational Note

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Committee Statement

Committee Statement: The title of UL 2196 has been revised and is being updated to reflect the new title.
Response Message:

First Revision No. 9008-NFPA 70-2018 [Global Input]

See attachment for 706.2 edits.

Supplemental Information

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706.2_Global.docx		

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Committee Statement

Committee Statement: The changes better define an Energy Storage System and provide clarification between an ESS and a UPS system or a large battery system that is used only when power is lost to the building.

The term “matched components” is deleted as it is not defined and is not enforceable.

Deleted the phrase “will generally be manufactured by a single entity” from the definition of energy storage system, self-contained as it is considered unnecessary.

Added language includes major components and the term converter is more general to various technologies than motor generator.

Inverter Input Circuit is used in multiple areas of the NEC and should be relocated to Art. 100.

Inverter Output Circuit is used in multiple areas of the NEC and should be relocated to Art. 100.

Change “standalone” to “stand-alone” to hyphenate the term for consistency.

Battery is relocated to 480.2.

Cell, Container, Electrolyte, Intercell Connection", Intertier Connector, Nominal Voltage (Battery or Cell), Sealed Cell or Battery, and Terminal are being deleted since these are already covered in 480.2.

Parent text is added to 706.2 to provide clarity on the application of the definitions within that section.

Response Message:

Public Input No. 2777-NFPA 70-2017 [Definition: Inverter Utilization Output Circuit.]

Public Input No. 4262-NFPA 70-2017 [Definition: Inverter Output Circuit.]

Public Input No. 4255-NFPA 70-2017 [Definition: Inverter Input Circuit.]

Public Input No. 3840-NFPA 70-2017 [Definition: Energy Storage System, Pre-Engineered of Matche...]

Public Input No. 3265-NFPA 70-2017 [Definition: Energy Storage System, Self-Contained.]

Public Input No. 2776-NFPA 70-2017 [Definition: Energy Storage System, Self-Contained.]

Public Input No. 2987-NFPA 70-2017 [Definition: Energy Storage System (ESS).]

Public Input No. 2869-NFPA 70-2017 [Definition: Energy Storage System (ESS).]

Public Input No. 2981-NFPA 70-2017 [Section No. 706.2]

Public Input No. 2246-NFPA 70-2017 [Section No. 706.2]

PANEL #	13
TG #	4
TG CHAIR	John Kovacik
TG MEMBERS	Garbark, Adams, Gromadzki, Cantor, Froemming, Neeser, Florence, Biason and Scroggins

Section	PI	PAGE	RESOLUTION
706.2	2987 28692869 3840 2776 3265 2981 2777 4255 4262 2246		FR TG4- Statement: The changes better define an Energy Storage System and provide clarification between an ESS and a UPS system or a large battery system that is used only when power is lost to the building. The term “matched components” is deleted as it is not defined and is not enforceable. Deleted the phrase “will generally be manufactured by a single entity” from the definition of energy storage system, self-contained as it is considered unnecessary. Added language includes major components and the term converter is more general to various technologies than motor generator. Inverter Input Circuit is used in multiple areas of the NEC and should be relocated to Art. 100. Inverter Output Circuit is used in multiple areas of the NEC and should be relocated to Art. 100. Change “standalone” to “stand-alone” to hyphenate the term for consistency. Battery is relocated to 480.2. Cell, Container, Electrolyte, Intercell Connection", Intertier Connector, Nominal Voltage (Battery or Cell), Sealed Cell or Battery, and Terminal are being deleted since these are already covered in 480.2. Parent text is added to 706.2 to provide clarity on the application of the definitions within that section.

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

~~**Battery.**~~

~~Two or more cells connected together electrically in series, in parallel, or a combination of both to provide the required operating voltage and current levels.~~

Commented [TC1]: This was relocated to Article 480 and edited per FR-8979

~~**Cell.**~~

~~The basic electrochemical unit, characterized by an anode and a cathode, used to receive, store, and deliver electrical energy.~~

~~**Container.**~~

~~A vessel that holds the plates, electrolyte, and other elements of a single unit, comprised of one or more cells, in a battery. It can be referred to as a jar or case.~~

Diversion Charge Controller.

Equipment that regulates the charging process of an ESS by diverting power from energy storage to direct-current or alternating-current loads or to an interconnected utility service.

~~**Electrolyte.**~~

~~The medium that provides the ion transport mechanism between the positive and negative electrodes of a cell.~~

Energy Storage System (ESS).

One or more components assembled together capable of storing energy ~~for use at a future time. ESS(s) can include but is not limited to batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). These systems can have ac or dc output for utilization and can include inverters and converters to change stored energy into electrical energy.~~and providing electrical energy into the premises wiring system or an electric power production and distribution network.

Informational Note 1: ESS(s) can include but is not limited to batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air).Energy Storage Systems 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 other storage systems such as a UPS system, which is a power supply used to provide alternating current power to a load for some period of time in the event of a power failure.

Energy Storage System, Self-Contained.

Energy storage systems where the components such as cells, batteries, or modules and any necessary controls, ventilation, illumination, fire suppression, inverter or converter, or alarm systems are assembled, installed, and packaged into a singular energy storage container or unit.

> Informational Note: Self-contained systems~~ will generally be manufactured by a single entity~~, tested and listed to safety standards relevant to the system, and readily connected on site to the electrical system and in the case of multiple systems to each other.

Energy Storage System, Pre-Engineered~~ of Matched Components~~.

Energy storage systems that are not self-contained systems but instead are pre-engineered and field-assembled using separate components supplied as a system by a singular entity that are ~~matched and~~ intended to be assembled as an energy storage system at the system installation site.

Informational Note: Pre-engineered systems ~~of matched components~~ for field assembly as a system will generally be designed by a single entity and comprised of components that are tested and listed separately or as an assembly.

Energy Storage System, Other.

Energy storage systems that are not self-contained or pre-engineered systems ~~of matched components~~ but instead are composed of individual components assembled as a system.

Informational Note: Other systems will generally be comprised of different components combined on site to create an ESS. Those components would generally be tested and listed to safety standards relevant to the application.

Flow Battery.

An energy storage component similar to a fuel cell that stores its active materials in the form of two electrolytes external to the reactor interface. When in use, the electrolytes are transferred between reactor and storage tanks.

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

~~**Intercell Connector.**~~

~~An electrically conductive bar or cable used to connect adjacent cells.~~

~~**Intertier Connector.**~~

~~In a battery system, an electrical conductor used to connect two cells on different tiers of the same rack or different shelves of the same rack.~~

~~**Inverter Input Circuit.**~~

~~Conductors between the inverter and the ESS in stand-alone and multimode inverter systems.~~

~~**Inverter Output Circuit.**~~

~~Conductors between the inverter and another electric power production source, such as a utility for an electrical production and distribution network.~~

Commented [TC2]: Move to Article 100

Inverter Utilization Output Circuit.

Conductors between the multimode or ~~standalone~~ stand-alone inverter and utilization equipment.

~~**Nominal Voltage (Battery or Cell).**~~

~~The value assigned to a cell or battery of a given voltage class for the purpose of convenient designation. The operating voltage of the cell or battery may vary above or below this value.~~

~~**Sealed Cell or Battery.**~~

~~A cell or battery that has no provision for the routine addition of water or electrolyte or for external measurement of electrolyte specific gravity.~~

~~Informational Note: Some cells that are considered to be sealed under conditions of normal use, such as valve-regulated lead-acid or some lithium cells, contain pressure relief valves.~~

~~**Terminal.**~~

~~That part of a cell, container, or battery to which an external connection is made (commonly identified as a post, pillar, pole, or terminal post).~~

First Revision No. 8865-NFPA 70-2018 [Detail]

701.12(I)

(I) **DC Microgrid Systems.**

Sources connected to a dc microgrid system shall be permitted where the system is capable of being isolated from all nonlegally required sources.

A dc microgrid system used as a source of power for legally required systems shall be of suitable rating and capacity to supply and maintain the total legally required load for not less than 2 hours of full-demand operation.

Where a dc microgrid system source serves as the normal supply for the building or group of buildings concerned, it shall not serve as the sole source of power for the legally required standby system.

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Committee Statement

Committee Statement: A new first level subdivision is added to 701.12 clarify that a DC microgrid system that includes multiple sources and is separate from the normal source of supply is permitted as a legally required source. A requirement for handling the full legally required load is added to correlate with similar requirements for fuel cells. Additional text is added to clarify that where a DC microgrid system source serves as the normal supply for the building or group of buildings, it is not permitted to serve as the sole source of power for the legally required standby system.

Response Message:

First Revision No. 8868-NFPA 70-2018 [Detail]

In 712.2, change the title and definition of Resistively Grounded to:

Functional Grounded.

A system that has an electrical reference to ground that is not solidly grounded.

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Committee Statement

Committee Statement: The definition has been updated to correlate with a similar definition used in Article 690. The term “functionally” is changed to “functional” to correlate with the use of the term throughout the document.

The CMP requests that the Correlating Committee review this action and any changes to the defined term “functional grounded PV system” in section 690.2.

Response Message:

Public Input No. 3865-NFPA 70-2017 [Article 712]

First Revision No. 8874-NFPA 70-2018 [Detail]

In 445.18 change title to:

Disconnecting Means and Emergency Stop Switch

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Committee Statement

Committee Statement: This revision aligns with the addition of (D) First Responder Shutdown Means in One and Two-Family Dwelling Units to 445.18. See FR 7846
Response Message:

First Revision No. 8875-NFPA 70-2018 [Detail]

Add following sentence to 480.2 after "Definitions."

The definitions in this section shall apply only within this article.

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Committee Statement

Committee Statement: Parent text is added to clarify the application of definitions in the XXX.2 section to correlate with the global effort to provide clarity.

Response Message:

Public Input No. 1220-NFPA 70-2017 [Section No. 480.2]

First Revision No. 8956-NFPA 70-2018 [Detail]

Article 706

Part II needs to be renumbered to Part IV

706.20 needs to be renumbered to 706.30

706.21 needs to be renumbered to 706.31

703.23 needs to be renumbered to 706.33

Part IV needs to be renumbered to Part V

Part V needs to be renumbered to Part VI

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Committee Statement

Committee Statement: This revision is editorial.
Response Message:

First Revision No. 9001-NFPA 70-2018 [Detail]

In 708.1, remove Informational Note 4, which references NFPA 99, and renumber the remaining notes.

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Committee Statement

Committee Statement: The informational note referencing NFPA 99 is not relevant in Article 708 and is deleted.
Response Message:

First Revision No. 7775-NFPA 70-2018 [Section No. 455.2]

455.2 Definitions.

Manufactured Phase.

This definition shall apply within this article and throughout the *Code* .

The ~~manufactured or derived~~ phase that originates at the phase converter and is not solidly connected to either of the single-phase input conductors.

Phase Converter.

This definition shall apply within this article and throughout the *Code* .

An electrical device that converts single-phase power to 3-phase electric power.

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.

Rotary-Phase Converter.

This definition shall apply only within this article.

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.

Static-Phase Converter.

This definition shall apply only within this article.

A device without rotating parts, sized for a given 3-phase load to permit operation from a single-phase supply.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 09:21:45 EST 2018

Committee Statement

Committee Statement: This revision is part of a global effort to provide clarity and usability of definitions that are in the XXX.2 section of Articles.

Response Message:

Public Input No. 2239-NFPA 70-2017 [Section No. 455.2]

First Revision No. 7502-NFPA 70-2018 [Definition: Luminaire, Directly Controlled.]

Emergency Luminaire, Directly Controlled.

An emergency luminaire that has a control input for an integral dimming or switching function that drives the luminaire to ~~full~~ the required illumination level upon loss of normal power.

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

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 08 08:38:52 EST 2018

Committee Statement

Committee Statement: This revision narrows the scope of the definition added in the 2017 revision cycle. As modified it refers only to those directly-controlled luminaires which are used for emergency lighting. This revision also recognizes that in all cases it may not be necessary to drive the luminaire to the full brightness capability of the emergency luminaire.

Response Message:

Public Input No. 1634-NFPA 70-2017 [Definition: Luminaire, Directly Controlled.]

First Revision No. 7503-NFPA 70-2018 [Section No. 700.3(B)]

(B) Tested Periodically.

Systems shall be tested periodically on a schedule ~~acceptable to~~ approved by the authority having jurisdiction to ensure the systems are maintained in proper operating condition.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 08 08:48:45 EST 2018

Committee Statement

Committee Statement: The term “acceptable” is not defined. This revision is editorial in nature and uses the defined term “approved” for clarity.

Response Message:

Public Input No. 378-NFPA 70-2017 [Section No. 700.3(B)]

First Revision No. 7508-NFPA 70-2018 [Section No. 700.6(B)]

(B) Carrying Load.

To indicate that the ~~battery~~ emergency source is carrying load.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 08 09:17:38 EST 2018

Committee Statement

Committee Statement: This revision is editorial in nature and provides correlation with 701.6(B). The required signal must indicate that the “emergency source” is carrying load.

Response Message:

Public Input No. 1885-NFPA 70-2017 [Section No. 700.6(B)]

First Revision No. 7509-NFPA 70-2018 [Section No. 700.6(D)]

(D) Ground Fault.

To 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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 08 09:19:37 EST 2018

Committee Statement

Committee Statement: The permission to locate the ground fault sensing device necessitates an alternative location for the system bonding jumper and this revision provides necessary clarity.

Note that this change should also be applied in Article 701.6(D).

Response Message:

Public Input No. 3537-NFPA 70-2017 [Section No. 700.6(D)]

First Revision No. 7969-NFPA 70-2018 [Section No. 706.23(A)]

(A) General.

Provisions shall be provided to control the charging process of the ESS. All adjustable means for control of the charging process shall be accessible only to qualified persons.

~~Informational Note: Certain types of energy storage equipment such as valve-regulated lead acid or nickel cadmium can experience thermal failure when overcharged.~~

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 11 13:52:11 EST 2018

Committee Statement

Committee Statement: The IN is deleted. Although accurate, it only calls out a small segment of battery chemistries. Many hazards exist in charging other types of battery chemistries, far too many to cover in an IN.

Response Message:

Public Input No. 3794-NFPA 70-2017 [Section No. 706.23(A)]

First Revision No. 7719-NFPA 70-2018 [Definition: Electric Power Production and Distribution Netw...]

Electric Power Production and Distribution Network.

Power production, distribution, and utilization equipment and facilities, such as electric utility systems that ~~deliver electric power to the connected loads, that~~ are connected to premises wiring and are external to and not controlled by an interactive system. (CMP-13)

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 18:34:56 EST 2018

Committee Statement

Committee Statement: The definition was revised to clarify that an electric power production and distribution network includes the associated equipment, facilities, and wiring.

Response Message:

Public Input No. 3306-NFPA 70-2017 [Definition: Electric Power Production and Distribution Netw...]

First Revision No. 7750-NFPA 70-2018 [Definition: Interactive Inverter.]

Interactive Inverter.

An inverter intended for use in parallel with power source(s) such as an electric utility to supply common loads ~~that may deliver power to the utility~~ . (CMP-13)

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 08:07:00 EST 2018

Committee Statement

Committee Statement: This revision is editorial and provides clarity in the definition of Interactive Inverter. Loads do not supply power. Interactive inverters can be interactive with any appropriate ac source, not just sources generated by a public utility. It is understood that interactive inverters may deliver power to the utility. This revision also recognizes the evolution of interactive inverter types that may warrant separate definitions.

Response Message:

Public Input No. 4316-NFPA 70-2017 [Definition: Interactive Inverter.]

First Revision No. 8981-NFPA 70-2018 [Definition: Switch, Bypass Isolation.]

Switch, Bypass Isolation.

~~A manually operated~~ An automatic or a nonautomatic 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)

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 24 17:29:47 EST 2018

Committee Statement

Committee Statement: Bypass isolation switches used in conjunction with transfer switches can be automatic or nonautomatic and the definition should reflect what is available.
Response Message:

First Revision No. 7886-NFPA 70-2018 [New Definition after Definition: Pressurized [as applied to...]

Prime Mover.

The machine that supplies the mechanical horsepower of a generator. (CMP-13)

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 20:36:08 EST 2018

Committee Statement

Committee Statement: A definition of Prime Mover was added to improve clarity in application of the code. The term is used in several articles and therefore included in the general definitions of Article 100.

Response Message:

Public Input No. 3400-NFPA 70-2017 [Part I.]

First Revision No. 7720-NFPA 70-2018 [Section No. 445.11]

445.11 Marking.

Each generator shall be provided with a nameplate giving the manufacturer's name, the rated frequency, the number of phases if ac, the rating in kilowatts or kilovolt-amperes, the power factor, the normal volts and amperes corresponding to the rating, the rated ambient temperature, and either the rated temperature rise or the insulation system class .

Nameplates or manufacturer's instructions shall provide the following information for all stationary generators and portable generators rated more than 15 kW:

(1) Subtransient, transient, synchronous, and zero sequence reactances

(2) Power rating category

(3) Insulation system class

(4) Indication if the generator is protected against overload by inherent design, an overcurrent protective relay, circuit breaker, or fuse

(5) Maximum ~~short-circuit~~ 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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 18:44:37 EST 2018

Committee Statement

Committee Statement: 445.11 is updated to reflect the proper term "Available fault current".

Revisions are also made to allow for marking either the rated temperature rise or the insulation system class to correlate with similar marking requirements for motors in Article 430.

Response Message:

Public Input No. 1256-NFPA 70-2017 [Section No. 445.11]

Public Input No. 2056-NFPA 70-2017 [Section No. 445.11]

First Revision No. 7770-NFPA 70-2018 [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 lockable ~~in the~~ open ~~position~~ in accordance with 110.25.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 08:51:29 EST 2018

Committee Statement

Committee Statement: The present language “lockable in the open position” is updated to “lockable open" to correlate with the terminology used section 110.25.

Response Message:

Public Input No. 1576-NFPA 70-2017 [Section No. 445.18(A)]

First Revision No. 7846-NFPA 70-2018 [New Section after 445.18(C)]

(D) First Responder Shutdown Means in One- and Two-Family Dwelling Units.

For other than cord-and-plug-connected portable generators, a means to shut down the prime mover shall be located outside the dwelling unit at a readily accessible location. Where the shutdown means required in 445.18(B) is outdoors in a readily accessible location, an additional shutdown means shall not be required.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 14:40:43 EST 2018

Committee Statement

Committee Statement: This revision adds requirements for a means to shutdown the prime mover of other than cord and plug connected generators in one and two family dwellings. This is necessary for the fire service and other first responders to secure on-site power sources during emergencies.

Response Message:

Public Input No. 5-NFPA 70-2017 [Section No. 445.18(B)]

Public Input No. 3772-NFPA 70-2017 [Section No. 445.18(B)]

Public Input No. 4195-NFPA 70-2017 [Section No. 445.18(B)]

First Revision No. 8089-NFPA 70-2018 [Section No. 480.7]

480.7 DC Disconnect Methods.

(A) Disconnecting Means.

A disconnecting means shall be provided for all ungrounded conductors derived from a stationary battery system with a voltage over 60 volts dc. A disconnecting means shall be readily accessible and located within sight of the battery system.

For one-family and two-family dwellings, a disconnecting means or its remote control shall be located at a readily accessible location outside the building for use by first responders.

Informational Note: See 240.21(H) for information on the location of the overcurrent device for battery conductors.

Global FR-8979

(B) Disconnection of Series Battery Circuits.

Battery circuits ~~subject to field servicing, where exceeding~~ 240 volts 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 nominal for maintenance by qualified persons. Non–load-break bolted or plug-in disconnects shall be permitted.

(C) 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 battery system, the disconnecting means shall be capable of being locked in the open position, in accordance with 110.25, and the location of the controls shall be field marked on the disconnecting means.

(D) Busway.

Where a DC busway system is installed, the disconnecting means shall be permitted to be incorporated into the busway.

(E) Notification.

The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the battery if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:

(1) Nominal battery voltage

(2) ~~Maximum available~~ Available fault short-circuit current derived from the stationary battery system

(3) An arc flash label applied in accordance with acceptable industry practice

(4) Date the ~~short-circuit current~~ calculation was performed

(4) ~~The battery disconnecting means shall be marked in accordance with 110.16 .~~

Informational Note No. 1: Battery equipment suppliers can provide information about ~~short-circuit~~ available fault current on any particular battery model.

Informational Note No. 2: ~~The available short-circuit current marking(s) addressed in 480.7(D)(2) is related to required short-circuit current ratings of equipment.~~ *NFPA 70E*-2015, *Standard for Electrical Safety in the Workplace*, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment.

(F) Identification of Power Sources.

Battery systems shall be indicated by 480.7(F)(1) and (F)(2).

(1) Facilities with Utility Services and Battery Systems.

Plaques or directories shall be installed in accordance with 705.10 and 712.10(A).

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 outside a building or structure supplied by a stand-alone system located at each service equipment location or at an approved readily visible location. The plaque or directory shall denote the location of each power source disconnecting means on or in the premises or be grouped with other plaques or directories for other on-site sources.

Exception: This requirement does not apply where a disconnect in 480.7(A) is not required.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 12 14:47:42 EST 2018

Committee Statement

Committee Statement: The following revisions were made.

A requirement was added for one-family and two-family dwellings, that a disconnecting means or its remote control shall be located at a readily accessible location outside the building This disconnect would be for use by first responders when arriving on-site to ensure a safe and complete shutdown of the battery system before approaching the system or entering the building.

Subsections were renumbered due to reorganization. Also see Global FR-

In 480.7(D now E) “Maximum available short-circuit current” is changed to “Available fault current” and “short-circuit current” is changed to “available fault current” to be consistent with similar changes throughout the NEC.

A new 480.7(F) was added to address ongoing concerns expressed by the fire service and other first responders on the need to secure on-site power sources during emergencies and awareness of where those sources are. Directories provide warning and location awareness of on-site battery sources. Requirements for plaques and directories already exists, hence pointing to Articles 705 and 712 minimizes language redundancy. An exception was added tied to the scope of 480.7(A) – Disconnecting Means, to only require plaques or directories if a disconnecting means is required per 480.7(A).

Disconnect marking requirements are modified to correlate with similar requirements in Article 706 for consistency.

Response Message:

Public Input No. 3770-NFPA 70-2017 [Section No. 480.7(A)]

Public Input No. 1257-NFPA 70-2017 [Section No. 480.7(D)]

Public Input No. 3729-NFPA 70-2017 [New Section after 480.7(D)]

First Revision No. 7721-NFPA 70-2018 [Section No. 695.2]

695.2 Definitions.

The definitions in this section shall only apply within this article.

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.

On-Site Power Production Facility.

The normal supply of electric power for the site that is expected to be constantly producing power.

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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 18:49:39 EST 2018

Committee Statement

Committee Statement: New parent text is proposed for these sections to increase clarity and usability. Section 695.2 contains definitions which only apply to this article.

Response Message:

Public Input No. 1969-NFPA 70-2017 [Section No. 695.2]

First Revision No. 7722-NFPA 70-2018 [Section No. 695.3(B)]

(B) Multiple Sources.

If reliable power cannot be obtained from a source described in 695.3(A), power shall be supplied by one of the following: [**20:**9.3.2]

(1) Individual Sources.

An approved combination of two or more of the sources from 695.3(A).

(2) Individual Source and On-site Standby Generator.

An approved combination of one or more of the sources in 695.3(A) and an on-site standby generator complying with 695.3(D). [**20:**9.3.4]

*Exception to 695.3(B)(1) and (B)(2): An alternate source of power shall not be required where a back-up engine-driven ~~or~~ fire pump, back-up steam turbine-driven fire pump ~~is installed.~~ ~~[**20:** 9.3.3]~~ , or back-up electric motor-driven fire pump with an independent power source in accordance with 695.3(A) or (C) is installed.*

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 18:52:15 EST 2018

Committee Statement

Committee Statement: The requirements of this section were revised to include a back-up electric motor-driven fire pump supplied by an independent normal source to the existing exceptions to Section 695.3(B)(1) and 695.3(B)(2). Section 9.3.3 of NFPA 20 permits this system arrangement in lieu of multiple sources for a fire pump supply.

Response Message:

Public Input No. 1493-NFPA 70-2017 [Section No. 695.3(B)(2)]

First Revision No. 7729-NFPA 70-2018 [Section No. 695.3(C)(3)]

(3) Selective Coordination.

The overcurrent protective device(s) in each disconnecting means shall be selectively coordinated with ~~any other~~ all supply-side overcurrent protective device(s).

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, maintain, and operate the system.

Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 23:02:17 EST 2018

Committee Statement

Committee Statement: This section was revised to clarify the qualifications for those providing selective coordination and the necessary documentation to ensure the installation complies with the selective coordination design. A revision was made to address system connections in which selective coordination does not provide benefit to system performance.

Response Message:

Public Input No. 2085-NFPA 70-2017 [Section No. 695.3(C)(3)]

First Revision No. 7672-NFPA 70-2018 [Section No. 695.4(B)(2)]

(2) Overcurrent Device Selection.

Overcurrent devices shall comply with 695.4(B)(2)(a) or (B)(2) (b).

(a) *Individual Sources.* Overcurrent protection for individual sources shall comply with ~~695.4(B)(2)(a)(1) or (2).~~ the following:

(1) Overcurrent protective device(s) shall be rated to carry indefinitely the sum of the locked-rotor current of the largest fire pump motor and the ~~pressure maintenance pump motor(s) and the~~ full-load current of all of the other pump motors and ~~associated fire pump~~ accessory equipment ~~when connected to this power supply.~~ . [**20:** 9.2.3.4] Where the locked-rotor current value does not correspond to a standard overcurrent device size, the next standard overcurrent device size shall be used in accordance with 240.6. The requirement to carry the locked-rotor currents indefinitely shall not apply to conductors or devices other than overcurrent devices in the fire pump motor circuit(s).

Exception: The requirement to carry the locked-rotor currents indefinitely shall not apply to feeder overcurrent protective devices installed in accordance with 695.3(C). ~~*[20: 9.2.3.4]*~~

(2) Overcurrent protection shall be provided by an assembly listed for fire pump service and complying with the following:

a. The overcurrent protective device shall not open within 2 minutes at 600 percent of the full-load current of the fire pump motor(s).

b. The overcurrent protective device shall not open with a re-start transient of 24 times the full-load current of the fire pump motor(s).

c. The overcurrent protective device shall not open within 10 minutes at 300 percent of the full-load current of the fire pump motor(s).

d. The trip point for circuit breakers shall not be field adjustable. [**20:**9.2.3.4.1]

(b) *On-Site Standby Generators.* Overcurrent protective devices between an on-site standby generator and a fire pump controller shall be selected and sized to allow for instantaneous pickup of the full pump room load, but shall not be larger than the value selected to comply with 430.62 to provide short-circuit protection only. [**20:**9.6.1.1]

Supplemental Information

File Name	Description	Approved
Article_695_TG_2_Draft_edited_KC.doc	See 695.4(B)(2) for track changes on the proposed edits. For staff use	
FR7672.docx	Clean text--For staff use	

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 14:08:46 EST 2018

Committee Statement

Committee Statement: The overcurrent device requirements for individual sources was revised for clarity and better alignment with NFPA 20. The last sentence of 695.4(B)(2)(a)(1) was moved into a new exception to provide clarity for installations installed in accordance with 695.3(C).

Response Message:

Public Input No. 3190-NFPA 70-2017 [Section No. 695.4(B)(2)]

First Revision No. 7730-NFPA 70-2018 [Section No. 695.6(A)]

(A) Supply Conductors.

(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.

Global FR-8980

(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.) of concrete.

b. The cable or raceway is a listed fire-resistive cable system.

Informational Note No. 1: Fire-resistive cables are tested to ANSI/UL ~~2196~~2196-2017, ~~*Tests for Fire Resistive Cables*~~ *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*.

Informational Note No. 2: 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 a listed electrical circuit protective system.

Informational Note No. 1: Electrical circuit protective systems could include, but are not limited to, thermal barriers or a protective shaft and are tested in accordance with UL 1724, *Fire Tests for Electrical Circuit Protection Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems on proper installation requirements to maintain the fire rating.

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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:

City:

State:

Zip:

Submittal Date: Tue Jan 09 23:13:35 EST 2018

Committee Statement

Committee Statement: A new exception was added to the requirements for conductors supplied by service and on-site power production facilities to clarify when the requirements of 230.6(1) or (2) apply. An informational note was also added to remind users of the requirement in 250.24(C) for routing the grounded conductor to the service equipment for the fire pump.

Response Message:

Public Input No. 3126-NFPA 70-2017 [Section No. 695.6(A)(1)]

Public Input No. 1446-NFPA 70-2017 [New Section after 695.6(A)(1)]

First Revision No. 7677-NFPA 70-2018 [Section No. 695.6(I)]

(I) Junction Boxes.

Where fire pump wiring to or from a fire pump controller is routed through a junction box, the following requirements shall be met:

(1) The junction box shall be securely mounted. [**20:**9.7(1)]

(2) Mounting and installing of a junction box shall not violate the enclosure type rating of the fire pump controller(s). [**20:**9.7(2)]

(3) Mounting and installing of a junction box shall not violate the integrity of the fire pump controller(s) and shall not affect the short-circuit current rating of the controller(s). [~~**20:** 9.7(3)~~]

(4) As a minimum, a Type 2, drip-proof enclosure (junction box) shall be used where installed in the fire pump room. The enclosure shall be listed to match the fire pump controller enclosure type rating. [**20:**9.7(4)]

(5) Terminals, junction blocks, wire connectors, and splices, where used, shall be listed. [**20:**9.7(5)]

(6) A fire pump controller or fire pump power transfer switch, where provided, shall not be used as a junction box to supply other equipment, including a pressure maintenance (jockey) pump(s).

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 14:47:20 EST 2018

Committee Statement

Committee Statement: This revision editorially corrects item (3) to the correct term, short-circuit current rating.

Response Message:

Public Input No. 1287-NFPA 70-2017 [Section No. 695.6(I)]

First Revision No. 7679-NFPA 70-2018 [Section No. 695.6(J)]

(J) ~~Raceway~~ Terminations.

Where raceways or cable are terminated at a fire pump controller, the following requirements shall be met: [**20:** ~~9.9~~]

(1) Listed ~~conduit hubs~~ raceway or cable fittings shall be used. [**20:** ~~9.9.1~~]

(2) The type rating of the ~~conduit hub(s)~~ raceway or cable fittings shall be at least equal to that of the fire pump controller. [**20:** ~~9.9.2~~]

(3) The installation instructions of the manufacturer of the fire pump controller shall be followed. [**20:**9.9.3]

(4) Alterations to the fire pump controller, other than ~~conduit entry~~ raceway or cable terminations as allowed elsewhere in this *Code*, shall be approved by the authority having jurisdiction. [**20:** ~~9.9.4~~]

Supplemental Information

File Name	Description	Approved
Article_695_TG_2_Draft_edited_KC.doc	See track changes for 695.6(J)--for staff use	
Panel_13_FR-7679_695.6_J_leg_changes.docx	FINAL--for production use	

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 14:50:30 EST 2018

Committee Statement

Committee Statement: The allowable wiring methods in 695.6(D) and Section 9.4.4.1 of NFPA 20 do not align with the requirement to use conduit hubs for raceway terminations. Cable fittings that are listed for the wiring method used and with a type rating at least equal to that of the fire pump controller are appropriate for these installations. Editorial revisions were made to address the use of the terms “raceway,” “conduit,” and “cable”

Response Message:

Public Input No. 630-NFPA 70-2017 [Section No. 695.6(J)]

Public Input No. 2850-NFPA 70-2017 [Section No. 695.6(J)]

First Revision No. 7732-NFPA 70-2018 [Section No. 695.14(F)]

Global FR-8980

(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 control wiring shall be continuously monitored. Loss of integrity of the remote start circuit(s) shall initiate visual and audible annunciation of generator malfunction at the generator local and remote annunciator(s) and start the generator(s).

Informational Note: See NFPA 20-~~2013~~2016, *Standard for the Installation of Stationary Pumps for Fire Protection*, Section 3.3.7.2, for more information on fault-tolerant external control circuits.

The control conductors shall be protected to resist potential damage by fire or structural failure. ~~They shall be permitted to be~~Where routed through a ~~building(s)~~building, the conductors shall be protected from fire for 2 hours using one of the following methods:

(1) ~~Be~~The cable or raceway is encased in a minimum 50 mm (2 in.) of concrete.

(2) ~~Be protected by a fire-rated assembly listed to achieve a minimum fire rating of 2 hours and dedicated to the fire pump circuits.~~The cable or raceway is a listed fire-resistive cable system.

Informational Note No. 1: Fire-resistive cables are tested to ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*, 2017 edition.

Informational Note No. 2: The listing organization provides information for fire-resistive cable systems on proper installation requirements to maintain the fire rating.

(3) ~~Be~~The cable or raceway is protected by a listed electrical circuit protective system ~~with a minimum 2-hour fire rating. The installation shall comply with any restrictions provided in the listing of the electrical circuit protective system used.~~.

Informational Note No. 1: Electrical circuit protective systems could include, but are not limited to, thermal barriers or a protective shaft and are tested in accordance with UL 1724, *Fire Tests for Electrical Circuit Protection Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems on proper installation requirements to maintain the fire rating.

Supplemental Information

File Name	Description	Approved
Panel_13_FR-7732_695.14_F_leg_changes.docx	For staff use	

Submitter Information Verification

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Submittal Date: Tue Jan 09 23:19:55 EST 2018

Committee Statement

Committee Statement: Control conductors for generators need to be protected to resist damage with requirements matching that of 695.6(A)(2)(d) when routed inside of a building. Revisions to this section clarify the intent of the CMP. The generator remote start circuit must be monitored for broken, disconnected, or shorted wires, and the generator must start where the circuit is compromised. The revisions to (3) clarify that the cable or raceway does not provide the protection. The system around the raceway or cable offers the protection.

Response Message:

Public Input No. 3466-NFPA 70-2017 [Section No. 695.14(F)]

Public Input No. 2639-NFPA 70-2017 [Section No. 695.14(F)]

Public Input No. 676-NFPA 70-2017 [Section No. 695.14(F)]

First Revision No. 8093-NFPA 70-2018 [Definitions (700.2): Branch Circ... to Emergency S...]

Branch-Circuit Emergency Lighting Transfer Switch.

This definition shall apply only within this article.

A device connected on the load side of a branch-circuit overcurrent protective device that transfers only emergency lighting loads from the normal supply to an emergency supply.

Informational Note: See ANSI/UL 1008, *Transfer Switch Equipment*, for information covering branch-circuit emergency lighting transfer switches.

Emergency Systems.

This definition shall apply within this article and throughout the *Code* .

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.

Informational Note: 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.

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Submitter Full Name: NEC-CMP Panel 13
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Submittal Date: Fri Jan 12 15:08:24 EST 2018

Committee Statement and Meeting Notes

Committee Statement: This revision is added as part of a global effort within this code to provide clarity and usability of terms defined within this code. The NEC Style Manual in section 2.2.2.1, clearly states that:

“In general, Article 100 shall contain definitions of terms that appear in two or more other articles of the NEC.” And;

Section 2.2.2.2 clearly states that other Articles may contain definitions. Where this occurs, the definition(s) shall be in the second section.

There are many defined terms that are used throughout this code that are located in the XXX.2 section of different Articles. Examples include but are not limited to definitions for: MC cable in Article 330, RMC in Article 344, Emergency Systems in Article 700, Legally Required Standby Systems in Article 701 and Optional Standby systems in Article 702. The logical location for each of these defined terms (and many more) are in the XXX.2 section of the respective Article.

This global effort correlates with the NEC Style Manual requirements and provides significant clarity with respect to the application of defined terms in the XXX.2 sections of Articles throughout the code.

CMP-13 requests that the NEC Correlating Committee review these global actions and provide CC comments where necessary.

Response Message:

Committee Notes:

Date	Submitted By	
Jan 12, 2018	NEC-CMP Panel 13	Sections (A) and (B) are being added directly under 700.2 Definitions. The definitions for emergency systems and branch circuit emergency lighting switch are not being changed, just moved to the appropriate new sub-level (A) and (B)

Public Input No. 2245-NFPA 70-2017 [Section No. 700.2]

Editorial Comment

Click here

First Revision No. 8898-NFPA 70-2018 [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, which 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.

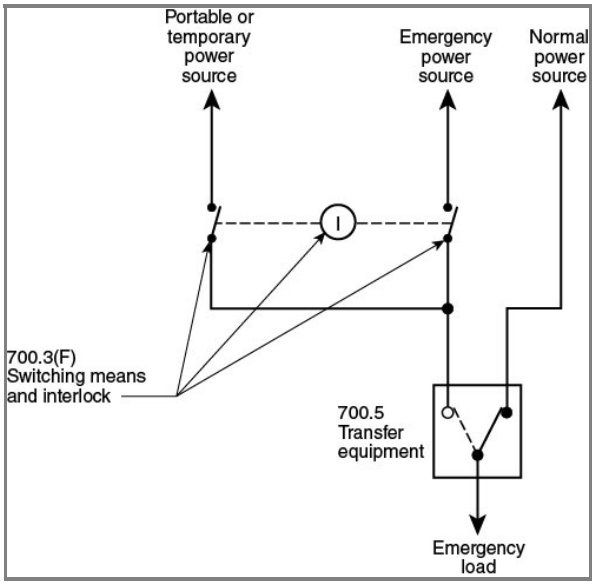
(4) Mechanical or electrical interlocking shall prevent inadvertent interconnection of power sources.

(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.

It shall be permissible to utilize manual switching to switch from the permanent source of power to the portable or temporary alternate source of power and to utilize the switching means for connection of a load bank.

Informational Note: There are many possible methods to achieve the requirements of 700.3(F). See Figure Informational Note 700.3(F) for one example.

Figure Informational Note 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 ~~suppression~~ 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.

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Committee Statement

Committee Statement: The IBC and the IFC, and NFPA 5000 use and define the term "fire protection system", none of them use or define "fire suppression system". A fire suppression system is a fire protection system.
Response Message:

First Revision No. 7505-NFPA 70-2018 [Section No. 700.4]

700.4 Capacity and Rating .

(A) ~~Capacity and~~ Rating.

~~An emergency system shall have adequate capacity and rating for all loads to be operated simultaneously.~~ The emergency system equipment shall be suitable for the ~~maximum~~ available fault current at its terminals.

(B) Capacity.

An emergency system shall have adequate capacity in accordance with Article 220.

(C) Selective Load Pickup, Load Shedding, and Peak Load Shaving.

The alternate power source shall be permitted to supply emergency, legally required standby, and optional standby system loads where the source has adequate capacity or where automatic selective load pickup and load shedding is provided as needed to ensure adequate power to (1) the emergency circuits, (2) the legally required standby circuits, and (3) the optional standby circuits, in that order of priority. The alternate power source shall be permitted to be used for peak load shaving, provided these conditions are met.

Peak load shaving operation shall be permitted for satisfying the test requirement of 700.3(B), provided all other conditions of 700.3 are met.

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Committee Statement

Committee Statement: The first sentence in 700.4(A) is deleted and a new first level subdivision (B) is added to address capacity. For clarity, this requirement is revised with a reference to Article 220. The section title and first level subdivision (A) titled are modified for clarity and usability.

Additionally, the term “maximum” is deleted for clarity. This revision is part of a global effort in this code to correlate the use of the terms, short circuit current, fault current, and the fuse of the terms available and maximum.

This revision is based upon favorable action on public inputs 1247 and 1248 under the purview of CMP-10. Action on these public inputs to add a new definition of “Fault Current” and a new definition for “Available Fault Current” will be reviewed by the committee during the public comment stage.

CMP-13 requests that the correlating committee review the actions on all related public inputs and provide correlating committee notes where necessary.

Response Message:

Public Input No. 248-NFPA 70-2017 [Section No. 700.4(A)]

Public Input No. 1288-NFPA 70-2017 [Section No. 700.4(A)]

First Revision No. 7507-NFPA 70-2018 [Section No. 700.5]

700.5 Transfer Equipment.

(A) General.

Transfer equipment~~, including automatic transfer switches,~~ shall be automatic, ~~identified~~ listed, and marked for emergency use, and approved by the authority having jurisdiction. 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 Switches.

Means shall be permitted to bypass and isolate the transfer equipment. Where bypass isolation switches are used, inadvertent parallel operation shall be avoided.

(C) Automatic Transfer Switches.

Automatic transfer switches shall be electrically operated and mechanically held. ~~Automatic transfer switches shall be listed for emergency system use.~~

(D) Use.

Transfer equipment shall supply only emergency loads.

(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.

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Committee Statement

Committee Statement: As transfer equipment suitable for emergency use must be automatic, the phrase “including automatic transfer switches” is redundant. The requirement for the transfer switch to be listed and marked is deleted in first level subdivision 700.5(C) and is relocated into first level subdivision 700.5(A) for clarity.

A new last sentence is added to clarify that meter mounted transfer switches are not permitted for use in emergency systems.

Response Message:

Public Input No. 1812-NFPA 70-2017 [Section No. 700.5(A)]

Public Input No. 3475-NFPA 70-2017 [Section No. 700.5(A)]

First Revision No. 8899-NFPA 70-2018 [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 700.10(B)(1) through (B) (5):

(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 from an emergency source to supply emergency and other (nonemergency) loads in accordance with 700.10(B)(5)a., (B)(5) b., (B)(5) c., and (B)(5) d. as follows:

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: For further information, see Informational Note Figure 700.10(B)(a) and Informational Note Figure 700.10(B)(b).

Figure Informational Note Figure 700.10(B)(a) Single or Multiple Feeders ~~without~~ Without Overcurrent Protection.

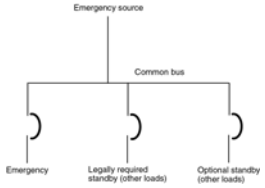
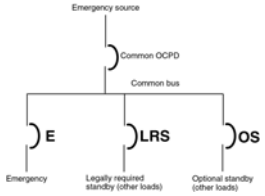


Figure Informational Note Figure 700.10(B)(b) Single or Multiple Feeders with Overcurrent Protection.



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 utilize 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.

Wiring of two or more emergency circuits supplied from the same source shall be permitted in the same raceway, cable, box, or cabinet.

Supplemental Information

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Committee Statement

Committee Statement: This revision is editorial in nature and provides clarity to 700.10(B).
Response Message:

First Revision No. 7658-NFPA 70-2018 [Section No. 700.10(D)]

(D) Fire Protection.

(1) Occupancies.

Emergency systems shall meet the additional requirements in ~~(D)(1)~~ 700.10(D)(2) through ~~(D)(3)~~ (D)(4) in the following occupancies:

(1) Assembly occupancies for not less than 1000 persons

(2) Buildings above 23 m (75 ft) in height

(2) ~~Health care occupancies where persons are not capable of self preservation~~

(3) Educational occupancies with more than 300 occupants

Global FR-8980

(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 ~~suppression~~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: Electrical circuit protective systems could include but not be limited to thermal barriers or a protective shaft and are tested to UL 1724, *Fire Tests for Electrical Circuit Protection Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems on proper installation requirements to maintain the fire rating.

(3) The cable or raceway is a listed fire-resistive cable system with a minimum 2-hour fire rating.

Informational Note No. 1: Fire-resistive cables are tested to ~~ANSI/UL 2196, *Tests for Fire Resistive Cables*~~ ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*.

Informational Note No. 2: The listing organization provides information for fire-resistive cable systems on proper installation requirements to maintain the fire rating.

(4) The cable or raceway is 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 ~~suppression systems (including sprinklers, carbon dioxide systems)~~ protection system or in spaces with a 2-hour fire resistance rating.

(4) Generator Control Wiring.

Control conductors installed between the transfer equipment and the emergency generator shall be kept entirely independent of all other wiring and shall meet the conditions of 700.10(D)(2). The integrity of the generator ~~control wiring~~ remote start circuit shall be ~~continuously~~ monitored for broken, disconnected, or shorted wires. Loss of integrity ~~of the remote start circuit(s) shall initiate visual and audible annunciation of generator malfunction at the generator local and remote annunciator(s) and~~ shall start the generator(s).

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Committee Statement

Committee Statement: This revision is adds a new second level subdisvion title for clarity.

The IBC and the IFC, and NFPA 5000 use and define the term "fire protection system", none of them use or define "fire suppression system". A fire suppression system is a fire protection system.

Existing 700.10(D) list item (3) addressing “health care occupancies where persons are not capable of self-preservation” is deleted to resolve conflicts between this section and NFPA 99. See TIA log 17-8.

The revision to Generator Control Wiring clarifies the intent of the committee. The generator remote start circuit must be monitored for broken, disconnected, or shorted wires and the generator must start where the circuit is compromised.

Response Message:

Public Input No. 2640-NFPA 70-2017 [Section No. 700.10(D)(3)]

Public Input No. 3732-NFPA 70-2017 [Section No. 700.10(D)(1)]

Public Input No. 3462-NFPA 70-2017 [Section No. 700.10(D)(3)]

Public Input No. 1268-NFPA 70-2017 [Section No. 700.10(D)(1)]

First Revision No. 8095-NFPA 70-2018 [Section No. 700.12]

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 ~~(E)~~ (H) . Unit equipment in accordance with 700.12(I) 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 ~~(E)~~ (H) shall be installed either in spaces fully protected by approved automatic fire ~~suppression systems (sprinklers, carbon dioxide systems, and so forth)~~ protection systems or in spaces with a ~~1-hour~~ 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 with any of the following occupancy classes — assembly, educational, residential, detention and correctional, business, and mercantile

(2) ~~Health care occupancies where persons are not capable of self-preservation~~

(3) Educational occupancies with more than 300 occupants

Informational Note No. 1: For the definition of *Occupancy Classification*, see Section 6.1 of NFPA *101*-~~2015~~ 2018 , *Life Safety Code*.

Informational Note No. 2: ~~For further information, see ANSI/IEEE 493-2007, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems*~~ 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* .

(C) Storage Battery.

Storage batteries 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 normal. Automotive-type batteries shall not be used.

An automatic battery charging means shall be provided.

(D) Generator Set.

(1) Prime Mover-Driven.

For a generator set driven by a prime mover ~~acceptable to~~ 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 service and for automatic transfer and operation of all required electrical circuits. A time-delay feature ~~permitting a 15-minute setting~~ shall be provided to avoid retransfer in case of short-time reestablishment of the normal source.

(2) Internal Combustion Engines as Prime Movers.

(a) On-Site Fuel Supply.

Where internal combustion engines are used as the prime mover, an on-site fuel supply shall be provided with an on-premises fuel supply sufficient for not less than 2 hours' ~~full-demand~~ operation of the system.

(b) Fuel Transfer Pumps.

Where power is needed for the operation of the fuel transfer pumps to deliver fuel to a generator set day tank, this pump shall be connected to the emergency power system.

(c) Public Gas System, Municipal Water Supply.

Prime movers shall not be solely dependent on a public utility gas system for their fuel supply or municipal water supply for their cooling systems. ~~Means shall be provided for automatically transferring from one fuel supply to another where dual fuel supplies are used.~~

Exception: Where ~~acceptable to~~ 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.

(d) Automatic Fuel Transfer.

Where dual fuel supplies are used, means shall be provided for automatically transferring from one fuel supply to another.

~~**(3)** Dual Supplies.~~

(3) 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.

(4) 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.

(5) 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) Uninterruptible Power Supplies.

Uninterruptible power supplies used to provide power for emergency systems shall comply with the applicable provisions of 700.12(C) and (B).

(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) Fuel Cell System.

Fuel cell systems used as a source of power for emergency systems shall be of suitable rating and capacity to supply and maintain the total load for not less than 2 hours of full-demand operation.

Installation of a fuel cell system shall meet the requirements of Parts II through VIII of Article 692.

Where a single fuel cell system serves as the normal supply for the building or group of buildings concerned, it shall not serve as the sole source of power for the emergency standby system.

(H) DC Microgrid Systems.

Sources connected to a dc microgrid system shall be permitted where the system is capable of being isolated from all non-emergency sources.

DC microgrid systems used as a source of power for emergency systems shall be of suitable rating and capacity to supply and maintain the total emergency load for not less than 2 hours of full-demand operation.

Where a dc microgrid system source serves as the normal supply for the building or group of buildings concerned, it shall not serve as the sole source of power for the emergency standby system.

(I) Unit Equipment.

(1) Components of Unit Equipment.

Individual unit equipment for emergency illumination shall consist of the following:

(1) A rechargeable battery

(2) A battery charging means

(3) Provisions for one or more lamps mounted on the equipment, or shall be permitted to have terminals for remote lamps, or both

(4) A relaying device arranged to energize the lamps automatically upon failure of the supply to the unit equipment

(2) Installation of Unit Equipment.

Unit equipment shall be installed in accordance with 700.12(I)(2)(1) through (I)(2) (6):

(1) The batteries shall be of suitable rating and capacity to supply and maintain the total lamp load associated with the unit in accordance with ~~(a) or (b)~~ the following :

   a. For a period of at least 1½ hours without the voltage falling below 87½ percent of normal battery voltage.

   b. The unit equipment shall supply and maintain not less than 60 percent of the initial emergency illumination for a period of at least 1½ hours.

(2) Unit equipment shall be permanently fixed (i.e., not portable) in place and shall have all wiring to each unit installed in accordance with the requirements of any of the wiring methods in Chapter 3. Flexible cord-and-plug connection shall be permitted, provided that the cord does not exceed 900 mm (3 ft) in length.

(3) The branch circuit feeding the unit equipment shall be ~~the same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches.~~ one of the following:

   ~~*Exception: In a separate and uninterrupted area supplied by a minimum of three normal lighting circuits that are not part of a multiwire branch circuit, a separate branch circuit for unit equipment shall be permitted if it originates from the same panelboard as that of the normal lighting circuits and is provided with a lock-on feature.*~~

   a. ~~the~~ The same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches

   b. A separate branch circuit, provided with a lock-on feature, that originates from the same panelboard as the normal lighting circuits

(4) The branch circuit that feeds unit equipment shall be clearly identified at the distribution panel.

(5) Emergency luminaires that obtain power from a unit equipment and are not part of the unit equipment shall be wired to the unit equipment as required by 700.10 and by one of the wiring methods of Chapter 3.

(6) Remote heads providing lighting for the exterior of an exit door shall be permitted to be supplied by the unit equipment serving the area immediately inside the exit door.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 12 15:25:30 EST 2018

Committee Statement

Committee Statement: List item (3) addressing “health care occupancies where persons are not capable of self-preservation” is deleted to resolve conflicts between this section and NFPA 99. See TIA log number 1293.

Additional revisions are editorial in nature and provide clarity and usability in the existing parent text of 700.12. Two new first level subdivisions are added for logical separation of requirements. No technical revisions are included.

The term “suppression” is deleted and replaced with “protection” for clarity. The IBC and the IFC, and NFPA 5000 use and define the term "fire protection system", none of them use or define "fire suppression system". A fire suppression system is a fire protection system. The list items sprinklers, carbons dioxide systems, and so forth are deleted as the term “fire protection system” is well understood.

The reference to spaces with a 1-hour fire rating is revised to 2-hour, to correlate with the requirements of 700.10(D) and NFPA 110 7.2.1.1.

A new first level subdivision is added to clarify that a dc microgrid system that is separate from the normal source of supply is permitted as an emergency source.

Existing informational note #2 is modified to reference an updated IEEE standard.

The term “acceptable” is not defined. This revision is editorial in nature and uses the defined term “approved” for clarity.

The reference to the 15 minute time delay is deleted as it is not appropriate to restrict the delay to a specific value. It will vary based on the application. See A6.2.8 in NFPA 110 for more information.

The use of “provisions of” is deleted for clarity and consistency with global efforts in this revision cycle.

This revision combines the existing requirements of 700.12(B)(2) and (B)(3) for clarity. As written the present text has conflicts. For clarity, the requirements in 700.12(B)(3) are relocated into 700.12(B)(2). Five new third level subdivisions are created for logical separation of requirements and usability. The term “full demand” is deleted as it is redundant. The requirement is for a “fuel supply sufficient for not less than 2 hours’ operation of the system.” The existing exception is moved into positive text and is properly relocated for clarity.after the requirement for an on-site fuel supply.

The term “acceptable” is replaced with the defined term “approved” for compliance with the NEC style manual.

A new first level subdivision is added to clarify that a DC microgrid system that includes multiple sources and is separate from the normal source of supply is permitted as an emergency source. A requirement for handling the full emergency load is added to correlate with similar requirements for fuel cells. Additional text is added to clarify that where a DC microgrid system source serves as the normal supply for the building or group of buildings, it is not permitted to serve as the sole source of power for the emergency standby system.

This revision to the new (I)(2) (previously (F)(2)) recognizes that lighting technology has improved significantly and it is not likely that there will be three normal lighting circuits in any given area. The exception is deleted and the permission for a separate branch circuit capable of being locked in the “on” position is added in positive text.

This revision editorially re-titles first level subdivisions accordingly.

Response Message:

Public Input No. 375-NFPA 70-2017 [Section No. 700.12(B)(3)]

Public Input No. 3824-NFPA 70-2017 [Section No. 700.12 [Excluding any Sub-Sections]]

Public Input No. 374-NFPA 70-2017 [Section No. 700.12(B)(1)]

Public Input No. 584-NFPA 70-2017 [Section No. 700.12]

Public Input No. 4087-NFPA 70-2017 [Section No. 700.12 [Excluding any Sub-Sections]]

Public Input No. 2526-NFPA 70-2017 [Section No. 700.12(F)(2)]

Public Input No. 874-NFPA 70-2017 [Section No. 700.12(F)(2)]

Public Input No. 655-NFPA 70-2017 [Section No. 700.12(F)(2)]

First Revision No. 7550-NFPA 70-2018 [Section No. 700.16]

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 ~~individual lighting element, such as the burning out of a lamp,~~ illumination source cannot leave in total darkness any space that requires emergency illumination.

(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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 08 13:41:48 EST 2018

Committee Statement

Committee Statement: This revision separates the existing requirement into four new first level subdivisions for clarity.

The intent of system reliability is clarified by identifying an “illumination source”, not a “lighting element.”

Response Message:

Public Input No. 1868-NFPA 70-2017 [Section No. 700.16]

Public Input No. 1879-NFPA 70-2017 [Section No. 700.16]

Public Input No. 2201-NFPA 70-2017 [Section No. 700.16]

First Revision No. 7561-NFPA 70-2018 [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 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 Article 700.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
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Submittal Date: Mon Jan 08 14:41:16 EST 2018

Committee Statement

Committee Statement: This revision permits normal power sensing from a normal source upstream of an emergency system transfer switch. When a UL924-listed dimmer or relay system is installed in compliance with 700.23, it is often fed from a normal/emergency source via an upstream UL1008 transfer switch. When normal power fails, the entire feed to the dimmer or relay panel is transferred. As such, the dimmer or relay panel must monitor a

normal-only source other than its own normal/emergency feed in order to determine whether it is operating on normal or emergency power, and whether a bypass of control function is required.

This has created confusion with the requirement of 700.17 (1) which implies that normal power sensing must be from the normal branch circuit feeding a normal/emergency load.

Response Message:

Public Input No. 1872-NFPA 70-2017 [Section No. 700.23]

First Revision No. 7564-NFPA 70-2018 [Section No. 700.24]

700.24 Directly Controlled Emergency Luminaires.

Where emergency illumination is provided by one or more directly controlled emergency luminaires that respond to an external control input to bypass normal control upon loss of normal power, such luminaires and external bypass controls shall be individually listed for use in emergency systems.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
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Street Address:
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Committee Statement

Committee Statement: This revision adds “emergency” and is editorial in nature providing clarity.
Response Message:

Public Input No. 1635-NFPA 70-2017 [Section No. 700.24]

First Revision No. 8900-NFPA 70-2018 [Section No. 701.1]

701.1 Scope.

~~The provisions of this article apply~~ This article applies to the electrical safety of the installation, operation, and maintenance of legally required standby systems consisting of circuits and equipment intended to supply, distribute, and control electricity to required facilities for illumination or power, or both, when the normal electrical supply or system is interrupted.

The systems covered by this article consist only of those that are permanently installed in their entirety, including the power source.

Informational Note No. 1: For further information, see NFPA 99-~~2015~~ 2016 , *Health Care Facilities Code*.

Informational Note No. 2: For further information regarding performance of emergency and standby power systems, see NFPA 110-~~2013~~ 2016 , *Standard for Emergency and Standby Power Systems*.

Informational Note No. 3: For further information, see ANSI/IEEE 446-1995, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications*.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
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Committee Statement

Committee Statement: In response to PI No. 3453, the use of “provisions of” is deleted for clarity and consistency with global efforts in this revision cycle/
Response Message:

First Revision No. 7575-NFPA 70-2018 [Section No. 701.2]

701.2 Definition.

The definition in this section shall apply within this article and throughout the *Code* .

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.

Informational Note: Legally required standby systems are typically installed to serve loads, such as heating and refrigeration systems, communications systems, ventilation and smoke removal systems, sewage disposal, lighting systems, and industrial processes, that, when stopped during any interruption of the normal electrical supply, could create hazards or hamper rescue or fire-fighting operations.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
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Street Address:
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Submittal Date: Mon Jan 08 16:00:54 EST 2018

Committee Statement

Committee Statement: This revision is added as part of a global effort within this code to provide clarity and usability of terms defined within this code. The NEC Style Manual in section 2.2.2.1, clearly states that:

“In general, Article 100 shall contain definitions of terms that appear in two or more other articles of the NEC.” And;

Section 2.2.2.2 clearly states that other Articles may contain definitions. Where this occurs, the definition(s) shall be in the second section

There are many defined terms that are used throughout this code that are located in the XXX.2 section of different Articles. Examples include but are not limited to definitions for: MC cable in Article 330, RMC in Article 344, Emergency Systems in Article 700, Legally Required Standby Systems in Article 701 and Optional Standby systems in Article 702. The logical location for each of these defined terms (and many more) are in the XXX.2 section of the respective Article.

This global effort correlates with the NEC Style Manual requirements and provides significant clarity with respect to the application of defined terms in the XXX.2 sections of Articles throughout the code.

CMP-13 requests that the NEC Correlating Committee review these global actions and provide CC comments where necessary.

Response Message:

Public Input No. 2233-NFPA 70-2017 [Section No. 701.2]

First Revision No. 7826-NFPA 70-2018 [Section No. 701.3(B)]

(B) Tested Periodically.

Systems shall be tested periodically on a schedule and in a manner ~~acceptable to~~ approved by the authority having jurisdiction to ensure the systems are maintained in proper operating condition.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
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Street Address:
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State:
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Submittal Date: Wed Jan 10 13:32:39 EST 2018

Committee Statement

Committee Statement: The term “acceptable” is not defined. This revision is editorial in nature and uses the defined term “approved” for clarity.

Response Message:

Public Input No. 376-NFPA 70-2017 [Section No. 701.3(B)]

First Revision No. 7576-NFPA 70-2018 [Section No. 701.4]

701.4 Capacity and Rating.

(0) ~~Where the alternate source has adequate capacity to handle all connected loads~~

(0) ~~Where automatic selective load pickup and load shedding is provided that will ensure adequate power to the legally required standby circuits~~

(A) Rating.

Legally required standby system equipment shall be suitable for the maximum available fault current at its terminals.

(B) Capacity.

A legally required standby system shall have adequate capacity ~~and rating for the supply of all equipment intended to be operated at one time.~~ in accordance with Article 220.

(C) Load Pickup, Load Shedding, and Peak Load Shaving.

The ~~legally required standby~~ alternate power source shall be permitted to supply ~~both~~ legally required standby and optional standby system loads ~~under either of the following conditions:~~ where the alternate source has adequate capacity or where automatic selective load pickup and load shedding are provided that will ensure adequate power to the legally required standby circuits.

Supplemental Information

File Name	Description	Approved
Panel_13_FR-7576_701.4_leg_changes.docx	For staff use	

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
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Street Address:
City:
State:
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Submittal Date: Mon Jan 08 16:03:42 EST 2018

Committee Statement

Committee Statement: Editorial revisions are made to logically separate this section into three first level subdivisions.

The present text specifically permits legally required systems to be sized with "adequate capacity and rating for the supply of all equipment intended to be operated at one time." This is revised for clarity by: (1) deleting this sentence, (2) adding a general requirement in (A) for rating, (3) adding a general requirement in (B) for capacity per Article 220 and (4) addressing systems with load pickup, load shedding and peak load shaving in (C).

Additionally, this revision is part of a global effort in this code to correlate the use of the terms, short circuit current, fault current, and the fuse of the terms available and maximum.

This revision is based upon favorable action on public inputs 1247 and 1248 under the purview of CMP-10. Action on these public inputs to add a new definition of "Fault Current" and a new definition for "Available Fault Current" will be reviewed by the committee during the public comment stage.

CMP-13 requests that the correlating committee review the actions on all related public inputs and provide correlating committee notes where necessary.

Response Message:

Public Input No. 249-NFPA 70-2017 [Section No. 701.4]

Public Input No. 1289-NFPA 70-2017 [Section No. 701.4]

First Revision No. 7580-NFPA 70-2018 [Section No. 701.5]

701.5 Transfer Equipment.

(A) General.

Transfer equipment~~, including automatic transfer switches,~~ shall be automatic, listed, and ~~identified~~ marked for emergency system or legally required standby use, and approved by the authority having jurisdiction. 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 705. Meter-mounted transfer switches shall not be permitted for legally required system use.

(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.

(C) Automatic Transfer Switches.

Automatic transfer switches shall be electrically operated and mechanically held. ~~Automatic transfer switches shall be listed for emergency use.~~

(D) Documentation.

The short-circuit current rating of the transfer equipment, based on the specific overcurrent protective device type and settings protecting the transfer equipment, shall be field marked on the exterior of the transfer equipment.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 08 16:22:15 EST 2018

Committee Statement

Committee Statement: As transfer equipment suitable for legally required standby use must be automatic, the phrase "including automatic transfer switches" is redundant. The requirement for the transfer switch to be listed and marked is deleted in first level subdivision 701.5(C) and is relocated into first level subdivision 7010.1(A) for clarity.

A new last sentence is added to clarify that meter mounted transfer switches are not permitted for use in legally required systems.

Response Message:

Public Input No. 1881-NFPA 70-2017 [Section No. 701.5(A)]

Public Input No. 3477-NFPA 70-2017 [Section No. 701.5(A)]

First Revision No. 8864-NFPA 70-2018 [Section No. 701.12]

701.12 General Requirements.

Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings concerned, legally required standby power will be available within the time required for the application but not to exceed 60 seconds. The supply system for legally required standby purposes, in addition to the normal services to the building, shall be permitted to comprise one or more of the types of systems described in ~~701.12(C)~~ 701.12(A) through ~~(F)~~ (I) . Unit equipment in accordance with 701.12(J) shall satisfy the applicable requirements of this article.

(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: For further information, see ANSI/IEEE 493-2007, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems*.

(C) Storage Battery.

Storage batteries 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 normal. Automotive-type batteries shall not be used.

An automatic battery charging means shall be provided.

(D) Generator Set.

(1) Prime Mover-Driven.

For a generator set driven by a prime mover ~~acceptable to~~ approved by the authority having jurisdiction and sized in accordance with 701.4, means shall be provided for automatically starting the prime mover upon failure of the normal service and for automatic transfer and operation of all required electrical circuits. A time-delay feature permitting a 15-minute setting shall be provided to avoid retransfer in case of short-time re-establishment of the normal source.

(2) Internal Combustion Engines as Prime Mover.

Where internal combustion engines are used as the prime mover, an on-site fuel supply shall be provided with an on-premises fuel supply sufficient for not less than 2 hours of full-demand operation of the system. Where power is needed for the operation of the fuel transfer pumps to deliver fuel to a generator set day tank, the pumps shall be connected to the legally required standby power system.

(3) ~~Dual Supplies.~~ Public Gas System, Municipal Water Supply.

Prime movers shall not be solely dependent on a public utility gas system for their fuel supply or on a municipal water supply for their cooling systems. Means shall be provided for automatically transferring one fuel supply to another where dual fuel supplies are used.

Exception: Where ~~acceptable to~~ 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.

(4) Battery Power.

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.

(5) 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.

(E) Uninterruptible Power Supplies.

Uninterruptible power supplies used to provide power for legally required standby systems shall comply with ~~the applicable provisions of~~ 701.12(C) and (B).

(F) Separate Service.

Where approved, a separate service shall be permitted as a legally required source of standby power. This service shall be in accordance with ~~the applicable provisions of~~ Article 230, with a separate service drop or lateral or a separate set of overhead or underground service conductors sufficiently remote electrically and physically from any other service to minimize the possibility of simultaneous interruption of supply from an occurrence in another service.

(G) Connection Ahead of Service Disconnecting Means.

Where ~~acceptable to~~ approved by the authority having jurisdiction, connections located ahead of and not within the same cabinet, enclosure, vertical switchgear section, or vertical switchboard section as the service disconnecting means shall be permitted. The legally required standby service shall be sufficiently separated from the normal main service disconnecting means to minimize simultaneous interruption of supply through an occurrence within the building or groups of buildings served.

Informational Note: See 230.82 for equipment permitted on the supply side of a service disconnecting means.

(H) Fuel Cell System.

Fuel cell systems used as a source of power for legally required standby systems shall be of suitable rating and capacity to supply and maintain the total load for not less than 2 hours of full-demand operation.

Installation of a fuel cell system shall meet the requirements of Parts II through VIII of Article 692.

Where a single fuel cell system serves as the normal supply for the building or group of buildings concerned, it shall not serve as the sole source of power for the legally required standby system.

Detail FR-8865

(I) DC Microgrid Systems.

Sources connected to a dc microgrid system shall be permitted where the system is capable of being isolated from all nonlegally required sources.

A dc microgrid system used as a source of power for legally required systems shall be of suitable rating and capacity to supply and maintain the total legally required load for not less than 2 hours of full-demand operation.

Where a dc microgrid system source serves as the normal supply for the building or group of buildings concerned, it shall not serve as the sole source of power for the legally required standby system.

(J) Unit Equipment.

Individual unit equipment for legally required standby illumination shall consist of the following:

(1) A rechargeable battery

(2) A battery charging means

(3) Provisions for one or more lamps mounted on the equipment and shall be permitted to have terminals for remote lamps

(4) A relaying device arranged to energize the lamps automatically upon failure of the supply to the unit equipment

The batteries shall be of suitable rating and capacity to supply and maintain the total lamp load associated with the unit for not less than ~~(a) or (b)~~ the following :

(1) For a period of 1½ hours, without the voltage falling below 87½ percent of normal voltage

(2) The unit equipment shall supply and maintain not less than 60 percent of the initial emergency illumination for a period of at least 1½ hours.

Unit equipment shall be permanently fixed in place (i.e., not portable) and shall have all wiring to each unit installed in accordance with the requirements of any of the wiring methods in Chapter 3. Flexible cord-and-plug connection shall be permitted, provided that the cord does not exceed 900 mm (3 ft) in length. The branch circuit feeding the unit equipment shall be the same branch circuit as that serving the normal lighting in the area and connected ahead of any local switches. Legally required standby luminaires that obtain power from a unit equipment and are not part of the unit equipment shall be wired to the unit equipment by one of the wiring methods of Chapter 3.

Exception: In a separate and uninterrupted area supplied by a minimum of three normal lighting circuits, a separate branch circuit for unit equipment shall be permitted if it originates from the same panelboard as that of the normal lighting circuits and is provided with a lock-on feature.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 19 16:53:06 EST 2018

Committee Statement

Committee Statement: Two new first level subdivisions are added for logical separation of requirements. These revisions are editorial in nature and provide clarity and usability in the existing parent text of 701.12. The term “acceptable” is not defined and is deleted in three locations. This revision is editorial in nature and uses the defined term “approved” for clarity.

This revision editorially retitles first level subdivisions.

The use of the term “provisions of” is deleted for clarity and consistency throughout this code.

The title of first level subdivision of existing 701.12(B)(3) is revised for clarity.

No technical revisions are included.

Response Message:

Public Input No. 377-NFPA 70-2017 [Section No. 701.12(B)(1)]

Public Input No. 625-NFPA 70-2017 [Section No. 701.12]

Public Input No. 379-NFPA 70-2017 [Section No. 701.12(B)(3)]

First Revision No. 7825-NFPA 70-2018 [Sections 701.25, 701.26, 701.27]

701.30 Accessibility.

The branch-circuit overcurrent devices in legally required standby circuits shall be accessible to authorized persons only.

701.31 Ground-Fault Protection of Equipment.

The alternate source for legally required standby systems shall not be required to provide ground-fault protection of equipment with automatic disconnecting means. Ground-fault indication at the legally required standby source shall be provided in accordance with 701.6(D) if ground-fault protection of equipment with automatic disconnecting means is not provided.

701.32 Selective Coordination.

Legally required standby system(s) overcurrent devices shall be selectively coordinated with all supply-side overcurrent protective devices.

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Exception: Selective coordination shall not be required between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
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Submittal Date: Wed Jan 10 13:27:49 EST 2018

Committee Statement

Committee Statement: This revision editorially revises section numbering to achieve a common numbering format with Article 700. Where common numbering is achievable in this code, it enhances usability.

Response Message:

Public Input No. 971-NFPA 70-2017 [Section No. 701.25]

Public Input No. 972-NFPA 70-2017 [Section No. 701.26]

Public Input No. 973-NFPA 70-2017 [Section No. 701.27]

First Revision No. 8901-NFPA 70-2018 [Section No. 702.1]

702.1 Scope.

~~The provisions of this article apply~~ 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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
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Street Address:
City:
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Submittal Date: Mon Jan 22 10:41:04 EST 2018

Committee Statement

Committee Statement: In response to PI No. 3453, the use of “provisions of” is deleted for clarity and consistency with global efforts in this revision cycle.
Response Message:

First Revision No. 7600-NFPA 70-2018 [Section No. 702.2]

702.2 Definition.

The definition in this section shall apply within this article and throughout the *Code* .

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.

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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
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Zip:
Submittal Date: Tue Jan 09 08:24:42 EST 2018

Committee Statement

Committee Statement: This revision is added as part of a global effort within this code to provide clarity and usability of terms defined within this code. The NEC Style Manual in section 2.2.2.1, clearly states that:

“In general, Article 100 shall contain definitions of terms that appear in two or more other articles of the NEC.” And;

Section 2.2.2.2 clearly states that other Articles may contain definitions. Where this occurs, the definition(s) shall be in the second section

There are many defined terms that are used throughout this code that are located in the XXX.2 section of different Articles. Examples include but are not limited to definitions for: MC cable in Article 330, RMC in Article 344, Emergency Systems in Article 700, Legally Required Standby Systems in Article 701 and Optional Standby systems in Article 702. The logical location for each of these defined terms (and many more) are in the XXX.2 section of the respective Article.

This global effort correlates with the NEC Style Manual requirements and provides significant clarity with respect to the application of defined terms in the XXX.2 sections of Articles throughout the code.

CMP-13 requests that the NEC Correlating Committee review these global actions and provide CC comments where necessary.

The definition of “Optional Standby System” is modified for clarity by adding “or stored” power in addition to on-site generated power.

Response Message:

Public Input No. 1140-NFPA 70-2017 [Definition: Optional Standby Systems.]

Public Input No. 2234-NFPA 70-2017 [Section No. 702.2]

First Revision No. 7603-NFPA 70-2018 [Section No. 702.4(A)]

(A) Available ~~Short-Circuit~~ Fault Current.

Optional standby system equipment shall be suitable for the ~~maximum~~ available ~~short-circuit~~ fault current at its terminals.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
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Submittal Date: Tue Jan 09 08:32:56 EST 2018

Committee Statement

Committee Statement: This revision is part of a global effort in this code to correlate the use of the terms, short circuit current, fault current, and the use of the terms available and maximum.

This revision is based upon favorable action on public inputs 1247 and 1248 under the purview of CMP-10. Action on these public inputs to add a new definition of “Fault Current” and a new definition for “Available Fault Current” will be reviewed by the committee during the public comment stage.

CMP-13 requests that the correlating committee review the actions on all related public inputs and provide correlating committee notes where necessary.

Response Message:

Public Input No. 1290-NFPA 70-2017 [Section No. 702.4(A)]

First Revision No. 7606-NFPA 70-2018 [Section No. 702.4(B)]

(B) System Capacity.

~~The calculations of load on the standby source shall be made in accordance with Article 220 or by another approved method.~~

(1) Manual Transfer Equipment.

Where manual transfer equipment is used, an optional standby system shall have adequate capacity and rating for the supply of all equipment intended to be operated at one time. The user of the optional standby system shall be permitted to select the load connected to the system.

(2) Automatic Transfer Equipment.

Where automatic transfer equipment is used, an optional standby system shall comply with 702.4(B)(2) (a) or (B) (2)(b) in accordance with Article 220 .

(a) *Full Load.* The standby source shall be capable of supplying the full load that is transferred by the automatic transfer equipment.

(b) *Load Management.* Where a system is employed 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 load management system.

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Committee Statement

Committee Statement: The parent text in 702.4(B) is deleted and a reference to Article 220 is added to 702.4(B)(2) for clarity. Where manual transfer is applied the requirement is to have adequate capacity for the load that will be applied manually. The reference to Article 220 applies where automatic transfer will be applied and calculations to determine capacity can be performed.

Response Message:

Public Input No. 2487-NFPA 70-2017 [Section No. 702.4(B)]

First Revision No. 7830-NFPA 70-2018 [Section No. 702.5]

702.5 Transfer Equipment.

Transfer equipment shall be required for all standby systems subject to the ~~provisions~~ requirements of this article and for which an electric utility supply is either the normal or standby source.

~~Transfer equipment, located on the load side of branch circuit protection, shall be permitted to contain supplemental overcurrent protection having an interrupting rating sufficient for the available fault current that the generator can deliver. The supplementary overcurrent protection devices shall be part of a listed transfer equipment.~~

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.

Transfer switches installed between the utility meter and the meter enclosure shall be listed meter-mounted transfer switches. Meter-mounted transfer switches on the line side of the service disconnecting means shall be suitable for use as service equipment. Meter-mounted transfer switches shall be of the manual type unless rated as determined by 702.4(B)(2) .

Informational Note: For more information, see UL 1008M, *Transfer Switch Equipment, Meter Mounted* .

~~The~~ In other than dwelling units, 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.

Transfer equipment shall be suitable for the intended use and designed and installed so as to prevent the inadvertent interconnection of ~~normal and alternate~~ all 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~~ .

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Submittal Date: Wed Jan 10 13:38:02 EST 2018

Committee Statement

Committee Statement: The first paragraph of this section is modified and relocated as the last paragraph. Editorial revisions are made for clarity.

The second paragraph of this section is deleted. The current ANSI Standard for transfer switch equipment (UL 1008, 8th Edition) prohibits the use of supplemental overcurrent protection, the allowance for such devices is no longer valid.

The requirement to field mark the transfer equipment is modified to exclude dwelling units. This correlates with similar marking requirements in 110.24.

The sentence in the existing first paragraph is deleted because Article 705 does not specifically address transfer equipment associated with optional standby systems and because it is not necessary

to reference electric power production systems in section 702.5, which is titled Transfer Equipment.

The term “provisions” is replaced with the term “requirements” for clarity and consistency throughout this code.

A new paragraph is added to address the permitted use of meter mounted transfer switches. These requirements are necessary to ensure safe installation and use. A reference to UL 1008M was included for additional information.

The requirements for inadvertent connection are modified to include the inadvertent connection of a normal supply and the alternate source and the inadvertent connection of multiple alternate sources.

Response Message:

Public Input No. 4351-NFPA 70-2017 [Section No. 702.5]

Public Input No. 3479-NFPA 70-2017 [Section No. 702.5]

Public Input No. 622-NFPA 70-2017 [Section No. 702.5]

First Revision No. 8103-NFPA 70-2018 [Section No. 706.1]

706.1 Scope.

This article applies to all ~~permanently installed~~ energy storage systems (ESS) ~~operating at over 50 volts ac or 60 volts dc~~ 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: For batteries rated in ampere hours, kWh is equal to the nominal rated voltage times ampere-hour rating divided by 1000.

Informational Note No. 2: The following standards are frequently referenced for the installation of energy storage systems:

(1) NFPA 111-~~2013~~ 2016 , *Standard on Stored Electrical Energy Emergency and Standby Systems*

(2) NFPA 855 , *Standard for the Installation of Stationary Energy Storage Systems*

(3) IEEE 484-2008, *Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications*

(4) IEEE 485-1997, *Recommended Practice for Sizing Vented Lead-Acid Storage Batteries for Stationary Applications*

(5) IEEE 1145-2007, *Recommended Practice for Installation and Maintenance of Nickel-Cadmium Batteries for Photovoltaic (PV) Systems*

(6) IEEE 1187-2002, *Recommended Practice for Installation Design, and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications*

(7) IEEE 1578-2007, *Recommended Practice for Stationary Battery Electrolyte Spill Containment and Management*

(8) IEEE 1635/ASHRAE 21-2012, *Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications*

(9) NECA 416, *Recommended Practice for Installing Energy Storage Systems (ESS)*

(10) UL 810A, *Electrochemical Capacitors*

(11) UL 1973, *Batteries for Use in Stationary, Vehicle Auxiliary Power, and Light Electric Rail (LER) Applications ~~and Stationary Applications~~*

(12) UL 1989, *Standard for Standby Batteries*

(12) ~~UL Subject 2436, *Spill Containment For Stationary Lead Acid Battery Systems*~~

(13) UL ~~Subject~~ 9540, ~~*Safety of Energy Storage Systems and Equipment*~~ *Standard for Safety Energy Storage Systems and Equipment*

(14) UL Subject 1974, *Standard for Evaluation of Repurposed Batteries*

(15) UL Subject 2436, *Spill Containment For Stationary Lead Acid Battery Systems*

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
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Committee Statement

Committee Statement: Replacing minimum voltage values with minimum energy capacity values allows to close the gap that currently exists in the NEC 2017 language, while maintaining an allowance for applications of small energy storage equipment commonly used to serve dedicated utilization equipment such as tools, alarm systems, or similar applications. The 1kWh capacity aligns with new language in building and fire codes. A new Informational Note No. 1 is added to specify the relationship between Amp-Hours and Kilowatt-hours.

The scope is revised to provide clarity that an ESS can store and provide energy during normal operating conditions. Energy Storage Systems do not include a UPS or large battery system that is used only when power is lost to the building.

The scope is revised to apply not only to permanently installed ESS, but also to those used in temporary applications, such as concerts, festivals, disaster relief, etc. Temporary systems pose the same fire and shock hazard as permanent systems.

NFPA 855 is added to the existing information note. NFPA 855 is the standard on the installation of ESS and is expected to be released before the 2020 NEC is published.

UL 9540 is no longer an Outline of Investigation, it is now a standard. As such, the term “Subject” before the number is being removed.

UL 1974 is added to the existing information note. UL 1974 is an Outline of Investigation under development for repurposed batteries, and provides a ‘metric’ by which second-use batteries can be documented and verified as safe.

NECA 416 is added to the existing informational note. NECA 416 is a standard on recommended workmanship practices and helps complete the list of related standards.

Response Message:

Public Input No. 1108-NFPA 70-2017 [Section No. 706.1]

Public Input No. 2751-NFPA 70-2017 [Section No. 706.1]

Public Input No. 2759-NFPA 70-2017 [Section No. 706.1]

Public Input No. 2957-NFPA 70-2017 [Section No. 706.1]

Public Input No. 3249-NFPA 70-2017 [Section No. 706.1]

Public Input No. 3706-NFPA 70-2017 [Section No. 706.1]

First Revision No. 7857-NFPA 70-2018 [Section No. 706.3]

706.3 ~~Other Articles.~~ Qualified Personnel.

~~Wherever the requirements of other articles of this *Code* and Article 706 differ, the requirements of Article 706 shall apply. If the ESS is capable of being operated in parallel with a primary source(s) of electricity, the requirements in 705.6 , 705.12 , 705.14 , 705.16 , 705.32 , 705.40 , 705.100, 705.143, and Part IV of Article 705 shall apply.~~ The installation and maintenance of ESS equipment and all associated wiring and interconnections shall be performed only by qualified persons.

Informational Note: See Article 100 for the definition of *qualified person* .

Submitter Information Verification

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Committee Statement

Committee Statement: This section is deleted. There is no need to explain when the requirements of Article 706 apply. Section 90.3 clearly states how the NEC is to be used. There is no need to cite specific requirements from other Articles that may apply. There are requirements from many Articles that apply depending on the application of the ESS, not just those from Article 705. Stating all of these requirements would be exhaustive.

The installation and maintenance of energy storage systems must be performed by persons trained specifically in the unique requirements and hazards of these systems. Improper installation and/or maintenance can result a catastrophic failure. The text in this proposed new section mirrors the requirements for qualified personnel for the installation of PV systems. See 690.4(C) and associated Informational Note

Response Message:

Public Input No. 2753-NFPA 70-2017 [Section No. 706.3]

Public Input No. 951-NFPA 70-2017 [New Section after 706.8]

First Revision No. 8922-NFPA 70-2018 [Section No. 706.4]

706.4 System Classification and Marking Requirements .

(A) Classification.

ESS shall be classified as one of the types described as follows:

(1) ESS, self-contained

~~Informational Note: Some self-contained systems may be listed.~~

(2) ESS, pre-engineered ~~of matched components~~

(3) ESS, other

(B) Marking.

Each ESS shall be provided with a nameplate plainly visible after installation having the following information:

(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) Nominal voltage and amperes

(6) Available fault current derived by the ESS at the output terminals

(7) Utility-interactive capability, if applicable

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Committee Statement

Committee Statement: This marking requirement in this revision correlates with the marking requirements found in UL 9540.

Response Message:

Public Input No. 3415-NFPA 70-2017 [Section No. 706.4]

Public Input No. 3838-NFPA 70-2017 [Section No. 706.4]

First Revision No. 8923-NFPA 70-2018 [Section No. 706.5]

706.5 ~~Equipment.~~ Listing.

Equipment shall meet the requirements of 706.5(A) or (B).

(A) ESS, Other.

Monitors, controls, switches, fuses, circuit breakers, power conversion systems, inverters and transformers, energy storage ~~components~~ devices, battery management systems , and other components of the ~~energy storage system~~ ESS other than lead-acid batteries, shall be listed.

(B) ESS, Self-Contained, and ESS, Pre-engineered.

~~Alternatively, self-contained~~ Self-contained ESS and pre-engineered ESS shall be listed ~~as a complete energy storage system~~ .

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Committee Statement

Committee Statement: The title of the section was changed to “listing” as this section addresses listing requirements. The existing paragraph was split into two to clarify the listing requirement as applied to the different ESS classifications. In new 706.5(A) the term “energy storage components” is replaced with “energy storage devices” to clarify that the storage media should be listed, and to eliminate the potentially confusing dual use of the term “components.” Battery management systems were added to correlate with 480.3.

Response Message:

Public Input No. 2754-NFPA 70-2017 [Section No. 706.5]

First Revision No. 8924-NFPA 70-2018 [New Section after 706.6]

706.7 Maintenance.

Energy storage systems 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.

Informational Note: For information related to general electrical equipment maintenance and developing an effective electrical preventive maintenance (EPM) program, see NFPA 70B -2016 *Recommended Practice for Electrical Equipment Maintenance* or ANSI/NETA ATS-2017, *Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems* .

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Committee Statement

Committee Statement: Energy storage systems often include components such as electrochemical batteries of various types. These systems and their components often require maintenance and response as components need repair. Battery maintenance systems typically provide continuous output of information related to the state of system components. The new requirement will call attention to the need for effective maintenance and even monitoring in some

cases to avoid system component failure that could impact the safety of buildings and structures in addition to personnel.

Public Input No. 1712-NFPA 70-2017 [New Article after 706]

Public Input No. 2379-NFPA 70-2017 [New Section after 706.11(B)]

First Revision No. 8925-NFPA 70-2018 [New Section after 706.6]

706.9 Maximum Voltage.

(A) ESS, Self-Contained and ESS, Pre-engineered.

The maximum voltage of self-contained or pre-engineered systems intended for field assembly as a system shall be the rated ESS input and output voltage(s) indicated on the ESS nameplate(s) or system listing.

(B) ESS, Other.

The maximum voltage for each circuit shall be in accordance with one of the following:

(1) For dc circuits, the voltage shall be calculated based on the highest charging voltage, including any temperature compensation and equalization.

(2) For ac circuits, the voltage shall be the nominal ac voltage.

(3) For circuits connected to two or more series-connected dc-to-dc converters, the voltage shall be determined in accordance with the instructions included in the listing or labeling of the dc-to-dc converter. If these instructions do not state the rated voltage of series-connected dc-to-dc converters, the voltage shall be the sum of the maximum rated voltage output of all the dc-to-dc converters connected in series.

(4) For circuits connected to the output of a single dc-to-dc converter, the voltage shall be the rated maximum voltage output of the dc-to-dc converter.

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Submittal Date: Mon Jan 22 15:49:36 EST 2018

Committee Statement

Committee Statement: Throughout Article 706 there are multiple references to voltage of an ESS. This new section provides prescriptive requirements for the determination of maximum voltage.

Response Message:

Public Input No. 2761-NFPA 70-2017 [New Part after II.]

First Revision No. 8942-NFPA 70-2018 [Section No. 706.7]

Part II. Disconnecting Means

706.15 Disconnecting Means.

(A) ESS Disconnecting Means.

A disconnecting means shall be provided for all ungrounded conductors derived from an ESS. A disconnecting means shall be readily accessible and located within sight of the ESS. The disconnecting means shall be lockable open in accordance with 110.25.

The disconnecting means is permitted to be integral to listed ESS equipment.

For one-family and two-family dwellings, a disconnecting means or its remote control shall be located at a readily accessible location outside the building.

~~Informational Note: See 240.21(H) for information on the location of the overcurrent device for conductors.~~

(B) Remote Actuation.

Where controls to activate the disconnecting means of an ESS are used and are not located within sight of the system, the ~~disconnecting means shall be capable of being locked in the open position, in accordance with 110.25 , and the~~ location of the controls shall be field marked on the disconnecting means.

~~**(C)** Busway.~~

~~Where a dc busway system is installed, the disconnecting means shall be permitted to be incorporated into the busway.~~

(C) Notification and Marking .

~~The disconnecting means shall be legibly marked in the field. The marking shall meet the requirements of 110.21(B) and shall include the following:~~ Each ESS disconnecting means shall plainly indicate whether it is in the open (off) or closed (on) position and be permanently marked "ENERGY STORAGE SYSTEM DISCONNECT." The disconnecting means shall be legibly marked in the field to indicate the following:

(1) Nominal ESS ac voltage and maximum ESS dc voltage

(2) ~~Maximum available short-circuit~~ Available fault current derived from the ESS

(3) ~~The associated clearing time or arc duration based on the available short-circuit current from the ESS and associated overcurrent protective devices if applicable~~ An arc-flash label applied in accordance with acceptable industry practice

(4) Date the calculation was performed

~~*Exception: The labeling in 706.7(D)(1) through (D)(4) shall not be required if an arc flash label is applied in accordance with acceptable industry practice.*~~

Informational Note No. 1: Industry practices for equipment labeling are described in *NFPA 70E*-~~2015~~ 2018 , *Standard for Electrical Safety in the Workplace*. This standard provides specific criteria for developing arc-flash labels for equipment that provides nominal system voltage, incident energy levels, arc-flash boundaries, minimum required levels of personal protective equipment, and so forth.

Informational Note No. 2: Battery equipment suppliers can provide information about ~~short-circuit~~ available fault current on any particular battery model.

For ESS disconnecting means where the line and load terminals may be energized in the open position, the device shall be marked with the following words or equivalent:

WARNING

ELECTRIC SHOCK HAZARD

TERMINALS ON THE LINE AND LOAD

SIDES MAY BE ENERGIZED IN THE OPEN POSITION

The notification(s) and marking(s) shall comply with 110.21(B).

(D) Partitions ~~and Distance~~ Between Components .

~~Where energy storage system input and output terminals are more than 1.5 m (5 ft) from connected equipment, or where the circuits from these terminals pass through a wall or partition, the installation shall comply with the following:~~

(0) ~~A disconnecting means shall be provided at the energy storage system end of the circuit. Fused disconnecting means or circuit breakers shall be permitted to be used.~~

(0) ~~A second disconnecting means located at the connected equipment shall be installed where the disconnecting means required by 706.7(E)(1) is not within sight of the connected equipment.~~

~~Informational Note No. 1: For remote disconnect controls in information technology equipment rooms, see 645.10 .~~

~~Informational Note No. 2: For overcurrent protection of batteries, see 240.21(H) .~~

(0) ~~Where fused disconnecting means are used, the line terminals of the disconnecting means shall be connected toward the energy storage system terminals.~~

(0) ~~Disconnecting means shall be permitted to be installed in energy storage system enclosures where explosive atmospheres can exist if listed for hazardous locations.~~

(0) ~~Where the disconnecting means in (1) is not within sight of the disconnecting means in (2), placards or directories shall be installed at the locations of all disconnecting means indicating the location of all other disconnecting means.~~

Where circuits from the input or output terminals of energy storage components in 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.

Supplemental Information

File Name	Description	Approved
Panel_13_FR-8942_706.7_leg_changes.docx	For staff use	

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
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Street Address:
City:
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Submittal Date: Wed Jan 24 08:17:19 EST 2018

Committee Statement

Committee Statement: This revision permits a disconnecting means to be part of an ESS, revises disconnecting means requirements, deletes subsection (C) on busway, revises marking requirements and moves the locking means requirement from (B) to (A). The informational note to reference 240.21(H) is unnecessary and is deleted. A requirement is added for one-family and two-family dwellings, that a disconnecting means or its remote control shall be located at a readily accessible location outside the building, and a 10 ft. line-of-sight requirement for the disconnecting means and ESS is added.

Response Message:

Public Input No. 2870-NFPA 70-2017 [Section No. 706.7]

Public Input No. 3413-NFPA 70-2017 [Section No. 706.7(D)]

Public Input No. 1294-NFPA 70-2017 [Section No. 706.7(D)]

Public Input No. 3661-NFPA 70-2017 [Section No. 706.7]

Public Input No. 2874-NFPA 70-2017 [Section No. 706.7(E)]

Public Input No. 2756-NFPA 70-2017 [Section No. 706.7(A)]

Public Input No. 3760-NFPA 70-2017 [Section No. 706.7(A)]

Public Input No. 2959-NFPA 70-2017 [Section No. 706.7]

Public Input No. 4206-NFPA 70-2017 [Section No. 706.7(B)]

Public Input No. 4210-NFPA 70-2017 [Section No. 706.7(A)]

Public Input No. 2757-NFPA 70-2017 [Section No. 706.7(D)]

First Revision No. 8943-NFPA 70-2018 [Section No. 706.8]

706.16 Connection to Other ~~Energy~~ Sources.

~~Connection~~ The connection of an ESS to other ~~energy~~ sources shall comply with ~~the requirements of 705.12~~ 706.16(A) through (F) .

(A) ~~Load~~ Source Disconnect.

A ~~load~~ disconnect that has multiple sources of power shall disconnect all energy sources when in the off position.

(B) Identified Interactive Equipment.

~~Only inverters and ac modules~~ ESS that operate in parallel with other ac sources shall use inverters that are listed and identified as interactive~~ shall be permitted on interactive systems~~ .

(C) Loss of Interactive System Power.

Upon loss of primary source, an ESS with a utility-interactive inverter shall comply with the requirements of 705.40.

(D) Unbalanced Interconnections.

Unbalanced ac connections between an ~~energy storage system~~ ESS and other ac electric power production sources shall be in accordance with 705.100.

(E) ~~Point of~~ Connection to Other Energy Sources .

The ~~point~~ connection of ~~connection between~~ an ~~energy storage system and electric power production~~ ESS to other energy sources shall be in accordance with 705.12 and Parts III and VI of Article 712 .

(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.

Submitter Information Verification

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Committee Statement

Committee Statement: This revision corrects an editing error that inadvertently transferred AC modules from 690, aligns with work done in previous cycles to expand the requirements to all interactive systems, not just utility-interactive, closes gaps for DC microgrids and stand-alone operation, and clarifies the requirements for unbalanced connections. Throughout, the term Energy Storage System has been shortened to ESS. The revisions to (A) proposed in PI No. 4171 were not included because the requirement should remain in this section for clarity and emphasis.

Response Message:

Public Input No. 2758-NFPA 70-2017 [Section No. 706.8]

Public Input No. 4171-NFPA 70-2017 [Section No. 706.8]

Public Input No. 4271-NFPA 70-2017 [Section No. 706.8(D)]

Public Input No. 4274-NFPA 70-2017 [Section No. 706.8(E)]

First Revision No. 8944-NFPA 70-2018 [Section No. 706.10]

Part III. Installation Requirements

706.20 ~~Energy Storage System Locations~~ General .

~~Battery locations shall conform to 706.10(A) , (B), and (C).~~

(A) Ventilation.

Provisions appropriate to the energy storage technology shall be made for sufficient diffusion and ventilation of any possible gases from the storage device, if present, to prevent the accumulation of an explosive mixture. A pre-engineered or self-contained ESS shall be permitted to provide ventilation in accordance with the manufacturer's recommendations and listing for the system.

Informational Note No. 1: See NFPA 1-~~2015~~ 2018 , *Fire Code*, Chapter 52, for ventilation considerations for specific battery chemistries.

Informational Note No. 2: Some storage technologies do not require ventilation.

Informational Note No. 3: A source for design of ventilation of battery systems is IEEE 1635-2012/ASHRAE Guideline 21-2012, *Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications*, and the UBC.

Informational Note No. 4: Fire protection considerations are addressed in NFPA 1-~~2015~~ 2018 , *Fire Code*.

(B) ~~Guarding of Live Parts.~~ Dwelling Units.

~~Guarding of live parts shall comply with 110.27 .~~ An ESS for 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.

~~Spaces about the ESS shall comply with 110.26 . Working space shall be measured from the edge of the ESS modules, battery cabinets, racks, or trays. For battery racks, there shall be a minimum clearance of 25 mm (1 in.) between a cell container and any wall or structure on the side not requiring access for maintenance. ESS modules, battery cabinets, racks, or trays shall be permitted to contact adjacent walls or structures, provided that the battery shelf has a free air space for not less than 90 percent of its length. Pre-engineered and self-contained ESSs shall be permitted to have working space between components within the system in accordance with the manufacturer's recommendations and listing of the system.~~

(1) General.

Working spaces for ESS shall comply with 110.26 and 110.34.

(2) Pre-engineered and Self-Contained ESS.

Listed pre-engineered and self-contained ESSs shall be permitted to have space between components in accordance with the manufacturer's instructions and listing.

Informational Note: Additional space ~~is often~~ may be needed to accommodate ESS ~~equipment~~ hoisting equipment, tray removal, or spill containment.

(3) Other ESS.

Requirements for spaces around batteries that are components of electrochemical ESSs are provided in 480.10(C).

~~**(D)** Egress.~~

~~A personnel door(s) intended for entrance to and egress from rooms designated as ESS rooms shall open in the direction of egress and shall be equipped with listed panic hardware.~~

~~**(D)** Illumination.~~

~~Illumination shall be provided for working spaces associated with ESS and their equipment and components. Luminaires shall not be controlled by automatic means only. Additional luminaires shall not be required where the work space is illuminated by an adjacent light source. The location of luminaires shall not do either of the following:~~

(0) ~~Expose personnel to energized system components while performing maintenance on the luminaires in the system space~~

(0) ~~Create a hazard to the system or system components upon failure of the luminaire~~

Supplemental Information

File Name	Description	Approved
Panel_13_FR-8944_706.10-move_leg_changes.docx	For staff use	

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Committee Statement

Committee Statement: The revisions are editorial and improve usability for the installation requirements for an Energy Storage System. The following changes were made.

1. "Part III. Installation requirements" has been added to better group the requirements found in 706.20 and beyond.

2. The voltage level demarcation of 100 volts for dwelling unit energy storage systems has been relocated from 706.30(A) to 706.20(B).

3. The exception to 706.30(A) being relocated to 706.20(B) is revised to permit a maximum ESS voltage of 600V volts dc where live parts are not accessible during routine ESS maintenance.

4. The exception to 706.30(A) being relocated to 706.20(B) is revised to clarify that the voltages given in the requirements for this subsection are the dc battery voltages.

5. 706.20(B), Spaces about ESS Components has been renumbered to (C) and now refers the user of the code to either 110.26 or if the system consists of batteries 480.10(C).

6. Guarding of Live Parts in 706.20(B) was deleted since this requirement is already found in 110.27.

7. The IN in 706.20(C) is deleted as it does not comply with the style manual.

8. The subsections on Egress and Illumination have been deleted since these are components of battery installations and are already covered in 480.10(E) and (G).

Response Message:

Public Input No. 2961-NFPA 70-2017 [Section No. 706.10]

Public Input No. 3845-NFPA 70-2017 [Section No. 706.30]

Public Input No. 3800-NFPA 70-2017 [Section No. 706.30(A)]

First Revision No. 8953-NFPA 70-2018 [Section No. 706.11]

706.21 Directory (Identification of Power Sources) .

ESS shall be indicated by ~~706.11(A) and (B). The~~ markings or labels that shall be in accordance with 110.21(B).

(A) ~~Directory~~ Facilities with Utility Services and ESS .

~~A permanent plaque or directory denoting all electric power sources on or in the premises shall be installed at each service equipment location and at locations of all electric power production sources capable of being interconnected~~ Plaques or directories shall be installed in accordance with 705.10 and 712.10(A) .

Exception: ~~Installations with large numbers of power production sources shall be permitted to be designated by groups~~ Multiple power production sources that are grouped shall be permitted to use a common designation on the directory .

(B) Facilities with Stand-Alone Systems.

A permanent plaque or directory shall be installed outside a building or structure supplied by a stand-alone system at each service equipment location or at an approved readily visible location. The plaque or directory shall denote the location of each power source disconnecting means on or in the premises or be grouped with other plaques or directories for other on-site sources.

Any structure or building with an ESS ~~that is not connected to a utility service source and is a stand-alone system~~ shall also have a permanent plaque or directory installed on the exterior of the building or structure at ~~a readily visible location acceptable to the authority having jurisdiction~~ an approved readily visible location . The plaque or directory shall indicate the location of system disconnecting means ~~and that the structure contains a stand-alone electrical power system~~ .

Exception: Multiple power production sources that are grouped shall be permitted to use a common designation on the directory.

Supplemental Information

File Name	Description	Approved
Panel_13_FR-8953_706.11_leg_changes.docx	For staff use	

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 24 10:45:11 EST 2018

Committee Statement

Committee Statement: This revision combines subsections 706.11(A) and (B) for facilities with stand-alone systems for clarity and usability. The interrelationship between the subsections necessitated bringing them together. A new subsection (A) was added for facilities with utility services and ESS. “Acceptable to the authority having jurisdiction” is replaced with the defined term “approved.”

Response Message:

Public Input No. 3702-NFPA 70-2017 [Section No. 706.11]

Public Input No. 385-NFPA 70-2017 [Section No. 706.11(B)]

First Revision No. 8958-NFPA 70-2018 [Section No. 706.20(A)(1)]

(1) Nameplate-Rated Circuit Current.

~~The nameplate(s)-rated circuit~~ Circuit current shall be the rated current indicated on the ESS nameplate(s) or system listing ~~for pre-engineered or self-contained systems of matched components intended for field assembly as a system.~~ . 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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
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Submittal Date: Wed Jan 24 11:02:47 EST 2018

Committee Statement

Committee Statement: This subsection is revised to clarify that an ESS may have two nameplates, each respectively indicating input or output circuit rating, or one nameplate showing input and output circuit ratings. The term “matched components” is deleted to align with the revised definitions.

Response Message:

Public Input No. 2766-NFPA 70-2017 [Section No. 706.20(A)(1)]

Public Input No. 3836-NFPA 70-2017 [Section No. 706.20(A)(1)]

Public Input No. 3842-NFPA 70-2017 [Section No. 706.20(A)(1)]

First Revision No. 8960-NFPA 70-2018 [Section No. 706.20(A)(4)]

(4) Inverter Utilization Output Circuit Current.

The maximum current shall be the continuous ~~inverter~~ ac output current rating of the inverter when the inverter is producing rated power ~~at the lowest input voltage~~ .

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 24 11:06:53 EST 2018

Committee Statement

Committee Statement: This subsection is revised to clarify that the Inverter Utilization Output Current is an ac value of the output of an ESS, and to delete the phrase “at the lowest input voltage.” The output current of an ESS is the same regardless of the input dc voltage.

Response Message:

Public Input No. 3035-NFPA 70-2017 [Section No. 706.20(A)(4)]

First Revision No. 8961-NFPA 70-2018 [Section No. 706.20(B)]

(B) Conductor Ampacity ~~and Overcurrent Device Ratings~~ .

The ampacity of the feeder circuit conductors from the ESS(s) to the wiring system serving the loads to be serviced by the system shall not be less than the greater of the (1) nameplate(s)-rated circuit current as determined in accordance with 706.30(A) or (2) the rating of the ESS(s) overcurrent protective device(s).

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
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Zip:
Submittal Date: Wed Jan 24 11:08:46 EST 2018

Committee Statement

Committee Statement: The title of this subsection is revised to delete “Overcurrent Device Ratings” as the subsection only addresses conductor ampacity.

Response Message:

Public Input No. 2768-NFPA 70-2017 [Section No. 706.20(B)]

Public Input No. 2871-NFPA 70-2017 [Section No. 706.20(B)]

First Revision No. 8963-NFPA 70-2018 [Section No. 706.21]

706.31 Overcurrent Protection.

(A) Circuits and Equipment.

ESS circuit conductors shall be protected in accordance with the requirements of Article 240. Protection devices for ESS circuits shall be in accordance with the requirements of 706.31(B) through (F). Circuits shall be protected at the source from overcurrent.

(B) Overcurrent Device Ampere Ratings.

Overcurrent protective devices, where required, shall be rated in accordance with Article 240 and the rating provided on systems serving the ESS and shall be not less than 125 percent of the maximum currents calculated in 706.30(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 706.30(B) .

(C) Direct Current Rating.

Overcurrent protective devices, either fuses or circuit breakers, used in any dc portion of an ESS shall be listed ~~and~~ 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 ~~ESS~~ circuits from the input ~~and output terminals are more than 1.5 m (5 ft) from connected equipment, or where the circuits from these terminals~~ or output terminals of energy storage components in an ESS pass through a wall ~~or partition~~ , floor, or ceiling , overcurrent protection shall be provided at the ~~ESS~~ energy storage component of the circuit .

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 24 11:27:36 EST 2018

Committee Statement

Committee Statement: This revision adds an exception that allows the use of 100% rated overcurrent protective devices in lieu of sizing 125%. It deletes “and” in 706.21(C) for clarity. It revises706.21(F) to correlate with

revision to 706.7(E).

Response Message:

Public Input No. 2771-NFPA 70-2017 [Section No. 706.21(B)]

Public Input No. 2772-NFPA 70-2017 [Section No. 706.21(C)]

Public Input No. 2872-NFPA 70-2017 [Section No. 706.21(C)]

First Revision No. 8962-NFPA 70-2018 [Section No. 706.23(B)(3)]

(3) ~~Energy Storage Systems~~ ESS Using ~~Utility-~~ Interactive Inverters.

Systems using ~~utility-~~ interactive inverters to control energy storage state-of-charge by diverting excess power into ~~the utility system~~ an alternate electric power production and distribution system, such as utility, shall comply with 706.33(B)(3)(a) and (B)(3)(b).

(a) These systems shall not be required to comply with 706.33(B)(2).

(b) These systems shall have a second, independent means of controlling the ESS charging process for use when the ~~utility~~ alternate system is not ~~present~~ available or when the primary charge controller fails or is disabled.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 24 11:13:45 EST 2018

Committee Statement

Committee Statement: This revision aligns with work done in previous cycles to expand the requirements to all interactive systems, not just utility-interactive, and addresses requirements for operation when the alternate system is not available or unable to absorb excess. The term Energy Storage System has been shortened to ESS.

Response Message:

Public Input No. 2774-NFPA 70-2017 [Section No. 706.23(B)(3)]

Public Input No. 2873-NFPA 70-2017 [Section No. 706.23(B)(3)]

Public Input No. 3796-NFPA 70-2017 [Section No. 706.23(B)(3)]

Public Input No. 4276-NFPA 70-2017 [Section No. 706.23(B)(3)]

First Revision No. 7976-NFPA 70-2018 [Section No. 706.40]

706.40 General.

All electrical connections to and from the system and system components shall be in accordance with the applicable provisions of Article 692. The system and system components shall also meet ~~the provisions of~~ Parts I, II, and ~~II~~ III of this article. Unless otherwise directed by this article, flow battery ESS shall comply with the applicable provisions of Article 692.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
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Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 11 14:19:21 EST 2018

Committee Statement

Committee Statement: This revision adds Part III to correlate with editorial separation of Article 706 into parts. The phrase “The provisions of” is unnecessary and redundant and is being deleted to increase usability.

Response Message:

First Revision No. 8870-NFPA 70-2018 [Section No. 708.1]

Detail FR-9001

708.1 Scope.

~~The provisions of this article apply~~ This article applies to the installation, operation, monitoring, control, and maintenance of the portions of the premises wiring system intended to supply, distribute, and control electricity to designated critical operations areas (DCOA) in the event of disruption to elements of the normal system.

Critical operations power systems are those systems so classed by municipal, state, federal, or other codes by any governmental agency having jurisdiction or by facility engineering documentation establishing the necessity for such a system. These systems include but are not limited to power systems, HVAC, fire alarm, security, communications, and signaling for designated critical operations areas.

Informational Note No. 1: Critical operations power systems are generally installed in vital infrastructure facilities that, if destroyed or incapacitated, would disrupt national security, the economy, public health or safety; and where enhanced electrical infrastructure for continuity of operation has been deemed necessary by governmental authority.

Informational Note No. 2: For further information on disaster and emergency management, see *NFPA 1600*-~~2013~~ 2016 , *Standard on Disaster/Emergency Management and Business Continuity/Continuity of Operations Programs*.

Informational Note No. 3: For further information regarding performance of emergency and standby power systems, see NFPA 110-~~2013~~ 2016 , *Standard for Emergency and Standby Power Systems*.

~~Informational Note No. 4: For further information regarding performance and maintenance of emergency systems in health care facilities, see NFPA 99-2015, *Health Care Facilities Code*.~~

Informational Note No. 4: For specification of locations where emergency lighting is considered essential to life safety, see NFPA *101*-~~2015~~ 2018 , *Life Safety Code*, or the applicable building code.

Informational Note No. 5: For further information regarding physical security, see NFPA 730-~~2014~~ 2018 , *Guide for Premises Security*.

Informational Note No. 6: Threats to facilities that may require transfer of operation to the critical systems include both naturally occurring hazards and human-caused events. See also A.5.3.2 of *NFPA 1600*-~~2013~~ 2016 , *Standard on Disaster/Emergency Management and Business Continuity/Continuity of Operations Programs*.

Informational Note No. 7: See Informative Annex F, Availability and Reliability for Critical Operations Power Systems; and Development and Implementation of Functional Performance Tests (FPTs) for Critical Operations Power Systems.

Informational Note No. 8: See Informative Annex G, Supervisory Control and Data Acquisition (SCADA).

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 19 17:38:05 EST 2018

Committee Statement

Committee Statement: This revision deletes the use of “provisions of” for clarity and consistency throughout this code.

Response Message:

First Revision No. 9000-NFPA 70-2018 [Section No. 708.2]

708.2 Definitions.

The definitions in this section shall apply within this article and throughout the *Code* .

Commissioning.

The acceptance testing, integrated system testing, operational tune-up, and start-up testing is the process by which baseline test results verify the proper operation and sequence of operation of electrical equipment, in addition to developing baseline criteria by which future trend analysis can identify equipment deterioration.

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.

Designated Critical Operations Areas (DCOA).

Areas within a facility or site designated as requiring critical operations power.

Supervisory Control and Data Acquisition (SCADA).

An electronic system that provides monitoring and controls for the operation of the critical operations power system. 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.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 29 09:03:57 EST 2018

Committee Statement

Committee Statement: This revision is added as part of a global effort within this code to provide clarity and usability of terms defined within this code. The NEC Style Manual in section 2.2.2.1, clearly states that:

“In general, Article 100 shall contain definitions of terms that appear in two or more other articles of the NEC.” And;

Section 2.2.2.2 clearly states that other Articles may contain definitions. Where this occurs, the definition(s) shall be in the second section

There are many defined terms that are used throughout this code that are located in the XXX.2 section of different Articles. Examples include but are not limited to definitions for: MC cable in Article 330, RMC in Article 344, Emergency Systems in Article 700, Legally Required Standby Systems in Article 701 and Optional Standby systems in Article 702. The logical location for each of these defined terms (and many more) are in the XXX.2 section of the respective Article.

This global effort correlates with the NEC Style Manual requirements and provides significant clarity with respect to the application of defined terms in the XXX.2 sections of Articles throughout the code.

Response Message:

First Revision No. 7626-NFPA 70-2018 [Section No. 708.6(B)]

(B) Tested Periodically.

Systems shall be tested periodically on a schedule ~~acceptable to~~ approved by the authority having jurisdiction to ensure the systems are maintained in proper operating condition.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 10:14:57 EST 2018

Committee Statement

Committee Statement: The term “acceptable” is deleted and replaced with the defined term “approved” for clarity

Response Message:

Public Input No. 380-NFPA 70-2017 [Section No. 708.6(B)]

First Revision No. 7627-NFPA 70-2018 [Section No. 708.14]

708.14 Wiring of HVAC, Fire Alarm, Security, Emergency Communications, and Signaling Systems.

All conductors or cables shall be installed using any of the metal wiring methods permitted by 708.10(C)(1) and, in addition, shall comply with ~~708.14(1) through (8)~~ the following , as applicable:

(1) All cables for fire alarm, security, signaling systems, and emergency communications shall be shielded twisted pair cables or installed to comply with the performance requirements of the system.

(2) Shields of cables for fire alarm, security, signaling systems, and emergency communications shall be arranged in accordance with the manufacturer's published installation instructions.

(3) Optical fiber cables shall be used for connections between two or more buildings on the property and under single management.

(4) A listed primary protector shall be provided on all communications circuits. Listed secondary protectors shall be provided at the terminals of the communications circuits.

(5) Conductors for all control circuits rated above 50 volts shall be rated not less than 600 volts.

(6) Communications, fire alarm, and signaling circuits shall use relays with contact ratings that exceed circuit voltage and current ratings in the controlled circuit.

(7) All cables for fire alarm, security, and signaling systems shall be riser-rated and shall be a listed 2-hour electrical circuit protective system. Emergency ~~communication~~ communications cables shall be Type CMR-CI or shall be riser-rated and shall be a listed 2-hour electrical circuit protective system.

(8) Control, monitoring, and power wiring to HVAC systems shall be a listed 2-hour electrical circuit protective system.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 10:16:54 EST 2018

Committee Statement

Committee Statement: The term “communication” in 708.14(7) is made plural for clarity.
Response Message:

Public Input No. 176-NFPA 70-2017 [Section No. 708.14]

First Revision No. 7628-NFPA 70-2018 [Sections 708.20(A), 708.20(B)]

(A) General Requirements.

Current supply shall be such that, in the event of failure of the normal supply to the DCOA, critical operations power shall be available within the time required for the application. The supply system for critical operations power, 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 708.20(E) through (H).

Informational Note No. 1: Assignment of degree of reliability of the recognized critical operations power system depends on the careful evaluation in accordance with the risk assessment.

Informational Note No. 2: For guidance about determining degree of 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* .

(B) Fire Protection.

Where located within a building, equipment for sources of power as described in 708.20(E) through (H) shall be installed either in spaces fully protected by an approved automatic fire ~~suppression systems (sprinklers, carbon dioxide systems, and so forth)~~ protection system or in spaces with a 2-hour fire rating.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 09 10:19:00 EST 2018

Committee Statement

Committee Statement: Additional information is provided to code users through a new informational note referencing IEEE 3006.5 Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems.

This revision editorially deletes “suppression” and adds “protection.” A fire suppression systems is a fire protection system. The reference to types of fire protection systems is not all-inclusive and is deleted for clarity.

Response Message:

Public Input No. 3412-NFPA 70-2017 [Section No. 708.20(A)]

First Revision No. 8871-NFPA 70-2018 [Section No. 708.20(G)]

(G) Uninterruptible Power Supplies.

Uninterruptible power supplies used as the sole source of power for COPS shall comply with ~~the applicable provisions of~~ 708.20(E) and (F).

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 19 17:42:28 EST 2018

Committee Statement

Committee Statement: This revision deletes “provisions of” for clarity and consistency throughout this code in response to Global PI No. 3453.
Response Message:

First Revision No. 8872-NFPA 70-2018 [New Section after 708.24(C)]

(D) Bypass Isolation Automatic Transfer Switches.

Where loads are supplied by only one automatic transfer switch, the automatic transfer switch shall include a bypass isolation switch to facilitate maintenance as required in 708.6(C) without jeopardizing continuity of power. When the bypass isolation transfer switch is in the bypass mode, either it shall automatically initiate transfer between power sources upon loss of the connected power source or it shall remain actively supervised by a qualified person who can manually initiate a transfer between power sources.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 19 17:45:57 EST 2018

Committee Statement

Committee Statement: A new first level subdivision (D) is added to address bypass isolation switches where necessary. In some cases, designs provide means to put ATS in an electrically safe work condition so that ATS maintenance can be performed safely and the COPS loads are still powered. If a COPS design has loads that can only be supplied via one ATS, the maintenance may not get done or is done in an unsafe manner. Bypass isolation switches provide redundancy and continuous powering of the loads while the ATS is de-energized so that proper maintenance can be performed under safe work conditions. However, while in the bypass mode, if the connected power source fails, it is necessary to quickly transfer between power sources, This can be achieved either via an automatic bypass isolation switch or a person standing ready to manually operate the bypass isolation switch to another source.

Response Message:

Public Input No. 4106-NFPA 70-2017 [Section No. 708.24]

First Revision No. 8867-NFPA 70-2018 [Section No. 712.2]

712.2 Definitions.

The definitions in this section shall apply only within this article.

Direct Current Microgrid (DC Microgrid).

A direct current microgrid is a power distribution system consisting of more than one interconnected dc power source, supplying dc-dc converter(s), dc load(s), and/or ac load(s) powered by dc-ac inverter(s). A dc microgrid is typically not directly connected to an ac primary source of electricity, but some dc microgrids interconnect via one or more dc-ac bidirectional converters or dc-ac inverters.

Informational Note: Direct current power sources include ac-dc converters (rectifiers), bidirectional dc-ac inverters/converters, photovoltaic systems, wind generators, energy storage systems (including batteries), and fuel cells.

Grounded Three-Wire DC System.

A system with a solid connection or reference-ground between the center point of a bipolar dc power source and the equipment grounding system.

Grounded Two-Wire DC System

A system that has a solid connection or reference-ground between one of the current-carrying conductors and the equipment grounding system.

Nominal Voltage.

A value assigned to a circuit or system for the purpose of conveniently designating its dc voltage class.

Informational Note: The actual voltage at which a circuit operates can vary from the nominal voltage within a range that permits satisfactory operation of equipment.

Reference-Grounded DC System.

A system that is not solidly grounded but has a low-resistance electrical reference that maintains voltage to ground in normal operation.

Detail FR-8868

~~Resistively~~ Functional Grounded.

A system ~~with a high-resistance connection between the current carrying conductors and the equipment grounding system.~~ that has an electrical reference to ground that is not solidly grounded.

Primary DC Source.

A source that supplies the majority of the dc load in a dc microgrid.

Ungrounded DC System.

A system that has no direct or resistive connection between the current-carrying conductors and the equipment grounding system.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 19 17:17:12 EST 2018

Committee Statement

Committee Statement: 712.2 is updated to better clarify how definitions are used within Articles.

Response Message:

Public Input No. 1970-NFPA 70-2017 [Section No. 712.2]

First Revision No. 7815-NFPA 70-2018 [Section No. 712.4]

712.4 Listing and Labeling.

Any equipment used in the dc circuits of a ~~direct-current~~ dc ~~mirco grid~~ microgrid shall be listed and labeled for dc use.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 11:46:52 EST 2018

Committee Statement

Committee Statement: The term “micro grid” is changed to “microgrid” to correlate with the proper use of the term.

Response Message:

Public Input No. 3868-NFPA 70-2017 [Section No. 712.4]

First Revision No. 7839-NFPA 70-2018 [Section No. 712.10]

712.10 Directory.

(A) Source Directory.

A permanent directory denoting all dc electric power sources operating to supply the dc microgrid shall be installed at each source location capable of acting as the primary dc source.

(B) Building Directory.

A building supplied by a dc microgrid system shall have a permanent plaque or directory installed outside the building at each service equipment location or at an approved readily visible location. The plaque or directory shall denote the location of each power source disconnecting means on or in the building or be grouped with other plaques or directories for other on-site sources.

Exception: Multiple power production sources that are grouped shall be permitted to use a common designation on the directory.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 14:18:11 EST 2018

Committee Statement

Committee Statement: Section 712.10 is revised to require a directory of all sources of DC power to a building.

Response Message:

Public Input No. 3601-NFPA 70-2017 [Section No. 712.10]

Public Input No. 3859-NFPA 70-2017 [Section No. 712.10]

First Revision No. 7802-NFPA 70-2018 [Section No. 712.25]

712.25 Identification of Circuit Conductors.

Ungrounded circuit conductors in dc microgrids shall be identified according to the requirements of 210.5(C)(2) for branch circuits and 215.12(C)(2) for feeders.

~~**(B)**~~

~~Ungrounded conductors of 6 AWG or smaller shall be permitted to be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means.~~

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 11:15:25 EST 2018

Committee Statement

Committee Statement: The identification requirements in 712.25 conflict with the identification requirements for dc conductors in Article 210 and 215. The text is being revised to direct the user back to the appropriate dc identification sections in those two Articles.

Response Message:

Public Input No. 3861-NFPA 70-2017 [Section No. 712.25]

First Revision No. 7807-NFPA 70-2018 [Section No. 712.34]

712.34 DC Source Disconnecting Means.

The output of each dc source shall have a readily accessible disconnecting means that is lockable ~~in the open position~~ open in accordance with 110.25 and adjacent to the source.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 11:21:34 EST 2018

Committee Statement

Committee Statement: Editorial changes are made to improve grammar.

The phrase “lockable in the open position” is changed to “lockable open in accordance with 110.25.”

Response Message:

Public Input No. 3862-NFPA 70-2017 [Section No. 712.34]

Public Input No. 1586-NFPA 70-2017 [Section No. 712.34]

First Revision No. 8873-NFPA 70-2018 [Section No. 712.57]

712.57 Arc Fault Protection.

Where required elsewhere in this *Code*, specific systems within the dc microgrid shall have arc fault protection. The arc fault protection equipment shall be listed.

Informational Note: Section 90.4 applies when suitable equipment for arc fault protection is not available.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jan 19 18:01:20 EST 2018

Committee Statement

Committee Statement: This revision is editorial.
Response Message:

First Revision No. 7817-NFPA 70-2018 [Section No. 712.65]

712.65 Available DC ~~Short-Circuit~~ Fault Current.

(A) Field Marking.

The ~~maximum~~ available dc ~~short-circuit~~ fault current on the dc microgrid shall be field marked at the dc source(s). The field marking(s) shall include the date the ~~short-circuit~~ available fault current calculation was performed and be of sufficient durability to withstand the environment involved.

(B) Modifications.

When modifications to the electrical installation occur that affect the ~~maximum~~ available ~~short-circuit~~ fault current at the dc source, the ~~maximum~~ available ~~short-circuit~~ fault current shall be verified or recalculated as necessary to ensure the equipment ratings are sufficient for the ~~maximum~~ available ~~short-circuit~~ fault current at the line terminals of the equipment. The required field marking(s) in 712.65(A) shall indicate the new ~~maximum~~ available ~~short-circuit~~ fault current and date.

Submitter Information Verification

Submitter Full Name: NEC-CMP Panel 13
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 10 11:48:33 EST 2018

Committee Statement

Committee Statement: The term "short-circuit" is being changed to "available fault" after a Usability Task Group determined the proper usage of the terms short-circuit current and available fault current.

Response Message:

Public Input No. 1295-NFPA 70-2017 [Section No. 712.65]

First Revision No. 8866-NFPA 70-2018 [Section No. 712.72]

712.72 Interrupting and Short-Circuit Current Ratings.

Consideration shall be given to the contribution of ~~short-circuit~~ available fault currents from all interconnected power sources for the interrupting ratings and short-circuit current ratings of equipment in the dc microgrid system(s). Overcurrent protective devices and equipment used within a dc microgrid shall have an interrupting rating at nominal circuit voltage or a short-circuit current rating sufficient for the available ~~short-circuit~~ fault current at the line terminals of the equipment.

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Committee Statement

Committee Statement: The term "short-circuit" is being changed to "available fault" after a Usability Task Group determined the proper usage of the terms short-circuit current and available fault current.

Response Message:

Public Input No. 1296-NFPA 70-2017 [Section No. 712.72]

First Revision No. 8869-NFPA 70-2018 [Section No. 750.2]

750.2 Definitions.

~~For the purpose of this article, the following definitions shall apply.~~

Control.

This definition shall apply only within this article.

The predetermined process of connecting, disconnecting, increasing, or reducing electric power.

Energy Management System.

This definition shall apply within this article and throughout the *Code* .

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.

Monitor.

This definition shall apply only within this article.

An electrical or electronic means to observe, record, or detect the operation or condition of the electric power system or apparatus.

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Committee Statement

Committee Statement: 750.2 is updated to better clarify how definitions are used within Articles.
Response Message:

Public Input No. 2247-NFPA 70-2017 [Section No. 750.2]

First Revision No. 7640-NFPA 70-2018 [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:

$$\text{Availability} = \frac{MTBF}{MTTF + MTTR}$$

where:

MTBF = mean time between failures

MTTF = mean time to failure

MTTR = mean time to repair

See the following table for an example of how to establish required 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

* 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-~~2010~~ 2016 , *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~~ reliability ~~Requirements~~ 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* .

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Committee Statement

Committee Statement: This revision adds an informational note to reference a standard on the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems.

Response Message:

Public Input No. 3407-NFPA 70-2017 [Annex F [Excluding any Sub-Sections]]

First Revision No. 7641-NFPA 70-2018 [Part II.]

Part II. Development and Implementation of Functional Performance Tests (FPTs) for Critical Operations Power Systems Development of FPT

(1) Submit Functional Performance Tests (FPTs). System/component tests or FPTs are developed from submitted drawings, systems operating documents (SODs), and systems operation and maintenance manuals (SOMMs), including large component testing (i.e., transformers, cable, generators, UPS), and how components operate as part of the total system. The commissioning authority develops the test and cannot be the installation contractor (or subcontractor).

As the equipment/components/systems are installed, quality assurance procedures are administered to verify that components are installed in accordance with minimum manufacturers' recommendations, safety codes, and acceptable installation practices. Quality assurance discrepancies are then identified and added to a “commissioning action list” that must be rectified as part of the commissioning program. These items would usually be discussed during commissioning meetings. Discrepancies are usually identified initially by visual inspection.

(2) Review FPTs. The tests must be reviewed by the customer, electrical contractors, quality assurance personnel, maintenance personnel, and other key personnel (the commissioning team). Areas of concern include, among others, all functions of the system being tested, all major components included, whether the tests reflect the system operating documents, and verification that the tests make sense.

(3) Make Changes to FPTs as Required. The commissioning authority then implements the corrections, questions answered, and additions.

(4) FPTs Approval. After the changes are made to the FPTs, they are submitted to the commissioning team. When it is acceptable, the customer or the designated approval authority approves the FPTs. It should be noted that even though the FPT is approved, problems that arise during the test (or areas not covered) must be addressed.

Testing Implementation for FPTs. The final step in the successful commissioning plan is testing and proper execution of system-integrated tests.

(1) Systems Ready to Operate. The FPTs can be implemented as various systems become operative (i.e., test for the generator system) or when the entire system is installed. However, the final “pull the plug” test is performed only after all systems are completely installed. If the electrical contractor (or subcontractor) implements the FPTs, a witness must initial each step of the test. The electrical contractor cannot employ the witness directly or indirectly.

(2) Perform Tests (FPTs). If the system fails the test, the problem must be resolved and the equipment or system retested or the testing requirements re-analyzed until successful tests are witnessed. Once the system or equipment passes testing, it is verified by a designated commissioning official.

(3) Customer Receives System. After all tests are completed (including the “pull the plug” test), the system is turned over to the customer.

Informational Note: For information regarding reliability of critical operations power systems, see IEEE 3006.2-2016, *Recommended Practice for Evaluating the Reliability of Existing Industrial and Commercial Power System* s.

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Committee Statement

Committee Statement: This revision adds an informational note to reference a standard on Evaluating the Reliability of Existing Industrial and Commercial Power Systems.

Response Message:

Public Input No. 3195-NFPA 70-2017 [Part II.]